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Author for correspondence:
Robin Evans
e-mail: R.Evans@leeds.ac.uk

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The relationship between school characteristics and students becoming 'not in education, employment or training'

Robin Evans[1], Matthew Warburton[2], Daniel Birks[3], Patricia Ternes[4], Mark Mon-Williams[2,6] and Nick Malleson[7,5]

[1]Leeds Institute for Data Analytics, [2]School of Psychology, [3]School of Law, [4]Research Computing, and [5]School of Geography, University of Leeds, Leeds, UK
[6]Born in Bradford's Centre for Applied Education Research, Wolfson Centre for Applied Health Research, Bradford, UK
[7]The Alan Turing Institute, London, UK

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The impact of student-level risk factors on not in education, employment or training (NEET) rates (e.g. low attainment, absenteeism and socio-economic disadvantage) are well-documented. However, there is limited research on how school characteristics influence NEET rates, despite recognition that inclusive school environments can have a positive effect on education outcomes. In this work, we hypothesized that proxy measures of 'inclusivity' would affect sustained post-16 engagement, and we tested this hypothesis using 3 years of administrative data for secondary schools in England while controlling for known student and school local area risks. Our results indicate that schools with lower suspension rates, higher student progress ('Progress 8') and onsite post-16 provision had lower rates of students becoming NEET. Single-sex and faith schools also exhibited reduced NEET rates. These results suggest school culture and inclusivity play an important role in shaping student trajectories. The proportion of 16–17 year olds in England who become NEET has remained stubbornly high for more than a decade, putting these individuals at risk of long-term adverse outcomes. Our results suggest that policies promoting inclusive school environments, supportive disciplinary practices and clear post-16 pathways may help increase sustained engagement in education and training.

1. Introduction

Since 2014, young people in England have been expected to remain in full-time education or employment with training until their 18th birthday [1]. However, the proportion of 16–17 year olds who are not in education, employment or training (NEET) is now higher (4.6 %) than it was when this legislation was introduced (3.9%; [2]) and the total number of young people aged 16–24 who are NEET in the UK is approaching 1 million [3].

NEET status has been associated with a range of long-term negative outcomes, including unemployment, lower wages, poor health, drug misuse and participation in criminal activity [4–6]. A high rate of young people becoming NEET also has negative consequences for wider society and the national economy through increased demand on public services and lost tax revenue [7]. Consequently, youth disengagement from education and the labour market remains a persistent international concern. In the UK, the Government's 'Get Britain Working' campaign released new guidance for local authorities on how to identify and support young people at risk of becoming NEET [8]. More recently, a formal inquiry has been announced into the rising numbers of young people who are out of work and study owing to poor mental health [9].

It is crucial that we understand the factors that influence the risk of post-16 dropout if we are to address the problem of young people ending up NEET. Considerable research efforts have been made to understand the characteristics of students that increase their risk of becoming NEET. These are most consistently highlighted as learning status at the time of school entry [10], low academic attainment [10–13], high rates of school absence [14,15] and low socio-economic status [16]. It has been noted that these factors are insufficient for the early identification of many students who will go on to drop out [17]. It is also important to recognize that these identified factors have a probabilistic association with later outcomes [18], and that wider circumstances will also shape whether those at risk ultimately become NEET.

More holistic views of NEET risk have recognized levels of poverty where a child lives, housing conditions and parental work status as important factors in shaping NEET outcomes [19]. Lőrinc *et al.* [20] applied Bronfenbrenner's 'ecological systems theory' to understanding how young people's educational pathways are shaped by wider social factors. These researchers highlighted lack of stability in childhood (e.g. spending time in state care, immigration, moving schools) and family poverty as key factors in shaping young people's post-16 trajectories.

One area that does not appear to have received as much attention is whether there are characteristics of secondary schools that compound or mitigate young people's risk of becoming NEET. In 2015, the UK government stated that the main purpose of education is to equip all young people to overcome the challenges of adult life and secure meaningful careers, with the ultimate goals of growing the country's economy and achieving a fairer society [21]. The way in which different schools approach this goal is likely to play an important role in determining how successfully young people transition into adulthood. One school characteristic receiving growing attention is inclusivity. In November 2024, the UK's Secretary of State for Education stressed that school 'belonging' and inclusion are central to the government's mission [22].

The inclusivity of a school environment is difficult to quantify but published research has highlighted several indicators that provide proxy measures of this construct. One of these measures is the overall progress made by students by the end of their secondary education relative to the average progress made by similar students—a metric known as 'Progress 8' in England. Progress indicators recognize the additional effort and resources that are invested by schools to compensate for the disadvantages some students face before starting secondary school. Qualitative studies have identified that schools with high progress scores have school leaders with a 'growth mindset' and implement effective continuous professional development programmes for teaching staff [23,24]. Similarly, Day *et al.* [25] reported that an important driver of progress in high-performing schools is the headteacher's leadership style, their understanding of the school's needs and their ability to embed sensitive and effective strategies and policies within the school culture. In contrast, schools that do not prioritize knowing and understanding their students fail to foster feelings of school belonging, particularly for ethnic and religious minority students [26]. Faith schools, on the other hand, seem to foster a greater sense of belonging owing to increased similarity between teachers and students and shared membership in a religious community [27].

