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Optimising the impact of a multi-intervention outreach programme on progression to Higher Education: recommendations for future practice and research

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1 Optimising the impact of a multi-intervention outreach
2 programme on progression to Higher Education:
3 recommendations for future practice and research

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5 Short title: Optimising the impact of a multi-intervention outreach programme on progression to
6 Higher Education

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25 Abstract

26 Despite substantial financial commitment to widening participation activities internationally, robust
27 evidence demonstrating 'what works' in facilitating disadvantaged learners to access Higher
28 Education (HE) is remarkably sparse. Much effort has been directed at measuring immediate post-
29 intervention changes in the aspirations, attitudes and behaviours thought to drive access to HE,
30 rather than actual access itself. Here, we present an innovative quasi-experimental study of a multi-
31 intervention outreach programme (UniConnect) consisting of 1,386 learners from the Aimhigher
32 West Midlands database whose HE application results were known, while controlling for multiple
33 variables, including estimates of deprivation. The results showed that any engagement with
34 UniConnect, no matter how limited, was associated with an improved chance of achieving a place in
35 HE, but the type of engagement, the extent of engagement and the combination of types of
36 engagement all mattered. The more learners engaged with UniConnect, the greater were their
37 chances of HE acceptance, but the benefit of each additional engagement beyond five or six
38 engagements was small. To our knowledge, these findings are the first to indicate the number, type
39 and combinations of interventions that are most effective in supporting progression to HE. These
40 results therefore have important implications for future practice, enabling funding for such work to
41 be used for optimal impact. Furthermore, we found large differences in success between schools,
42 even when controlling for several other variables; a finding which has important implications for
43 future evaluation research.

44

45 **Keywords:** Access and Participation; evaluation; Higher Education; widening participation; multi-
46 intervention; UniConnect

47

48 Introduction

49 Across the world, there are persistent socio-economic and demographic based inequalities in terms
50 of educational qualifications. These inequalities can have a detrimental impact on later life chances
51 in terms of employment, wealth, health and housing [1-4]. James *et al.* [5] concluded that
52 internationally there are '*persistent inequalities in educational participation and outcomes, with*
53 *major social inequities to higher education in particular, despite mass education systems*' (p1) (see
54 also [6]). Regardless of educational achievement, there are also different expectations of entering
55 tertiary education amongst children of parents in higher versus lower status occupations, although
56 educational inequalities differ across countries, suggesting that these inequalities are mutable [7]. In
57 the UK, evidence suggests that inequalities are increasing, with more than one in five of the
58 population living in poverty [8]; an increase of 12.5% over 5 years. Successive governments have
59 attempted to address these inequalities through policies and funding to improve social mobility. A
60 focus of such policies has included attempts to improve disadvantaged groups' lower progression
61 rates into Higher Education (HE); that is education beyond secondary level, most commonly offered
62 at a university or higher education college. These attempts are often in the form of widening
63 participation or 'outreach' programmes that aim to increase expectations and
64 intentions, attainment, attitudes, awareness, and knowledge. In the UK, university outreach teams
65 have driven such initiatives under requirements and regulations set out by the Office for Students
66 (the HE regulator). Resource allocations to these initiatives are large, and so the stakes are
67 high; the UK Government anticipated spend on widening participation by the HE sector in 2020-21 to
68 reach around £860m [9]. However, given the amount of resource historically and currently allocated
69 to these activities, robust and objective evidence on 'what works, under what circumstances and for
70 whom' is remarkably sparse, Skillbeck arguing that, '*a significant limitation in drawing general*
71 *conclusions for future action on the basis of 'international good practice' is the dearth of evaluative*
72 *research...*' [6].

73 Gorard and colleagues (p32)[10] conducted an extensive and far reaching review of widening
74 participation research in England, but found that substantial proportions of the literature had to be
75 excluded from the review on the basis of either quality of evidence or inadequate reporting,
76 concluding that research on the efficacy of interventions is "*a major blindspot for the whole field*"
77 (see also [11-14]). Changes in attitudes, aspirations, knowledge and behaviours are frequently cited
78 as evidence of impact of interventions, but in a review of almost 170,000 pieces of evidence, Gorard
79 *et al.*[15] found little evidence of a *causal* link between attitudes to education and either attainment
80 or participation, although an association was confirmed. Bergin *et al.*[16] found that interventions
81 were more likely to affect which institution participants attended, than whether they attended at all.

82 Robinson and Salvestrini [17] provided a helpful updated review of evidence of the impact of various
83 widening access initiatives internationally, but progress has been slow. They noted: (i) the challenge
84 of inferring from these evaluations which *components* of multi-intervention programmes have led to
85 any success - a difficulty that hinders generalisation of the results to other programmes; (ii) the lack
86 of evidence on the impact of actual enrolments, as opposed to reported changes in aspirations and
87 attitudes; and (iii) the lack of evidence demonstrating causality. In their review, Robinson and
88 Salvestrini [17] categorised only three studies evaluating multi-intervention outreach as providing
89 evidence of causality (one finding positive impact); the Transforming Access and Student Outcomes
90 (TASO) website lists four, just two of those reporting positive impact. First, in the US, Bowman *et al.*
91 [18] reported positive and significant effects of the GEAR UP programme on enrolments and
92 graduation. Second, in the UK, Emmerson *et al.*[19] found a positive impact of an Aimhigher
93 programme on HE participation rates across Local Education Authorities that did and that did not
94 participate, although the effect found was not statistically significant overall and the interpretation
95 of the results was hindered by a difficulty in disentangling results from a separate programme.

96 Following the removal of funding for a national programme of coordinated outreach, known as
97 Aimhigher, the University of Birmingham, Aston, Birmingham City University, University College
98 Birmingham and University of Worcester continued to collaborate with a model based on
99 partnership subscriptions and targets linked to their Access Agreements (now Access and
100 Participation Plans). This partnership is known as Aimhigher West Midlands (Aimhigher WM) and
101 conducts outreach activities across 25 rural and urban West Midlands' wards. Aimhigher WM's
102 UniConnect programme (formerly known as the National Collaborative Outreach Programme: NCOP)
103 was established to support the government's social mobility goals of increasing the number of young
104 people from underrepresented groups who go into HE, from wards where participation was lower
105 than might be expected given the GCSE results of the young people who live there. The UniConnect
106 programme aims to address this unexplained 'participation gap' via increasing confidence and
107 motivation to succeed at school; expectation and intention to progress to HE; awareness and
108 knowledge of HE; and attainment and learning in Key Stages 4 and 5.

