

COMMUNITY DIRECTIONS

Engagement with online resources and widening participation status: observations from a large, diverse Foundation Year science cohort

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Abstract

Despite focused effort and attention over recent years, many potential barriers to progression and success remain within Higher Education. This study focuses on a cohort of 168 students studying on two semester-long Foundation Year Biological Sciences modules delivered at the University of East Anglia in the academic year 2021/22. These modules take place in consecutive semesters within the same academic year and specifically target students from underrepresented and widening participation backgrounds. This study seeks to understand whether a student's widening participation background influences their engagement with online study resources.

We analysed the engagement of individual students with resources provided on the virtual learning environment (VLE) and related this to POLAR4 quintiles. POLAR4 classifies local areas across the UK according to the young participation rate in Higher Education within that area. All POLAR4 categories saw lower module marks as well as engagement with practice assessments VLE-hosted resources in the second of the two semesters. These differences were greatest for students from the lowest POLAR4 quintile, POLAR4q1. POLAR4q1 students have significantly lower average module grades than all other categories across both semesters but with the gap widest in semester 2, despite the student

engagement score increasing. There was no difference in the engagement scores for students from POLAR4q1 backgrounds compared to others in their cohort during the autumn semester but in the spring semester, students from POLAR4q1 backgrounds had on average, higher engagement scores.

Students who grew up in a POLAR4q1 area are more likely to have had disrupted education journeys than their peers from other quintiles. As a result, it is likely they will need more than one intervention to be able to close the attainment gap that we see on these modules. We discuss this along with other potential causes and consequences for these findings alongside recommendations for interventions and further research.

Introduction

Higher Education (HE) does not offer equality of opportunity for all students. Many students who experience pre-university disrupted education journeys or who come from disadvantaged backgrounds, under-represented groups and lower income households, face barriers to entering and achieving in HE (Connell-Smith & Hubble, 2018). The number of students within HE from disadvantaged backgrounds has been increasing, reaching record levels in 2022 (UCAS, 2023), yet students from disadvantaged backgrounds are three times less likely to attend the more selective HE institutions (Farquharson et al., 2022) and

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those living in areas which have lower participation into HE have higher levels of drop out and poorer attainment (Bolton & Lewis, 2023). To address these inequalities within HE, the Office for Students requires institutions to implement a range of strategies through their Access and Participation Plan (APP) which demonstrate and evidence their efforts to address these inequalities of opportunity for different groups of students.

One group underrepresented in HE that is the focus of many APP activities are young people living in areas which have the lowest participation into HE, a measure known as Participation Of Local Areas (POLAR). POLAR4 (the most recent iteration of POLAR) (Office for Students, 2022) is calculated by dividing the number of young people from each area who enter HE aged 18 or 19 by the young population of that area. Areas are ranked by participation rate and split into five quintiles, each of which represents about a fifth of the young population (Office for Students, 2021, 2022). Providing a broad measure of how likely it is that a young person living in an area will go to study in HE, those from POLAR4q1 being least likely to attend university and those from POLAR4q5 most likely to attend university. Young people residing in POLAR4q1 areas are a priority target group for many HE organisations seeking to increase the number of students from underrepresented groups entering HE and as such, are the focus of many activities through their APP.

Home environment has a strong influence on a young person's aspirations, self-efficacy and self-worth. The COVID-19 pandemic has widened inequalities seen between children of different backgrounds with the disruption of home learning contributing to children from disadvantaged backgrounds falling twice as far behind as their better-off peers (Farquharson et al., 2022; Million Plus, 2022). The shift to online learning that came with COVID lockdowns was not equally provisioned or equally accessible (Farquharson et al., 2022).

In January 2021, whilst 80% of teachers from the most affluent 25% of schools reported nearly all of their pupils having access to a device to use for learning, in the most disadvantaged schools this figure was just 40% of teachers (Sutton Trust, 2021). In addition to

having less access to resources, including an online learning environment, disadvantaged children were also more likely to be absent than their counterparts (Farquharson et al., 2022) and spent less time engaged in their learning (Green, 2020; Nelson & Sharp, 2020; Williams et al., 2020). These differences in home environment impact a young person's education journey but also the likelihood of them aspiring to attend university and if they do attend, how likely they are to stay there and succeed.