An additional potential indicator of the inclusivity of a school environment is how student behaviour is perceived and managed. The term 'suspension' refers to the exclusion of a student from school for a fixed period, and suspensions are intended to be used when other behaviour management strategies have been exhausted [28]. However, in practice, the use of suspensions varies substantially between schools [29]. Vavrus & Cole [30] examined the use of suspension in observed and video-taped school lessons and reported that the decision to single out a student for suspension often appeared to be driven by underlying biases of teaching staff around gender and ethnicity. This observation is reinforced by nationally published suspension data that show boys are 68.7% more likely to be suspended than girls, and that Black Caribbean children are more than 16 times more likely to be suspended than Chinese children [31]. Christie *et al.* [29] found schools with the lowest suspension rates were distinct from those with the highest rates in several ways, including a favourable school 'climate', clear strategies for keeping students connected to the school and the use of preventative strategies to manage behaviour.

School size has also been associated with academic outcomes, with smaller schools achieving better standardized exam results than larger schools [32]. Smaller class sizes may facilitate the formation of relationships between classmates, teachers and parents [33], and so may increase levels of school belonging and engagement. Smaller ratios of students to teachers could result in better opportunities for individualized support and comprehensive teacher feedback on student work [34], and could also mean that any emerging behaviour or educational support needs are more likely to be noticed and dealt with promptly [35].

Existing research has shown that some students are at a higher risk of disengagement than others; however, despite good evidence that characteristics of the school environment can play an important role in shaping education outcomes [36], there has been little investigation of how these characteristics impact trajectories once students leave statutory education. We sought to test the hypotheses that: (i) school characteristics play an important role in determining whether students sustain participation in education or training once they graduate; and (ii) that markers of inclusivity in secondary schools are associated with lower post-16 dropout.

In this report, 'school characteristics' refer to measurable characteristics of secondary schools in England that capture aspects of their structure and culture. These include indicators of school identity (e.g. religious denomination, single-sex or mixed), performance (e.g. Progress 8 scores), structure (e.g. provision of post-16 pathways) and behaviour management approach (e.g. rate of suspension). These variables act as proxy indicators of the inclusivity of the school environment, through which schools may influence students' post-16 outcomes.

2. Material and methods

2.1. Data

All school and pupil population indicators in this study are based on routinely reported data from mainstream secondary schools in England. These data are published online by the Department for Education to support school improvement and inform parental decisions. Data over three academic years (2021/22–2023/24) were analysed.

The focus on mainstream settings excluded special schools from the current study. Private schools' data are not published by the Department for Education and so these schools were also not considered. In addition, the following types of school were excluded on the basis that they offer a specialist curriculum and/or only teach from Key Stage (KS) 4 onwards (which would mean students must have attended another establishment for most of their secondary education): City Technology Colleges specialize in science, technology and maths (n = 3); University Technical Colleges provide a fresh start for students at KS4 in a smaller, more supportive environment (n = 43); Studio Schools provide a fresh start for students at KS4 with a focus on developing practical skills (n = 19).

A relatively small number of schools had missing data across most variables of interest. On closer inspection, it was determined that these records represented schools that had closed and were removed from the data. The final samples included just over 3000 schools per year (actual school counts are listed with the results in table 1).

For each school, we used raw counts of students per variable rather than proportions or rates. This approach was chosen to avoid artificial correlations that can arise when multiple variables are expressed as rates sharing the same denominator (i.e. school headcount). Modelling the absolute

Table 1. Descriptive statistics for final set of model variables. Central tendencies (mean/mode), standard deviations (s.d.; continuous variables) and as proportion of total sample (categorical variables) for school characteristics and controls.

	mean/mode (*s.d./% of N*)		
	2021–2022 (*n* = 3036)	**2022–2023 (*n* = 3075)**	**2023–2024 (*n* = 3098)**
not sustained rate	*5.37 (3.73)*	*6.08 (3.89)*	*5.85 (3.60)*
school characteristics			
post-16 provision	true *(63%)*	true *(62%)*	true *(62%)*
school sex	mixed *(89%)*	mixed *(89%)*	mixed *(89%)*
	girls (6.7%)	*girls (6.6%)*	*girls (6.5%)*
	boys (4.7%)	*boys (4.7%)*	*boys (4.5%)*
religious denomination	no faith *(82%)*	no faith *(82%)*	no faith *(81%)*
	Christian (18%)	*Christian (17%)*	*Christian (17%)*
	other faith (1%)	*other faith (1%)*	*other faith (1%)*
suspensions	*152 (179)*	*209 (242)*	*252 (299)*
progress 8 score	0.00 *(0.50)*	−0.01 *(0.51)*	0.00 *(0.52)*
pupil population/area characteristics (controls)			
headcount: years 7–11	946 *(300)*	960 *(299)*	969 *(298)*
disadvantaged graduating students	46 *(28)*	47 *(27)*	48 *(28)*
graduating students with identified SEN	21 *(13)*	23 *(14)*	24 *(13)*
selective admissions policy	false *(95%)*	false *(95%)*	false *(95%)*
IMD of LSOA	9 *(11%)*	9 *(11%)*	9 *(11%)*

number of students in each category while including headcount as a covariate controls for variations in school size without introducing spurious dependencies between variables.