109 Morris and Golden [20] previously summarised research on the impact of the national Aimhigher
110 programme by a number of authors and suggested that although there was evidence of the
111 programme impact on GCSE gains, there was no statistical evidence that it changed participants'
112 minds about going on to HE (although there was qualitative evidence that it may have widened the
113 horizons of certain groups). Chilosi *et al.*[21] evaluated the effects of an Aimhigher programme on
114 GCSE attainment, HE applications and HE entries. They overcame reported ethical and legal concerns
115 regarding tracking of pupils by using multiple regression analysis on *cohort level* (rather than

116 individual) data and reported a positive effect of Aimhigher on all three measures overall, although
117 they also suggested that the programme may not have had the desired effect of increasing HE entry
118 in pupils from lower socioeconomic backgrounds. The present report builds on previous work [22]
119 evaluating the effectiveness of UniConnect to provide a more innovative and statistically rigorous
120 evaluation of the impact of UniConnect interventions on the rate of successful Universities and
121 Colleges Admissions Service (UCAS: who operate the application process for all British Universities)
122 acceptances. More specifically, our analyses enabled us to estimate the contribution of the different
123 interventions that formed the intervention programme, indicating which number, type and
124 combinations of interventions are most effective in supporting progression to HE. In our methods
125 section, we outline the interventions implemented, data collected, variables used and the
126 participant cohort and provide a summary of our general analysis strategy. In the results we detail
127 the outcomes of that strategy to provide information on: (i) the impact of Uniconnect engagement,
128 (ii) the most effective types and combinations of Uniconnect engagement and (iii) the combination
129 of other factors associated with UCAS success. Finally, in the discussion we consider more general
130 learnings and recommendations from the data for optimising multi-intervention outreach
131 programmes, as well as potential limitations of this study.

132 **Materials and Methods**

133 **Design**

134 This was a retrospective, quasi-experimental study investigating the extent to which engagement
135 with UniConnect activities was associated with successful application to HE. All learners included in
136 the study were eligible to participate in UniConnect activities but varied in the extent to which they
137 did so, including some who did not participate at all. This allows us to examine the relationship
138 between the number and type of UniConnect activities participated in and the outcome of successful
139 application to HE. Participants were not randomly allocated to different levels of UniConnect
140 intervention; instead, the degree of engagement was determined by a combination of the learners'
141 and the schools' choices. For example, those who did not engage with UniConnect at all, may have
142 simply chosen not to out of lack of interest, or their school may have chosen not to offer them the
143 opportunity, perhaps because they were deemed to have insufficient academic ability.

144 The critical outcome measure was UCAS application success, meaning that the learner had been
145 accepted onto a course of prescribed HE that included HNDs, HNCs, foundation degrees, a degree or
146 degree or graduate level apprenticeship. Learners classified as 'unsuccessful' included those who
147 made unsuccessful UCAS applications as well as those who made no application at all. There were

148 three categories of independent variables included in this study: Participant-related, School-related
149 and UniConnect Intervention-related.

150 Each partner involved in the Aimhigher consortium recorded their own data on the Aimhigher
151 tracking database. This database holds data on pupils' background characteristics and is employed to
152 track pupils' engagement within interventions. UCAS data was obtained directly from schools via a
153 standardised excel sheet and was then matched to records from the Aimhigher database to allow us
154 to explore whether there was an association between HE outcome, frequency of engagement and
155 intervention type(s).

156

157 Participants

158 Participants in this study were drawn from a population of 2,706 18-19-year old learners completing
159 full time Level 3 qualifications selected from the West Midlands UniConnect database who were due
160 to make a first application to university in the 2017/8 or 2018/9 application cycles. The sample does
161 not include individuals in this age group who were on other career pathways such as completing
162 part-time Level 3 qualifications, re-taking Level 2 qualifications, completing an apprenticeship, in
163 employment or training. For this reason, the overall HE participation rates of the UniConnect
164 population will be lower than those stated here.

165 The sample considered here consisted of 51% of this larger cohort (n=1,386, 792 women, 57.1%)
166 selected on the basis that the results of their UCAS applications were known. A selective sampling
167 approach was employed, where data was requested from schools that had large numbers (100 plus
168 learners) or proportions (20%+) of UniConnect learners on roll and which received high levels of
169 UniConnect resources and funding; this included a payment for teachers to help to coordinate
170 activities, access to mentoring and tutoring and an Aimhigher WM ambassador working in the school
171 or college with the pupils. Data was returned for 40 out of 46 schools in the 2017/18 cycle and 32
172 out of 40 in the 2018/19 cycle. This provided a return rate across both years of 81% of schools. The
173 sampling approach meant that the learners mostly attended larger schools but were otherwise
174 broadly representative of the larger cohort in terms of age and ethnicity. Seven hundred and eighty-
175 six (57%) learners applied to HE in the 2017/18 UCAS cycle and 600 (43%) in the 2018/9 cycle.

176 Individual ages were not available, but most were in Year 13 of school or their 2nd year at College (n=
177 1306, 94%) when they engaged with the UniConnect programme meaning they would have been 16-
178 18 years old. Nearly three quarters of the learners self-identified as White (n=1009, 72.8%), mostly
179 White-British (59.8%), 21.5% identified as black or minority ethnic status (BAME) and 6% declined to
180 define their ethnicity. The largest BAME groups were 3.4% Black-British (Caribbean), 2.9% Black-

181 British (African), 2.7% Mixed (white-Caribbean), 2.5% Asian-British (Pakistani), 1.9% Asian-British
182 (Indian), 1.7% mixed (white and Black-African) with other ethnicities making up less than 1% of the
183 sample.

184 Participants' area of domicile was identified by the Census Area Statistics (CAS) ward in which each
185 learner lived. CAS wards are small local areas used in the 2001 census that contain, on average 5,500
186 people, although this varies widely. CAS wards included in this study were rated as POLAR3 Quintile
187 1, meaning they were in locations where the rate of participation in HE was in the lowest quintile in
188 the UK, with an average of 16.1% of all young people going to a University or FE College compared to
189 a national average of 37.4% [23].

190 Estimates of individual deprivation were derived from the 2019 English Indices of Deprivation
191 measures (IoD2019) [24]. This is a post (zip) code measure of disadvantage. In addition to a measure
192 of overall deprivation, IoD2019 provides estimates of deprivation by locale in seven different
193 domains: Income, Employment, Education, Health, Crime, Barriers to housing and services and the
194 Living Environment) and the supplementary index of Income Deprivation Affecting Children Index
195 (IDACI) [25]. The IoD2019 and IDACI were available as rankings (from 1, most deprived to 32,844,
196 least deprived), deciles and, in some cases, raw scores (Income, Employment, IDACI). The learners
197 predominantly came from relatively deprived areas. The median and lower and upper quartiles
198 scores on the IoD2019 and IDACI are shown in Table 1. As can be seen, the median scores on most
199 measures placed these areas around the 12th percentile of all districts in England, although they did
200 rather better on 'Crime', 'Barriers to Housing and Services' and the 'Living Environment'. In raw
201 figures, 25% of the families in these areas experienced deprivation relating to low income, the
202 unemployment rate was 18% and nearly a third (31%) of children lived in income-deprived families.