2.2. Measure of NEET outcome

Each secondary school in England annually reports a number of 'not sustained' destinations. This metric represents the number of the school's graduating cohort who are known to have become NEET immediately after graduating or who start on a post-16 pathway but drop out within the first six months. These data are published as part of the following academic year's returns (i.e. the destinations for the cohort graduating in 2023/24 are published in the 2024/25 reports).

For the current sample, the number of known student destinations that were not sustained per school ranged from 0 to 59 per school, with a mean of 9.9 (approx. 0–57% of graduating students, M = 6.5 %). There appear to be higher numbers of students per school who did not sustain post-16 destinations from 2022/23 onwards (figure 1).

2.3. Measures of school characteristics

A wide range of school-level indicators were available in the published data. The choice of indicators for this study was informed by published research into the school characteristics that reflect the inclusivity of a school [25,30], as well as those that have been associated with wider education outcomes [32–34]. A brief description of each indicator examined in the current study is set out below.

2.3.1. School/class size

Three indicators were considered. The number of students on the school roll in the Autumn term each year was included to indicate school size. School headcount is not necessarily indicative of class size or

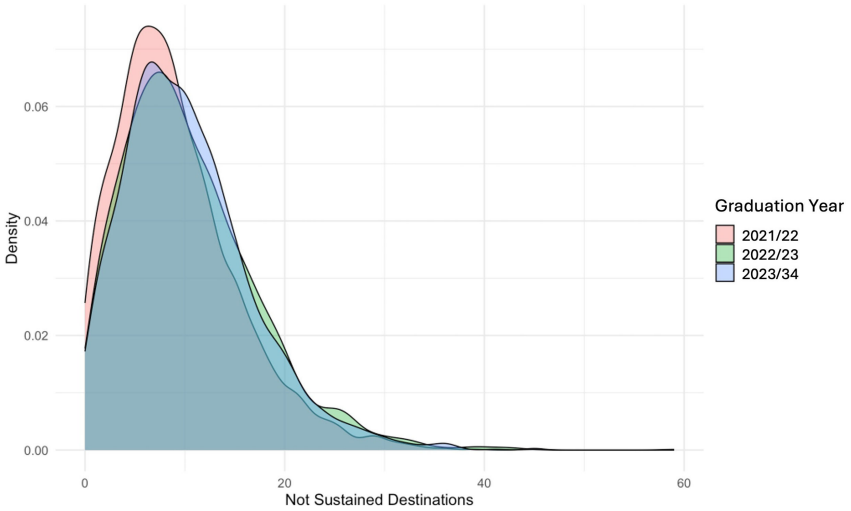

Figure 1. Kernel density plot of not sustained counts for secondary schools across England (2021/22 to 2023/24 academic years).

of the level of individualized support available in the classroom. Therefore, the ratios of students and teaching assistants to teachers were also included in our analyses.

2.3.2. School identity

Four indicators of school character or identity were examined. In recognition of the positive association between higher levels of similarity between students, teachers and parents and student engagement in education [27,37], indicators of whether schools are mixed or single-sex and whether they have a religious denomination were included in this study. A very small number of schools identify as a faith other than Christian, and so these schools were grouped together under the label 'other faith' for analysis.

We included a binary indicator of whether schools teach students up to the age of 16 years only or whether they offer an onsite post-16 pathway, including AS-levels, A-levels and BTECs [38]. Research has highlighted that a common theme for young people who become NEET is a lack of information or guidance around this transition [20]. In situations where schools have fostered feelings of school belonging and offer an onsite post-16 pathway, this could represent a 'default' option for students who may otherwise drop out.

School type was included to represent the role of variations in school establishment structures and policies. In recent years, there has been a push towards academization, giving schools greater autonomy over their curriculum and governance [39,40]. Published findings on the relationships between school types and education outcomes have been mixed—Macleod *et al.* [41] observed a very small positive effect of academy status on KS4 attainment, while Benson *et al.* [42] found no significant impact of school type on attainment.

2.3.3. School performance

Performance is measured by the Progress 8 indicator, which was introduced alongside Attainment 8 in 2016 to measure the progress students make between their KS2 (age 11 years) and KS4 (age 16 years) assessments [43]. Progress 8 recognizes the systematic variation in pupil attainment prior to starting secondary school and was selected as a proxy indicator of how well a school supports students of all abilities to achieve. This 'value added' metric has received much criticism as it is unadjusted for between-school variations in student disadvantage. In the current study, this variation is accounted for explicitly through the inclusion of control variables detailed below.

A further performance measurement, a school's Ofsted rating, was also considered. Ofsted is the organization responsible for inspecting and regulating educational provision in England and provides ratings intended to reflect the overall quality of a school's education and care. Although higher Ofsted ratings have been associated with lower NEET rates [11], this measure represents a coarse, aggre-

gate indicator of performance that may mask the influence of individual school-level characteristics. Consequently, Ofsted rating was not included as a predictor in the current study.

2.3.4. School culture/behaviour management

A school's use of suspensions and exclusions were included as a proxy indicators of its attitudes and policies around the perception and management of student behaviour [30]. The use of suspensions, in particular, varies considerably between schools. In the current sample, the rate of suspensions ranged from 0 to an equivalent of over 3.7 suspensions per student, per year. Suspension rates could also be an indicator of the level of disorder within a school, which has been associated with an increased risk of disengagement from education, particularly for minority ethnic groups [44].

2.4. Control measures for differences in the student population and economic context

The increased risk of becoming NEET for students with low socio-economic status is well established [16,45,46]. Therefore, deprivation indicators for both the graduating student population (the number of KS4 students eligible for free school meals) and geographic area (Index of Multiple Deprivation (IMD) for the school Lower Super Output Area (LSOA)) were included. The IMD score reflects the proportion of people in an area experiencing low income, involuntary exclusion from the labour market, a lack of attainment and skills, poor physical and mental health, risk of crime, access to housing or low-quality environment, such as air quality [47]. LSOAs in England represent 1000–3000 residents and are ranked between 1 (most deprived) and 10 (least deprived).

A binary indicator of whether the school is in an urban or rural area, along with a categorical variable representing the region of England, were included as proxy indicators for access to diverse employment opportunities and to reflect previous findings that students in urban areas report greater feelings of belonging and are at lower risk of becoming NEET [48].

Leaving school without formal qualifications significantly restricts young people's options for further education and training. Primary (KS2) and secondary (KS4) attainment indicators were explored in recognition of the important role of academic attainment. The KS2 average scaled score for the graduating cohort controlled for prior attainment. Attainment 8 was included to represent students' aggregate performance across eight GCSE subjects, with double weighting for English and Maths to reflect the high value placed on proficiency in these areas.

Selective schools require students to sit entrance exams and therefore student attainment measures tend to be higher without progress scores necessarily being affected. Selective schools also tend to have fewer students from deprived backgrounds or with special educational needs (SEN) [49]. A binary indicator of whether schools were selective in their admissions was included to control for these different patterns.

Several student demographics have been associated with NEET risk. Until 2016, girls were consistently more likely to be NEET than boys [13]; however, rates for girls are falling while rates for boys have increased [50]. White British ethnic backgrounds have been associated with an increased risk of becoming NEET compared to other ethnicities [51], while other research has observed minority ethnicities to be at increased risk when associated with victimization in school [52] and having English as an additional language may create a barrier to post-16 participation. The number of students on roll who are boys, the number with English as an additional language and the number who are identified as White British were included.

Having a SEN or disability is another challenge some young people face. SEN can affect students' ability to learn [53] and can make it difficult to concentrate or to form social relationships, which negatively affects education outcomes. Similarly, research has shown that young people with a limiting illness or disability are between 2.4 and 3.5 times more likely to be NEET than their peers [13,16]. The number of graduating students with an identified SEN was examined to control for the additional barriers to participation these students may face.

2.5. Statistical analysis

Data were prepared, linked and analysed in R via RStudio and Python via Jupyter Notebooks. All code and data are available in the electronic supplementary material [54].

Continuous predictors were scaled to *z*-scores to allow for more meaningful interpretation of coefficients as changes in standard deviations rather than single units.

The outcome variable in this study was the count of students graduating from each school who did not sustain their participation in post-16 education, employment or training. Therefore, a Poisson regression model was selected. The model was fitted using maximum likelihood via the `glmer` function in the `lme4` package, with the `bobyqa` optimizer (more stable with Poisson models) and an increased iteration limit (`maxfun` = 200 000) to support model convergence.

The coefficients estimated by a Poisson regression model can be exponentiated to produce an incidence rate ratio (IRR). The IRR can be interpreted in terms of the rate change in the count outcome associated with a one-unit increase in the predictor. For example, an IRR of 1.20 can be interpreted to mean a one-unit increase in this predictor is associated with a 20% increase in the number of students who do not sustain post-16 participation.

The model was fitted with and without interactions between the school characteristics and the cohort year to determine the stability of the relationships between school characteristics and the outcome over time.

A multi-level structure allowed for repeated measures per school identification (i.e. one measure per student cohort). This had the benefit of producing a school-level random intercept that could be interpreted in terms of the baseline risk of students becoming NEET associated with each school, not accounted for by the other variables in the model.

3. Results

3.1. Variable selection

Descriptive analyses and visualizations for the central academic year (2022/23) in this study were used to highlight which school characteristics and control variables appeared to have the most pronounced relationship with the number of students that did not sustain post-16 destinations. For this descriptive analysis only, not sustained rates were used (rather than counts) to avoid confounding by school size. To support this selection statistically, pairwise Jensen–Shannon distances (JSDs) were calculated to quantify the differences between the distributions in not sustained rates between each level of categorical variables, and the top and bottom 25% of schools for each continuous predictor. Kruskal–Wallis tests were performed to assess statistical significance of these differences.

To highlight two examples, figure 2 shows the density distributions of not sustained rates by suspension rate and by class size. While there is little variation in not sustained rates according to class size (JSD = 0.14), there is clearly a positive relationship between suspension rate and the proportion of students who do not sustain post-16 destinations—higher rates of suspension are associated with higher not sustained rates. The pairwise JSD of 0.53 confirms there were substantial differences in the outcome between the top and bottom 25% of ranked schools, and a Kruskal–Wallis test confirmed that these differences were significant ($H = 823$, $p < 0.001$).