203 -----Table 1 around here -----

204 Schools

205 For convenience, the term 'school' is used here to include both schools and FE colleges. Individual
206 data on prior educational achievement was not available for individual learners, although all had
207 been on a Level 3 course before the UniConnect programme was launched which means they must
208 have achieved a good level of Key Stage 4 (GCSE) attainment. Learners came from 42 different
209 schools out of the 81 UniConnect target schools with an average of 40 individuals each although the
210 numbers varied widely (SD= 54.4; range: 1-270). Five schools accounted for 46% of the total, each
211 with more than 70 learners each, but 22 schools had fewer than 20 learners each and six had fewer
212 than ten. Information on each school was available including the number of learners, the UCAS
213 success, the average 'A' level performance (mean 'A'-level points achieved, progress, percentage

214 achieving AAB grades, average best grade, *etc.*), learner destination (HE, employment,
215 apprenticeships), Office for Standards in Education (Ofsted) assessment, UniConnect engagement
216 and mean deprivation of the IoD2019 and IDACI scores of the individual learners that attended
217 them.

218 UniConnect Interventions

219 The models of delivery varied between rural and urban schools, but all interventions were classified
220 into seven different types of activities as shown in Table 2, which also shows the standard duration
221 of each type of activity and the number of times that each was delivered (by either number of pupils
222 or number of programmes). Of the 1,386 learners, 955 (69%) engaged in at least one UniConnect
223 activity. The mean number of engagements was 2.9, although the distribution was very skewed with
224 most users engaging on one or two occasions (Mdn =1). However, a small number of individuals
225 engaged frequently, with the top 1% engaging more than ten times each. The most common form of
226 engagement was seeking information, advice and guidance (information and guidance: 44%)
227 followed by master classes (30%), mentoring (21%), campus visits (9%), tutoring (3%), summer
228 school (2%), work experience (<1%) and other (<1%). As work experience and other activities were
229 so rare, involving around 1% of all learners, they were excluded from all further analysis. All activities
230 included some degree of information, advice and guidance. A Venn diagram showing the co-
231 engagement of the five most types of UniConnect activity is shown in Fig 1 [26]. With six different
232 UniConnect activities, there are 63 possible combinations of UniConnect activities, excluding no
233 activity. However, most individuals (94%) fell into one of only twelve combinations. It should be
234 noted that for all the data presented in this report, there is likely to be an element of self-selection
235 bias, as pupils with different demographics, socioeconomic background and prior attainment
236 characteristics were more likely attend certain interventions than others. In practice, access to many
237 of the activities were organised through the schools and the extent to which these activities were
238 truly accessible to all learners varied according to local practice. This means that those learners who
239 did not engage with UniConnect probably form a heterogeneous group that includes some who
240 were uninterested in engaging at all, some where the school did not encourage or allow engagement
241 and others who may have engaged had the opportunity been made available.

242 ----Table 2 around here ----

243 ----Fig 1 around here ----

244 There are five universities within the urban area, and each provided two members of staff to support
245 the co-ordination of activities within schools. Recent graduates known as UniConnect Progression
246 Ambassadors were placed within embedded schools to deliver support for learners (mentoring,

247 information and guidance, and workshops for learners and parents / carers) and to facilitate their
248 access to activities delivered by the partner universities. In addition, these schools were provided
249 with additional funding to help appoint a member of staff to build capacity to support the
250 UniConnect programme. In rural areas, co-ordinators were linked to schools to support the school's
251 participation with UniConnect. Rather than UniConnect Progression Ambassadors, Graduate
252 Ambassadors and FE mentors were commissioned to visit schools and offer online support. In these
253 rural areas, a commissioning model was run in which schools bid for funding to deliver activities to
254 meet the needs of learners within their organisation which they would not otherwise be able to
255 afford to provide.

256 Statistical Analysis

257 The dependent variable in all analyses was UCAS success (Yes/No). Identifying predictors of a binary
258 dependent variable was conducted using direct Logistic Regression using the χ^2 test of significance
259 for the overall model, with -2 log likelihood ratio (LLR), the Cox & Snell pseudo-R² (CSR²) and case
260 classification (including sensitivity and specificity) as indices of the completeness of the model and
261 for comparison between models. Low -2 log likelihood ratios and Cox & Snell pseudo-R² values
262 approaching 1 indicate better fit to the data. High χ^2 values are also associated with better fit but
263 values can only be compared when they have the same numbers of degrees of freedom. Sensitivity
264 is the true positivity rate, in this case, the percentage of individuals who were predicted to achieve
265 UCAS success out of all of those who did. Specificity is the true negative rate, in this case, the
266 percentage of individuals who were predicted to have failed to achieve UCAS success, out of all
267 those who failed. Sensitivity and specificity rates of at least 80% are usually required to be useful,
268 although this very much depends upon context. The importance of individual independent variables
269 was assessed using the odds ratio, Exp(B), with 95% confidence intervals as the index of significance.
270 The odds ratio is the ratio of the odds of the successful HE application in one group (odds being the
271 number of people who successfully applied to HE divided by the number who were not successful)
272 to the odds of the positive outcome in the other group.

273 In the case where there was a single dichotomous independent variable, relative risk was used as the
274 index of importance instead of the odds ratio. Although odds ratios are widely used, notably in
275 Logistic Regression, they are commonly and erroneously misinterpreted as relative risks. Relative risk
276 is the ratio of the probability of the successful HE application in one group to the probability of the
277 successful HE application in the other group, so for example, a relative risk of 1.5 would mean that
278 the group is 1.5 times, or 50%, more likely to have a UCAS acceptance than the other group. The
279 RRI's major advantage over the alternative measures of UniConnect engagement is that it better

280 reflects the relationship between engagement and the chance of progressing to HE. It is also simple
281 to derive from the number of engagements along with an estimate of the associated probability of
282 progressing to HE. As relative risks are more intuitive to understand than odds ratios, they were used
283 in preference whenever feasible.

284 Ethics Statement

285 The Aimhigher West Midlands programme has obligations set out by the Office for Students to
286 identify what interventions are most effective for the public benefit in terms of closing gaps in school
287 and higher education inequality. No new or additional data were collected for this research and all
288 data were anonymised.

289 Results

290 The impact of UniConnect engagement

291 Learners who engaged with UniConnect activities were much more likely to progress successfully to
292 HE (58%) than those who did not engage (39%). This means that any engagement with UniConnect,
293 no matter how limited, was associated with an improved chance of achieving a place, giving a
294 relative risk of 0.58/0.39 or 1.49. In other words, those who engaged were nearly 50% more likely to
295 be accepted into HE than those who did not (95% CI [1.31, 1.70]). This effect, although highly
296 statistically significant, was small ($\chi^2_{df=1}=43.1$, $p<.001$; LLR=1875.4; $CSR^2 = .031$) improving the correct
297 classification of success to 58.9% from a baseline correct classification rate of 51.9%. The sensitivity
298 of 57.9% and specificity of 61.3% were also poor.