An examination of the distribution of not sustained rates by school type suggested the prominent variation in this outcome was between academy converters and sponsor-led academies (figure 3), which between them make up 76% of schools in this sample. Academy converters are high-performing schools that have converted to academy status, while sponsor-led academies are under-performing schools that convert under the sponsorship of a highly performing school to improve outcomes [55]. Therefore, in this context this distinction could be more accurately interpreted as a proxy indicator of overall school performance, rather than revealing anything meaningful about how different establishment structures or policies relate to academic outcomes.

Three indicators of attainment were explored: KS2 scores (age 11), Attainment 8 (age 16) and Progress 8 (the progress made between age 11 and 16). All three measures had similar patterns of relationship with school-level not sustained rates, with higher attainment and progress being linked with lower levels of disengagement (figure 4). However, sequential attainment assessments are typically highly correlated, and because Progress 8 is calculated using Attainment 8, including all three variables in a model would induce issues with multicollinearity. This would make it difficult to isolate the unique contribution of each predictor.

Progress 8 was retained as the key variable of interest, as it may say more about the school environment than the attainment measures, which may primarily reflect student characteristics. The

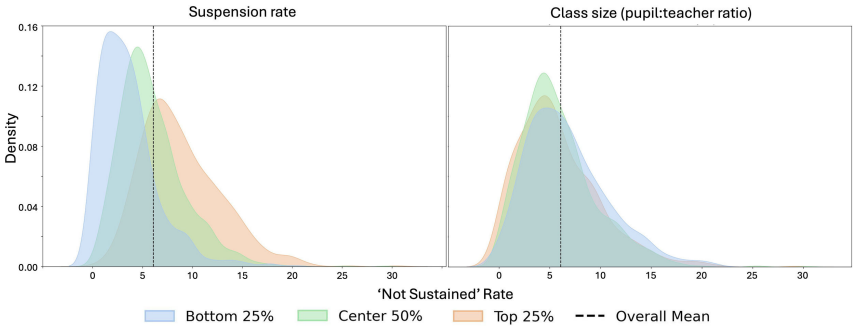

Figure 2. Density distributions of not sustained rates by school characteristic help to highlight indicators that may be associated with the proportion of students not sustaining post-16 participation. While the distribution of not sustained rates does not vary by class size, it appears to be positively associated with suspension rates.

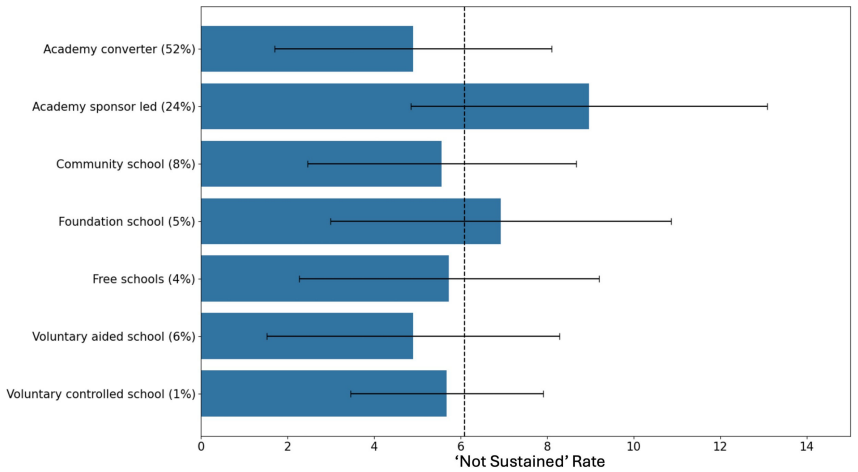

Figure 3. Mean and standard deviation of not sustained rates by institution type. The largest distinction is between the two academy types—academy converters and sponsor-led academies—which could be better interpreted as an association with overall school performance rather than differences in institution structure.

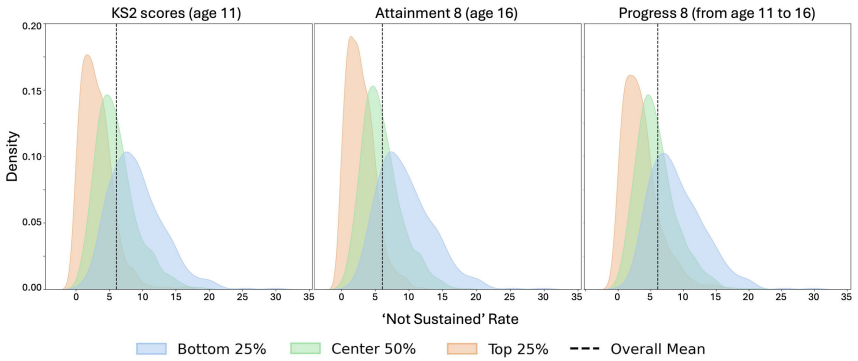

Figure 4. Density distribution of not sustained rates by attainment metric. All three indicators show similar distributions of relationship with the outcome.

JSD confirmed the substantial differences in not sustained rates between schools with the highest and lowest Progress 8 scores (JSD = 0.53, $H = 861$, $p < 0.001$).

The interpretation of Progress 8 scores is affected by selective admissions policies. As these students enter secondary education with elevated attainment scores, even performing very well at KS4 will not translate into high Progress 8 scores, which in this case is unconcerning. Conversely, in non-selective settings, low Progress 8 scores may reflect schools that fail to support expected progress, potentially exacerbating underlying risk.

To account for this distinction, a binary indicator of whether schools are selective in their admissions was included in the model. This adjustment allows Progress 8 scores to more accurately represent the extent to which school support students of all abilities to make progress by the end of their secondary education, relative to the national average for similar students.

Six school characteristics and five control variables were selected for inclusion in the regression model. Variables retained for the model showed substantial distributional differences as indicated by higher JSDs and statistically significant Kruskal–Wallis results (all $p < 0.001$), confirming that they were likely to contribute meaningfully to explaining variation in the outcome. The descriptive statistics for these variables are set out in table 1.

3.2. Regression modelling

Poisson mixed-effects models were fitted to explore the relationships between school characteristics and the number of students not sustaining participation in education, employment or training for at least six months after leaving secondary school.

To determine the stability of these relationships over time, models were estimated with and without interactions between each of the school characteristics and the cohort. The addition of all interaction terms increased the overall variance explained by the fixed and combined effects only minimally (0.3 and 0.1 percentage points, respectively; see table 2 for model comparison metrics). Similarly, model fit (Akaike information criterion (AIC) and log-likelihood scores) is slightly improved by the addition of interaction terms; however, the increase in Bayesian information criterion (BIC) score indicates this improvement is not sufficient to justify the added complexity of the model.

In this 'full' model, most interaction terms were not significant, suggesting the relationships between school characteristics and the number of students becoming NEET is relatively stable over the study period. The exceptions were the significant interaction terms for religious denomination, school sex and suspensions. A final model which included only the interaction terms for these three variables achieved near-identical explanatory power with far fewer parameters than the full model, so this model was preferred. The final model explained 82%[1] (conditional $R^2 = 0.817$) of variance in the number of students not sustaining post-16 participation. The fixed effects (school characteristics and controls) account for most of this, explaining 69% (marginal $R^2 = 0.688$) of the total variance. This means around 13% of the variance is attributable to unobserved between-school differences that were not captured by the variables included in the model.

Model diagnostics indicated that assumptions were appropriately met. Variance inflation factor values were all less than 2, suggesting no evidence of multicollinearity between variables. Furthermore, a dispersion ratio close to 1 (0.94, $p > 0.999$) indicated no evidence of under- or over-dispersion, suggesting that the Poisson distribution provided an appropriate fit to the data.

The model revealed significant associations between the examined school characteristics and the number of students who did not sustain post-16 participation, even once student-level and school local area risks were controlled for (see table 3 for full results). For categorical predictors, the most frequently occurring category was used as the reference (baseline) group.

These results reveal a protective effect of schools having a single-sex (boys: IRR = 0.80, $p < 0.001$; girls: IRR = 0.67, $p < 0.001$) or religious identity (Christian: IRR = 0.85, $p < 0.001$; other faith: IRR = 0.54, $p < 0.001$). Higher Progress 8 scores—which reflect students making academic progress beyond what was expected—also appear to have a protective effect on student dropout (IRR = 0.88, $p < 0.001$). Significant positive interaction terms suggested the protective effect of attending an other faith school (interaction IRR = 1.39, $p = 0.022$) or a school with higher Progress 8 scores (interaction IRR = 1.03, $p = 0.029$) increased over the study period.

In contrast, there appears to be an increased risk of student dropout associated with schools not offering their own post-16 provision (IRR = 1.18, $p < 0.001$), and for schools with higher usage of suspensions (IRR = 1.07, $p < 0.001$); however, a negative interaction term suggests the risk associated with use of suspensions has reduced slightly in the latest year (interaction IRR = 0.96, $p < 0.001$).

The direction of the relationship between each school characteristic and the number of students not sustaining post-16 destinations can be clearly seen in figure 5.

The model also estimated a random intercept per school, which can be interpreted in terms of the school-level differences in the baseline rate of students not sustaining post-16 participation. This term

[1]Marginal and conditional R^2 were calculated based on Nakagawa and Schielzeth's R^2 for generalized linear mixed models [56].

Table 2. Model comparison metrics exploring the inclusion of interaction terms. Preference for the final model, which included only significant interaction terms, for explanatory power with limited complexity.

	no interaction terms	all interactions with cohort year	final model (significant interactions only)
marginal R^2	0.685	0.688	0.688
conditional R^2	0.816	0.817	0.817
AIC	49 996.00	49 947.40	49 942.20
BIC	50 110.10	50 161.20	50 113.30
log likelihood	−24 982.00	−24 943.70	−24 947.10

Table 3. Multi-level Poisson regression model output. IRRs > 1 highlight where predictors are associated with and increased rate of students not sustaining post-16 participation, and IRRs < 1 highlight predictors that appear to have a protective effect.