299 It was considered that better classification might be achieved by combining information from across
300 all UniConnect activities and by using the total number of UniConnect engagements, rather than a
301 simple measure of engaged/not engaged. Using the total number of UniConnect engagements was
302 found to be a significant predictor of UCAS success ($\chi^2=29.24$, $df=1$, $p<.001$; LLR=1890.1; $CSR^2 = .021$),
303 but again, the association was weak with 58.9% of cases correctly classified compared to the
304 baseline correct classification of 51.9% (sensitivity 55.1%, specificity 62.9%). Note that the higher LLR
305 and the lower CSR^2 suggest that the total number of UniConnect Engagements is a poorer predictor
306 of UCAS success than the simple binary measure on engagement.

307 One reason for the poorer prediction of the total number of UniConnect engagements (i.e. the Total
308 Score) is because it assumes a linear relationship between engagement and UCAS acceptance, such
309 that the more individuals engaged with UniConnect, the more likely they were to achieve UCAS
310 acceptance. However, most relationships of this type are governed by a law of diminishing returns,

311 whereby each increase in activity provides a smaller additional effect until an asymptote is reached
 312 where no further benefit is gained no matter how much the activity is increased. In order to model
 313 this relationship we estimated the probability of UCAS success at different levels of UniConnect
 314 engagement. As few individuals engaged with more than a small number of UniConnect activities,
 315 we averaged across numbers of engagements to ensure sufficient sample size in each bin to get a
 316 stable estimate of the response. Specifically, we estimated the relative risk of UCAS success at
 317 activity levels of 1, 2-3, 4-5, 6-7, 8-9, 10-11, 12-13, 14-15, 16-17 and ≥ 18 engagements, compared to
 318 no engagement, weighted by the number of individuals in each bin and fitted a Brody curve, (a
 319 commonly used monotonic growth function with easily interpretable parameters): see Fig 2. The
 320 curve provided a good fit to the data (adjusted $R^2 = .90$; RMSE .09) that reached asymptote at a
 321 relative risk value of 1.69 meaning that no matter how much UniConnect engagement learners have,
 322 they should not expect to improve their chances of UCAS success by more than around 70% above
 323 those who did not engage.

324 ----- Fig 2 around here -----

325 This non-linear relationship between the number of UniConnect Engagements and UCAS success
 326 provides a convenient way of estimating each individual's likely benefit from their engagement with
 327 UniConnect which we call the Relative-Risk Index (RRI), also tabulated in Fig 2. This shows that
 328 engaging in a single activity raises the RRI from 1.00 to 1.25 and raises the probability of progression
 329 to HE from 39% to 49%. In contrast, engaging in seven activities vs. six activities changes the RRI
 330 from 1.64 to 1.66 and the probability of progression to HE from 64% to 65%. At its greatest,
 331 engaging with UniConnect provided a nearly 70% greater chance of UCAS acceptance than someone
 332 who did not engage. To get this full benefit however, more than a dozen engagements might be
 333 required but 90% of the maximum benefit was could be expected with as few as five or six
 334 engagements. Using logistic regression, the RRI was found to be a significant predictor of UCAS
 335 success ($\chi^2=59.4$, $df=1$, $p<.001$; $LLR=1859.6$; $CSR^2 = .042$). However, the association remained weak,
 336 with 58.9% of cases correctly classified compared to the baseline correct classification of 51.9%
 337 (sensitivity 55.1%, specificity 62.9%). Nevertheless, the RRI performed substantially better as an
 338 index of the degree of UniConnect engagement than either the total number of UniConnect
 339 engagements or binary measure of UniConnect engagement and so was used in further analyses
 340 (based on a higher CSR^2 value and a lower LLR value).

341
 342 The most effective types and combinations of UniConnect interventions
 343 The different types of engagement with UniConnect were not all equally effective. Fig 3a shows the
 344 relative risk of UCAS application success by activity type (whether engaged with alone or in

345 combination with other activities) and it can be seen that the UniConnect activities most strongly
346 linked to UCAS acceptance were summer schools, campus visits and information and guidance
347 whereas tutoring offered no significant benefit.

348 ---- Fig 3a and 3b around here ----

349 Similarly, not all combinations of engagement types were equally effective (see Fig 3b). Here,
350 summer schools and combinations of information, campus visits and master classes were most
351 effective. The predictive value of the 14 most common combinations of UniConnect activity together
352 was explored using logistic regression with the 14 combinations of UniConnect engagement entered
353 as a categorical independent variable with 'No engagement' as the reference category. The resulting
354 model was statistically significant ($\chi^2=68.75$, $df=14$, $p<.001$; $LLR=1850.6$; $CSR^2=.048$) with 59.1% of
355 cases correctly classified and relatively good levels of sensitivity (74.6%), although the specificity was
356 poor (42.3%). Learners who engaged with a single type of UniConnect activity tended to be less
357 successful than those who engaged more widely. Combinations of activities that included summer
358 schools did particularly well (see Fig 3b), with the second-best combination being information and
359 guidance, master classes and campus visits.

360 To summarise the results so far, any UniConnect engagement was associated with substantially
361 better chance of UCAS success but the type of engagement, the extent of engagement and the
362 combination of types of engagement all mattered.

363 Combination of other factors associated with UCAS success

364 So far, we have considered the impact of UniConnect interventions in isolation and ignored other
365 potential influences on UCAS success. However, to provide a comprehensive evaluation of the effect
366 of UniConnect interventions, we need to consider their effects in combination with other possible
367 influences on UCAS success. One way to do this would be to expand the logistic regression analyses
368 to include other independent variables of interest (e.g. demographics, school, levels of deprivation)
369 but there is good reason to suspect that this approach would be suboptimal as all the learners were
370 nested within schools and different local communities, each of which is likely to have a significant
371 effect on UCAS success. In such cases, a multi-level analysis with categorical outcomes is appropriate
372 and we adopted this approach following the analysis strategy recommended by Heck *et al.*[27]. In
373 the following analysis, the contribution of the relevant independent variables to UCAS success was
374 estimated using robust multi-level logistic regression with UCAS acceptance (Yes/No) as the
375 dependent variable (IBM SPSS 26).

376 Level 1 Fixed Effects

377 The independent variables were (with a brief rationale for their inclusion) as follows:

378 **Sex and Ethnicity.** Women are more likely to attend university in the UK than men [28]. Black, Asian,
379 and ethnic minority learners are more likely to enter HE than white learners, particularly amongst
380 lower SES communities. White ethnic groups made up 76.8% of those in HE but 84.6% of the overall
381 population of England and the proportion of white students fell by 37% between 2002/3 and
382 2017/18. Overall, low SES white men have a significantly lower rate of university attendance than
383 white women, or men from BAME (Black, Asian and Minority Ethnic) communities. For these reasons,
384 the interaction between sex (men/women) and ethnicity (white/ BAME) was entered into the
385 analyses.