term (*reference category*)	IRR	*lower CI*	*upper CI*
intercept	8.37	*8.20*	*8.54*
school characteristics			
no post-16 provision (*post-16 provision*)	1.18	*1.15*	*1.21*
school sex: boys (*mixed*)	0.80	*0.74*	*0.86*
school sex: girls (*mixed*)	0.67	*0.63*	*0.71*
denomination: Christian (*no faith*)	0.85	*0.81*	*0.89*
denomination: other faith (*no faith*)	0.54	*0.43*	*0.69*
1 s.d. increase in progress 8 score	0.88	*0.86*	*0.89*
1 s.d. increase in suspensions	1.07	*1.06*	*1.09*
controls			
outcome year: 2022/23	1.11	*1.09*	*1.13*
outcome year: 2023/24	1.08	*1.06*	*1.10*
headcount: year 7–11	1.18	*1.17*	*1.20*
IMD of school LSOA	0.92	*0.91*	*0.93*
selective admissions	0.30	*0.27*	*0.33*
KS4 cohort disadvantaged	1.16	*1.14*	*1.18*
KS4 cohort with SEN	1.01	*1.00*	*1.02*
interactions			
denomination: Christian * 2022/23	1.03	*0.98*	*1.08*
denomination: other faith * 2023/24	1.28	*0.96*	*1.70*
denomination: Christian * 2022/23	1.05	*1.00*	*1.10*
denomination: other faith * 2023/24	1.39	*1.05*	*1.83*
progress 8 * 2022/23	1.02	*1.00*	*1.04*
progress 8 * 2023/24	1.03	*1.01*	*1.05*
suspensions * 2022/23	0.98	*0.97*	*1.00*
suspensions * 2023/34	0.96	*0.94*	*0.98*

captures the variation between schools that is not explained by the measured covariates. Schools with positive random intercepts have a higher-than-average baseline risk of this negative outcome, while schools with negative random intercepts have a lower-than-average baseline.

Figure 6 shows the range of school random effects, from 0.46 to 2.23, indicating that, holding other factors constant, some schools have less than half the baseline rate of disengagement compared to the average, while others have more than double. Although 95% CI are relatively wide owing to the

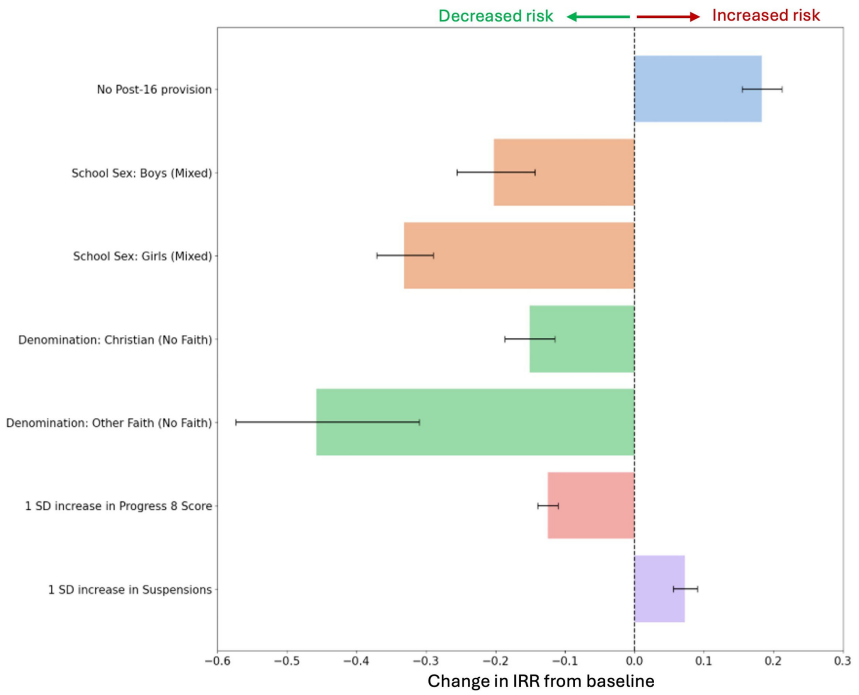

Figure 5. Change in risk associated with each school characteristic. Protective effect of single-sex and religious schools and of increases in Progress 8 scores. Increased risk associated with not having onsite post-16 provision and higher use of suspensions.

low number of repeated observations per school (between 1 and 3), this pattern nonetheless indicates meaningful between-school variation. Approximately 14% of schools (n = 448) have CIs that do not cross 1, suggesting significantly higher or lower baseline risk compared with the overall mean.

4. Discussion

We sought to test the hypotheses that: (i) school characteristics play an important role in determining whether students sustain participation in education or training once they graduate; and (ii) that markers of inclusivity in secondary schools are associated with lower post-16 dropout. We tested these hypotheses with mixed-effects Poisson regression models to examine the rate change in risk of student dropout associated with each characteristic, as well as the between-school variation in baseline risk, while controlling for known student-level and neighbourhood risk factors.

4.1. Inclusive schools

We postulate that the five school characteristics consistently associated with not sustained rates—suspension rate, Progress 8 score, post-16 provision, religious denomination and single-sex schools—can all be considered as proxy indicators of the inclusivity of the school culture and learning environment. Higher suspension rates and lower Progress 8 scores have been shown to reflect the inclusivity of a school's culture, in terms of how behaviour is perceived and managed by teaching staff [30], and how much resource is invested in ensuring students at all levels progress [23–25].