386 **Deprivation Indices.** Deprivation is associated with lower educational outcomes. The association
387 between deprivation indices and UCAS success was investigated using the IoD2019 index of overall
388 deprivation. As the rankings scores were skewed, we used the log of the ranks. We included the
389 IoD2019 overall index of deprivation but, in addition, as we wished to explore the specific
390 contributions of each of the IoD2019 subscales (Income, Employment, Health, Crime, Barriers to
391 Housing & services, Local Environment) and the IDACI. To do this, we regressed each subscale onto
392 the overall index score in turn and estimated the residual scale for each. These residual scales
393 provided an estimate of the unique variance for each subscale (i.e. the variance not shared with the
394 overall index) and were independent of each other, thus avoiding problems of multicollinearity.

395 **UniConnect Engagement.** Although the precise combination of UniConnect Activity provided the
396 best predictor of UCAS success, we elected to use the RRI of UniConnect Engagement as this
397 performed nearly as well as the combination measure but had the simplicity of being a simple and
398 easily estimated index that could be applied to all learners.

399 **Rural/ Urban.** The type of location of the school (rural vs. urban) was included as the structure of
400 UniConnect interventions differed between rural and urban schools.

401 Level-2 Random Effects

402 All learners and UniConnect interventions were nested within schools and locations and for this
403 reason both factors were considered as candidates for Level-2 random variables in the model.

404 We first considered school. Essentially, this involved determining whether the variation in outcomes
405 for learners in different schools was sufficiently large to make including school as a random effect in
406 the model worthwhile. This was done by producing a multi-level model of UCAS success with a single
407 Level-2 random effect (i.e. school). The results of this analysis showed that the school attended was

408 a significant predictor of outcome (Odds ratio=1.444, $t=2.989$, $p=.003$) and that the variance
409 between schools was significantly large (variance of the intercept =.326, $z=2.680$, $p=.007$),
410 accounting for approximately 9% of the variance in outcome.

411 Area of domicile is an important indicator of the likelihood of entering HE. As UniConnect
412 interventions were focussed on CAS wards where learners were least likely to attend university,
413 (quintile1 of POLAR3), we used CAS wards as the identifier of area of domicile, but, when this was
414 tested, the model was not significant (Odds ratio=1.101, $t=1.248$), $p=.212$) and the variance between
415 CAS wards was not significantly large (variance of the intercept =.056, $z=1.3.06$, $p=.192$), so this was
416 not included in the final model.

417

418 Final Model

419 As data on ethnicity had been refused by 79 individuals, the sample size for this analysis was 1,307
420 (94.3% of the total), of which 67.1% were correctly classified in terms of their UCAS success
421 (sensitivity 72.0%, specificity 61.8%). The results of the Level-1 fixed effects - after inclusion of the
422 school variable as a random effect - are shown in Table 3 and described below.

423 **Sex and Ethnicity.** BAME women (relative risk =1.41), white women (relative risk = 1.15) and BAME
424 men (relative risk=1.43) were all much more likely to attend university than white men. Women
425 were significantly more likely to achieve a university place than men (relative risk of 1.10; 95% CI
426 [1.04, 1.16]) which is somewhat lower than the national average where 30% more women than men
427 currently attend HE. If we consider the seven largest ethnic groups in this sample, three showed
428 substantially greater UCAS success than white learners (Asian British-Indian, Asian British-Pakistani
429 and Black British-African) with relative risks of UCAS success of 1.51, 1.65 and 1.55 and only one
430 group (Mixed White and Black Caribbean) were significantly less successful than their white
431 counterparts (risk ratio=0.65).

432 **Indices of Deprivation.** Overall, UCAS success was not associated with deprivation. Only the IDACI
433 was significantly associated with UCAS success (Odds ratio= 0.28, $t_{1269}=-2.74$, $p=.006$). Note that the
434 predictor was not the IDACI score *per se* but the residual of the IDACI score regressed on to the IoD
435 overall deprivation score. That is, learners living in areas where the proportion of children affected
436 by income deprivation was higher than would be expected (i.e. more deprived), given the overall
437 level of deprivation in that area, were slightly more likely to achieve UCAS success.

438 **UniConnect Engagement.** The relative-risk index of UniConnect engagement remained associated
439 with increased probability of UCAS success (odds ratio 4.10; 95% CI [1.87, 8.99]) even with other

440 factors (school, sex, ethnicity and deprivation) considered. The interaction between RRI and
441 Rural/Urban location was also significant (odds ratio 1.65; 95% CI [1.05, 2.59]) suggesting that there
442 was a difference in effectiveness of UniConnect interventions in favour of rural locations.

443 ----- Fig 4 around here -----

444 -----Table 3 around here -----

445 **School.** As already, noted, School was a significant random factor, but with the addition of the fixed
446 effects, the proportion of variance accounted for fell slightly to 9.6% (variance of the intercept =.350,
447 $z=2.34$, $p=.019$). This made school a substantially better predictor of UCAS success than any of the
448 measures of UniConnect engagement discussed. Fig 4 shows the relative risk for each school
449 compared to all other schools. These showed a very wide range from the least successful school,
450 where learners have less than a third of the chance of entering HE in comparison to learners at other
451 schools (relative risk=.32), to the most successful school where learners were nearly twice as likely
452 to be successful (relative risk=1.94). In terms of UCAS success rates, and ignoring schools with fewer
453 than ten UniConnect learners, the rate of success across schools ranged from 17% to 88%.

454 Given the importance of school in UCAS success rate, as a control analysis, we investigated if this
455 success rate was associated with variations between schools in UniConnect engagement – it was
456 not. Similarly, we tested whether variation in success rate was associated with variation between
457 schools in terms of levels of deprivation. In this case, there was some evidence that schools with a
458 higher proportion of learners living in areas with greater education and skills deprivation than would
459 be expected *given the area's overall level of deprivation*, tended to have lower UCAS success rates,
460 although it accounted for less than 8% of the variation. Overall, therefore, the variation in success
461 rates observed between schools is not accounted for by any of the variables that we measured.

462 Discussion

463 The primary finding of this study is that engagement with UniConnect interventions was associated
464 with a higher probability of being accepted into HE. Although the *type of engagement*, the *extent of*
465 *engagement* and the *combination of types of engagement* all mattered, any engagement, no matter
466 how modest, significantly enhanced the learner's chance of UCAS success. This was true even when
467 other factors, like sex and ethnicity, the school attended, rural vs. urban environment and the level
468 of deprivation were statistically controlled. Although this finding emerges from the UK, the fact that
469 it applies across such a broad range of conditions within the UK suggests it is likely to be applicable
470 in other contexts also.

471 Emmerson *et al.* [17] reported positive effects of an Aimhigher programme, with greater effects on
472 pupils from disadvantaged backgrounds. Our results reaffirm this finding in individual pupils from
473 disadvantaged backgrounds, providing a robust statistical analysis and controlling for several critical
474 factors, including school and local area. We have also extended the finding to include information on
475 which components and combinations of components of a programme have the greatest impact on
476 access to HE. The best combinations of activities for improving outcomes in our analysis also
477 included summer schools; although combinations of information and guidance, master classes and
478 campus visits were also effective. Previous research has suggested that summer schools are amongst
479 the most effective interventions, although not necessarily the most cost effective [29-31].

480 Our results also show how between five and six components in a multi-intervention programme
481 provide the optimal balance between input and impact, although simply having engaged with
482 UniConnect at all was the single best predictor of UCAS success. Although it is generally accepted
483 that multi-intervention programmes are more effective than single interventions (see e.g.[14, 17]),
484 to our knowledge there has been no previous research on the necessary, sufficient or optimal
485 number of interventions; our findings address this gap.

486 It was interesting to note that our results showed that the school attended was a better predictor of
487 UCAS success than any measure of UniConnect engagement. Chowdry *et al.*[32] also noted the
488 potentially important role that schools seem to play in encouraging pupils from lower socio-
489 economic backgrounds to apply to higher status HE institutions. It is important to note for future
490 evaluations of such programmes, therefore, that a comparison of participating vs. not participating
491 schools would likely not provide a well-controlled study. Contrary to expectations, area of domicile
492 did not have a significant influence of UCAS acceptance in our results. However, this was most likely
493 a consequence of our sample only including participants from areas with the lowest participation in
494 HE.

495 *Limitations*

496 Of course, given the study design, we cannot say with any certainty that the UniConnect
497 intervention was the cause of this beneficial outcome. Although all learners were eligible to
498 participate with UniConnect, in practice, any individual's opportunity to engage emerged from an
499 unknown combination self-selection, school-selection and UniConnect-selection. Self-selection,
500 because those who were uninterested in HE would be unlikely to engage. School selection, because
501 each school had limited access to UniConnect interventions and may have selected learners deemed
502 more likely to be succeed; and UniConnect selection because the resources allocated to different
503 schools varied by location (rural vs. urban) and the number of pupils resident in target wards. The

504 result is that those learners who did not engage at all were a heterogeneous group that did not
505 engage for a variety of reasons.

506 Despite this limitation, the finding that there was a relationship between the extent of engagement
507 and UCAS success provides better evidence for the efficacy of UniConnect interventions. Similarly,
508 the apparent difference seen in the efficacy of the various interventions (some of which, like
509 tutoring, seem to have provided little benefit despite the relatively large investment of time),
510 indicates that the benefits of engaging with UniConnect are unlikely to have been solely due to
511 learner selection. Other evidence comes from the overall UCAS success rate which was much higher
512 than would be expected based on the POLAR3 quintile of this sample and above the overall average
513 of 49% of UK students who took mainly Level 3 qualifications progressing to HE (Level 4 and above)
514 in the year after they finished 16 to 18 study [33].

515 Unsurprisingly, prior attainment is considered a key factor in progression to HE. Indeed, it has also
516 been shown that much (but not all) of the gap in socioeconomic differences in progression rates to
517 HE can be attributed to socioeconomic differences in attainment [32]. The causal direction of this
518 association, however, is a matter of some debate, with some proposing that lower attainment may
519 be a *result* of perceived barriers to HE [32]. A second limitation of our study was therefore that no
520 data were available on prior attainment.

521 Our data came from the schools the pupils attended, rather than the pupils themselves, eliminating
522 a potentially difficult source of response bias. However, these schools would have garnered this
523 information mainly from UCAS acceptances and pupil reports, rather than actual HE enrolment. A
524 few students each year will accept a place but fail to enrol making UCAS acceptance only a proxy
525 measure. Furthermore, in terms of the recording of outreach interventions, only outreach by
526 consortium partners was recorded, and not attendance at events provided by other higher
527 education providers outside of the region. It is therefore possible that participants had a higher
528 engagement in activities than those recorded here.

529 *Conclusions and future directions*

530 Importantly, we have provided a robust statistical analysis showing that the UniConnect programme
531 has been successful in its aim to help close the participation gap - with around 183 extra students in
532 our sample progressing to HE than would be expected with no engagement in the programme. Our
533 findings lead to clear recommendations for future research and practice in this area. First, in order to
534 make best use of funding resources and pupil time, future intervention programmes should
535 encourage pupils to participate in at least one - but no more than six - activities and should also

536 consider the combinations of interventions shown to be most effective. Whilst combinations
537 involving summer schools did seem to be effective, a combination of information, campus visits and
538 master classes was also shown to be highly effective and would likely be more cost-efficient.
539 Second, future evaluations of intervention programmes should exercise considerable caution before
540 employing school-based comparison groups, because of the already evident differences between
541 schools' success in achieving pupil progression to HE.

542

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550 educational design and innovative delivery modes in undergraduate provision within UK Higher
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553 References

- 554 1. Education Policy Institute. Key drivers of the disadvantage gap. Literature Review. Education in
555 England: Annual Report. 2018. Accessed 14.10.2020 from:
556 <https://www.basw.co.uk/system/files/resources/EPI-Annual-Report-2018-Lit-review.pdf>
- 557 2. Emmons WR, Kent AH, Ricketts LR. The demographics of wealth: how education, race and birth
558 year shape financial outcomes. Accessed 29.04.2021 from: [HFS_essay_1-2018.pdf](#)
559 (stlouisfed.org)
- 560 3. Eurostat: Statistics Explained. [Earnings statistics - Statistics Explained \(europa.eu\)](#). Accessed
561 29.04.2021 from: [https://ec.europa.eu/eurostat/statistics-
562 explained/index.php/Earnings_statistics#Higher_level_of_education_yields_higher_earnings](https://ec.europa.eu/eurostat/statistics-explained/index.php/Earnings_statistics#Higher_level_of_education_yields_higher_earnings)
- 563 4. Statistics Canada: Education, training and learning statistics. Accessed 29.04.2021 from:
564 https://www.statcan.gc.ca/eng/subjects-start/education_training_and_learning
- 565 5. James R, Bexley E, Anderson A, Devlin M, Garnett R, Marginson S, Maxwell L. Participation and
566 equity : a review of the participation in higher education of people from low socioeconomic
567 backgrounds and Indigenous people Centre for the Study of Higher Education, Melbourne,