Single-sex and religious schools may be associated with lower not sustained rates because such schools have increased similarity between students, and in the case of religious schools, between staff and parents. Increased similarity has been associated with higher levels of school belonging and engagement in education [27,37].

Schools that offered post-16 provision may exhibit lower not sustained rates because, as prior qualitative research has highlighted, a lack of information and guidance around post-16 pathways and the resulting indecision about next steps can be an important reason young people give for becoming NEET [20,51]. The option to remain in the same school for further study may help to mitigate this by providing a 'default' pathway for students to take. Nevertheless, it must be recognized that these are proxy measures and further research into direct measures of inclusivity is required.

Figure 6. Caterpillar plot of school random effects. IRRs with 95% CI (coloured by quantile) show the between-school variation in students becoming NEET after accounting for the school characteristics included in the model.

4.2. Limitations and future work

This study is constrained by the inherent limitations of administrative data, which allow for the identification of associations between school characteristics and post-16 dropout rates but are not sufficient for causal inference. We suggest future studies could use propensity score matching to identify comparable students attending schools with distinct characteristics, helping to mitigate some of the challenges in estimating the causal effect of the school environment on NEET risk. These methods are not a substitute for experimental data but provide a useful approach for strengthening causal inferences in its absence.

Although our models controlled for several important student- and local area-level characteristics, these represent only a small subset of the wider micro- and macro-level influences that shape young people's transitions after compulsory schooling. NEET outcomes emerge from complex, interacting systems involving family circumstances, local labour markets, school policies, community resources and broader socio-economic conditions, many of which could not be captured in the present analysis. As a result, the school-level associations identified here should be interpreted as part of this wider ecological context rather than as isolated determinants.

NEET status occurs after statutory schooling, so reverse causality is not a concern in the current study. However, the unaccounted between-school variation indicates there are likely to be unmeasured factors that influenced the outcomes we observed. Other indicators we would have explored had they been available in the data include staff retention and student-reported school belonging. In addition, formal suspensions are only one way in which behaviour is managed within schools, and it would have been interesting to explore how the use of other approaches—internal suspensions, detentions and managed moves—related to sustained post-16 participation, but these practices are not currently reported to the Department for Education.

There may also be unobserved factors influencing the associations observed here. For example, research has noted that faith secondary schools in England tend to have pupil populations with above-average socio-economic status and academic ability [57]. Although our findings suggest a school effect even once student characteristics are accounted for, there may be other systematic advantages these students experience outside of school, such as better educated parents or higher household income, that could shape their post-16 outcomes. Controlling for parental factors in future research could better isolate the role of the school environment.

Finally, it would be useful in future work to apply multilevel modelling approaches where students and schools are represented individually as distinct levels within the estimated models. This approach would better capture the heterogeneity of the student populations within schools, allowing robust investigation of the interactions between student- and school-level risk factors. The current study's use of the school-level outcome measure limited our investigation to a small subset of young people who become NEET within six months of leaving statutory education—different processes may be relevant to those who become NEET later. Future research exploring outcomes at the individual-level could consider longer-term NEET outcomes for those young people.

5. Conclusion

This study highlights the critical role of the school environment in shaping students' sustained participation in education, employment and training after leaving secondary school. The influence of school context has often been overlooked in previous research, which has tended to focus on individual-level risk factors. It is therefore vital that future research and policy development adopt a more holistic perspective, considering not only student characteristics but also the home, family and school environments in which young people develop.

The findings also provide evidence in support of the government's priority to increase inclusivity within schools. In practice, the use of suspensions to manage behaviour varies widely between schools. Our findings suggest that reconsidering zero-tolerance behaviour policies and adopting restorative practices may strengthen students' sense of belonging and reduce the likelihood of becoming NEET. Similarly, fostering a stronger sense of community—through policies that enhance relationships between students, staff and parents—could contribute to more positive post-16 outcomes.

Finally, the findings support the hypothesis that offering a clear or 'default' progression pathway can mitigate the risk of dropout among students who are uncertain about their next steps. While it may not be feasible for all secondary schools to provide their own post-16 provision, strengthening partnerships between schools without sixth forms and local post-16 providers and ensuring all students are well-informed about their options, could facilitate more successful transitions.

Ethics. This work did not require ethical approval from a human subject or animal welfare committee.

Data accessibility. The datasets supporting this article have been uploaded as part of Open Science Framework [54].

Supplementary material is available online [58].

Declaration of AI use. We have not used AI-assisted technologies in creating this article.

Authors' contributions. R.E.: conceptualization, formal analysis, investigation, methodology, validation, visualization, writing—original draft, writing—review and editing; M.W.: formal analysis, methodology, validation, writing—review and editing; D.B.: funding acquisition, methodology, supervision, writing—review and editing; P.T.: methodology, supervision, writing—review and editing; M.M.-W.: funding acquisition, methodology, supervision, writing—review and editing; N.M.: funding acquisition, methodology, supervision, writing—review and editing.

All authors gave final approval for publication and agreed to be held accountable for the work performed therein.

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