- 568 Vic.2008. Accessed 29.04.2021 from: <https://melbourne->
569 [cshe.unimelb.edu.au/research/archived-research/participation-and-equity](https://melbourne-cshe.unimelb.edu.au/research/archived-research/participation-and-equity)
- 570 6. Skilbeck M. Access and Equity in Higher Education: An International Perspective On Issues And
571 Strategies. The Higher Education Authority: Dublin.2000. Accessed 29.04.2021 from: [Access and](#)
572 [Equity in Higher Education : An International Perspective on Issues and Strategies](#)
573 [\(edepositireland.ie\)](#)
- 574 7. UNICEF Office of Research. 2018. An unfair start: inequalities in children’s education in rich
575 countries. Innocenti Report Card 15. Innocenti, Florence. Accessed 29.04.2021 from:
576 <https://www.unicef.org/reports/unfair-start>
- 577 8. Joseph Rowntree Foundation. UK Poverty 2018: A comprehensive analysis of poverty trends and
578 figures. Accessed 23.09.2020 from: [https://www.jrf.org.uk/report/uk-poverty-](https://www.jrf.org.uk/report/uk-poverty-2018?gclid=EAIaIQobChMlwOSjhDX4gIVQ7DtCh0GJgmvEAAAYASAAEgKGwPD_BwE)
579 [2018?gclid=EAIaIQobChMlwOSjhDX4gIVQ7DtCh0GJgmvEAAAYASAAEgKGwPD_BwE\)](https://www.jrf.org.uk/report/uk-poverty-2018?gclid=EAIaIQobChMlwOSjhDX4gIVQ7DtCh0GJgmvEAAAYASAAEgKGwPD_BwE)
- 580 9. Secretary of State for Education. Access and Participation: Secretary of State for Education
581 guidance to the Office for Students (OfS). Accessed 04.05.2020 from:
582 <https://www.officeforstudents.org.uk/media/1112/access-and-participation-guidance.pdf>
- 583 10. Gorard S, Smith E, May H, Thomas L, Adnett N, Slack K. Review of widening participation
584 research: Addressing the barriers to participation in higher education. Bristol: Higher Education
585 Funding Council for England (HEFCE). 2006. Accessed 14.10.2020 from
586 <https://dera.ioe.ac.uk/6204/1/barriers.pdf>
- 587 11. Doyle M, Griffin M. Raised aspirations and attainment? A review of the impact of Aimhigher
588 (2004–2011) on widening participation in higher education in England, London Rev Educ. 2012;
589 10: 75–88. DOI: 10.1080/14748460.2012.659060
- 590 12. Gorard S, Smith E. Beyond the ‘learning society’: what have we learnt from widening
591 participation research? Int J Lifelong Educ. 2006; 25: 575-594, DOI:10.1080/02601370600989269
- 592 13. Riddell S, Edward S, Boeren E, Weedon E. Widening Access to Higher Education: Does Anyone
593 Know What Works? A Report to Universities Scotland. 2013. Accessed 29.04.2021 from:
594 <http://www.universities-scotland.ac.uk/uploads/WideningAccessToHE-CREID.pdf>
- 595 14. Younger K, Gascoine L, Menzies V, Torgerson C. A systematic review of evidence on the
596 effectiveness of interventions and strategies for widening participation in higher education, J
597 Furth High Educ. 2019; 43: 742-773, DOI: 10.1080/0309877X.2017.1404558
- 598 15. Gorard S, See BH, Davies S. The impact of attitudes and aspirations on educational attainment
599 and participation. 2012. Accessed 29.05.2020 from:
600 <http://www.jrf.org.uk/sites/files/jrf/education-young-people-parents-full.pdf>

- 601 16. Bergin DA, Cooks HC, Bergin CC. Effects of a college access program for youth underrepresented
602 in higher education: A randomized experiment. *Res High Educ*, 2007; 48: 727–750. DOI:
603 [10.1007/s11162-006-9049-9](https://doi.org/10.1007/s11162-006-9049-9)
- 604 17. Robinson D, Salvestrini V. The impact of interventions for widening access to higher education: a
605 review of the evidence. Report to TASO: Transforming Access and Student Outcomes in Higher
606 Education. 2020. Accessed 14.10.2020 from: [https://taso.org.uk/wp-](https://taso.org.uk/wp-content/uploads/Widening_participation-review_EPI-TASO_2020.pdf)
607 [content/uploads/Widening_participation-review EPI-TASO 2020.pdf](https://taso.org.uk/wp-content/uploads/Widening_participation-review_EPI-TASO_2020.pdf)
- 608 18. Bowman NA, Kim S, Ingleby L, Ford DC, Sibaouih C. Improving College Access at Low-Income High
609 Schools? The Impact of GEAR UP Iowa on Postsecondary Enrollment and Persistence, *Educ Eval*
610 *Policy Anal*, 2018; 40: 399 –419. DOI: [10.3102/0162373718778133](https://doi.org/10.3102/0162373718778133)
- 611 19. Emmerson C, Frayne C, McNally S, Silva O. Aim Higher: Excellence Challenge: A policy evaluation
612 using the labour force survey, Department for Education and Skills, Research Report RR813.
613 2006. Accessed 29.04.2021 from: <https://www.ifs.org.uk/publications/3801>
- 614 20. Morris M, Golden M. Evaluation of Aimhigher: Excellence challenge interim report. Department
615 for Education and Skills, Research Report RR648. London: DfES. 2005. Accessed 29.04.2021 from:
616 <https://nfer.ac.uk/publications/EIC04/EIC04.pdf>
- 617 21. Chilosi D, Noble M, Broadhead P, Wilkinson M. Measuring the effect of Aimhigher on schooling
618 attainment and higher education applications and entries, *J Furth High Educ*. 2010; 34, 1-10.
619 DOI: [10.1080/03098770903477052](https://doi.org/10.1080/03098770903477052)
- 620 22. Horton M, Hilton G. Has Engagement in AHWM NCOP Increased Students' Higher Education
621 Progression Rates? (Interim NCOP Research Report 2019). Accessed 08.10.2020 from:
622 <https://aimhigherwm.ac.uk/research-impact/research-impact-he-progression/>
- 623 23. HEFCE (2012). POLAR 3: Young participation rates in Higher Education. Accessed 07.10.2020
624 from: https://dera.ioe.ac.uk/15706/7/POLAR3_Redacted.pdf
- 625 24. English Indices of Deprivation (2019). Accessed 08.10.2020 from:
626 <https://www.gov.uk/guidance/english-indices-of-deprivation-2019-mapping-resources>
- 627 25. Income Deprivation Affecting Children Index. Accessed 08.10.2020 from:
628 [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/835115/loD2019_Statistical_Release.pdf)
629 [/file/835115/loD2019_Statistical_Release.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/835115/loD2019_Statistical_Release.pdf)
- 630 26. Heberle H, Meirelles GV, da Silva FR, Telles GP, Minghim R. InteractiVenn: a web-based tool for
631 the analysis of sets through Venn diagrams. *BMC Bioinform*. 2015; 16: 169. DOI:[10.1186/s12859-](https://doi.org/10.1186/s12859-015-0611-3)
632 [015-0611-3](https://doi.org/10.1186/s12859-015-0611-3)
- 633 27. Heck RH, Thomas SL, Tabata L. *Multilevel Modeling of Categorical Outcomes Using IBM SPSS*.
634 Routledge:2012.

- 635 28. Department for Education. Destinations of key stage 4 and 16-18 students, England, 2017/18.
636 Accessed 23.09.2020 from:
637 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data
638 [/file/860135/Destinations_main_text_2020_REV.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/860135/Destinations_main_text_2020_REV.pdf)
- 639 29. McCaig C, Stevens A, Bowers-Brown T. Does Aimhigher work? Evidence from the national
640 evaluation. In: Higher Education Research Network, Sheffield, 2006. 1-16. Accessed 29.04.2021
641 from: https://shura.shu.ac.uk/2382/1/Does_Aimhigher_work_CM_AS_TB_2007.pdf
- 642 30. Ireland E, Golden S, Morris M. Evaluation of integrated Aimhigher: Tracking surveys of
643 Aimhigher. Department for Education and Skills, Research Report RR811. London: DfES. 2006.
644 Accessed 29.04.2021 from: <https://dera.ioe.ac.uk/6562/1/RR811.pdf>
- 645 31. Hatt S, Baxter A, Tate J. It was definitely a turning point! A review of Aimhigher summer schools
646 in the south west of England. *J Furth High Educ.* 2009; 33: 333–346. **DOI:**
647 [10.1080/03098770903266034](https://doi.org/10.1080/03098770903266034)
- 648 32. Chowdry H, Crawford C, Dearden L, Goodman A, Vignoles A. Widening participation in higher
649 education: analysis using linked administrative data. *J R Statist Soc A.* 2013; 176: 431-457. **DOI:**
650 [10.1111/j.1467-985X.2012.01043.x](https://doi.org/10.1111/j.1467-985X.2012.01043.x)
- 651 33. HESA. 2019. Data accessed 23.09.2020 from: [https://www.hesa.ac.uk/data-and-](https://www.hesa.ac.uk/data-and-analysis/students/whos-in-he)
652 [analysis/students/whos-in-he](https://www.hesa.ac.uk/data-and-analysis/students/whos-in-he)

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Deprivation Index	Ranking (out of 32,844)			Percentile			Raw Score		
	Q1	Median	Q3	Q1	Median	Q3	Q1	Median	Q3
Index of Multiple Deprivation	1,988	4,082	9,392	6.1	12.4	28.6			
Income	1,855	3,999	10,161	5.6	12.2	30.9	15.4%	25.0%	31.3%
Employment	1,867	4,215	10,534	5.7	12.8	32.1	11.4%	18.1%	23.1%
Education and Skills	2,126	4,503	8,949	6.5	13.7	27.2			
Health and Disability	2,871	5,142	9,874	8.7	15.7	30.1			
Crime	5,289	9,296	14,191	16.1	28.3	43.2			
Barriers to Housing and Services	5,479	9,176	15,637	16.7	27.9	47.6			
Living Environment	5,766	11,730	20,160	17.6	35.7	61.4			
Income Deprivation Affecting Children Index (IDACI)	1,549	3,956	10,223	4.7	12.0	31.1	19.8%	31.1%	39.5%

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658 Table 1. Median 2019 English Indices of Deprivation (IoD2019)

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Activity	Delivery Period	Duration	Frequency	# times activity delivered	Time of year
Information Advice and Guidance	Throughout year	0.5 – 7 hours (average 2 hours)	Throughout year	1690	Sep-Jul
Masterclass	Throughout year	1-7 hours (average 3 hours)	Throughout year	699	Sep-Jul
Mentoring*	40 weeks	19 hours	Weekly	6 (programmes)	Sep-Jul
Campus Visits	Throughout year	2-7 hours (average 4.45 hours)	Throughout year	296	Sep-Jul
Tutoring	20 weeks	10 hours	Weekly	2 (programmes)	Sep-Jul
Summer School	2-3 days	20-30 hours	Annual	34	Mar-Apr or Jun-Jul
Community Based Interventions	40 weeks	1-5 hours (average 2 hours)	Weekly	1 (programme)	Sep-Jul

661 Table 2. Typology of UniConnect Activities.

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Fixed Effects	Coefficient	S.E.	t-value*	p-value	Odds ratio	95% C.I.	
						Lower	Upper
Intercept (School)	-2.11	0.55	-3.87	<.001	0.12	0.04	0.35
Sex * BAME ^a							
BAME women	0.91	0.25	3.70	<.001	2.49	1.53	4.04
White women	0.26	0.12	2.26	0.024	1.30	1.04	1.63
BAME men	0.87	0.22	3.98	<.001	2.38	1.55	3.65
Index of Deprivation	0.02	0.10	0.19	0.849	1.02	0.85	1.23
Income	0.58	0.94	0.62	0.535	1.79	0.29	11.21
Employment	-1.11	0.63	-1.77	0.077	0.33	0.10	1.13
Education	-0.12	0.33	-0.35	0.726	0.89	0.47	1.70
Health and Disability	-0.63	0.41	-1.56	0.120	0.53	0.24	1.18
Crime	-0.25	0.34	-0.74	0.458	0.78	0.40	1.51
Barriers to Housing and Services	-0.16	0.37	-0.42	0.676	0.86	0.41	1.78
Living Environment	-0.55	0.32	-1.71	0.087	0.58	0.31	1.09
IDACI	-1.28	0.47	-2.74	0.006	0.28	0.11	0.69
UniConnect Engagement (RRI)	1.41	0.40	3.53	<.001	4.10	1.87	8.99
RRI by Rural/ Urban ^b	0.50	0.23	2.17	0.030	1.65	1.05	2.59

666 *df=1269; ^aReference Category: white man; ^bReference Category: Urban

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671 Table 3. Showing the results of the multi-level logistic regression analysis

Fig 1. Venn diagram showing the percentage of co-engagements of the five most common types of UniConnect activity. Percentage values below 1% have been suppressed for data protection purposes.

Fig 2. Showing the relative risk of UCAS acceptance (\pm standard error) by the number of UniConnect engagements and the best-fitting growth curve (\pm 95% confidence intervals) Showing the relationship between Number of UniConnect activities, the relative Risk Score of Engagement and the expected probability of HE progression

Fig 3. Panel a) Shows the relative risk of UCAS success for each type of UniConnect activity compared to no engagement. So, for example, the relative risk for Mentoring here refers to the overall risk associated with Mentoring regardless of whether it was engaged with alone or in combination with other activities. In contrast, Panel b) Shows the relative risk of UCAS acceptance for each of the twelve most common combinations of UniConnect activities where each relative risk compares the risk in the specified group to the risk of all other combinations. In this case, the relative risk for Mentoring refers to the risk of engaging with Mentoring and only Mentoring. Additional combinations including all combinations involving 'Summer School' and a miscellaneous group of combinations not otherwise included are also shown.

Fig 4. Showing the relative risk of UCAS success for learners attending each of the 36 largest schools plus a miscellaneous group of schools with fewer than ten learners. Each relative risk compares the risk of UCAS success in the specified group to the risk of all other schools combined

Journal Pre-proof