University students who are motivated to learn are more likely to remain on their courses and succeed in their studies (Tinto, 2019, 2023). The transition into HE is challenging for many students but can be particularly tough for students from disadvantaged backgrounds for whom the university environment may present an even starker contrast to their home environment (Krause & Coates, 2008; Pokorny et al., 2017). The start of a degree programme results in many students juggling an array of shifting circumstances, such as increased academic demands and their associated workload, as well as new living arrangements and social settings (Ramler et al., 2016) and the consequential changes in their immediate support networks. All universities recognise supporting student transition is key and therefore a multitude of approaches, programmes and initiatives have been developed across the sector aiming to support transition (see e.g. Universities UK, 2021 and Garnham & Walker, 2024).

We analyse how individual students from a range of University of East Anglia science-focused Foundation Year courses engaged with resources provided on the virtual learning environment (VLE). For each student, we also know which POLAR4 area classification they were residing in prior to their studies and thus, a proxy measure of how much exposure to HE they may have had prior to attending university. This study explores student engagement with assessment-related items, specifically end-of-topic quizzes, formative coursework items and practice exams. The specific study questions are:

1. How does engagement with VLE-hosted resources vary between

- students from POLAR4q1 areas compared to those from POLAR4q2-5?
2. How does attainment on the module vary between students from POLAR4q1 areas compared to those from POLAR4q2-5?
 3. How does engagement with VLE-hosted resources affect attainment on these modules?

Methods

The data for this study come from two introductory (Level three) biological sciences modules delivered at UEA in the academic year 2021/22. During the autumn semester of academic year 2021/22, 179 students were enrolled on the Introductory Biology module and in the following spring semester, the follow-on Further Biology module had 176 students enrolled. Of these enrolments, 168 students took both modules and thus form the sample included in our comparative analyses.

Students on each of these modules came from a range of Science and Medicine Foundation-level courses and across the modules, there was a broad range of aspirational progression courses (**Table 1**). Due to the low numbers enrolled from the Chemistry and Environmental Sciences courses and to protect the identity of these students, these specific courses are not included in any course breakdown analyses in this study.

Course of Study	Introductory Biology	Further Biology
Biological Sciences	32	32
Biochemistry	23	23
Chemistry	1	1
Environmental Sciences	3	3
Medicine (MBBS)	38	38
Pharmacology and Drug Discovery	18	18
Pharmacy (MPharm)	62	61
Total	177	176

Table 1 The course of study and number of students enrolled on two Foundation Year biological sciences modules delivered at the University of East Anglia in 2021/22.

The modules included in this study made use of Blackboard Learn for their VLE, with each module site providing a range of resources for the students, ranging from lecture slides and practical guidance through to practice tests and quizzes. This study explored student engagement with assessment-related items, specifically end-of-topic quizzes, formative coursework items and practice exams.

Students received detailed written feedback on their submitted formative coursework. For online quizzes and mock exams, students could access the correct answers after they had attempted the assessment. We calculated engagement scores for each student on each of the modules from the number of assessment-related items they had completed.

We used two approaches for calculating the engagement scores; the first assumed that every item that a student could engage with was equal in their potential to contribute to their module grade and gave each item the same score of 1. The second approach weighted the items based on their potential contribution to subsequent graded assessments and if an item was directly linked to a future graded item (e.g. a mock exam), it received a score of 3 where the items which did not directly relate to a subsequent graded item (e.g. a pre-practical quiz) received a score of 1. We then compare the engagement scores and module attainment for POLAR4q1 students with those from POLAR4q2-5. Module attainment is measured as the mark awarded for the module, calculated from an exam grade with a 60% weighting and a coursework item with a 40% weighting.

Statistical analysis

We analysed all data in R v4.2.2 (RCoreTeam, 2021), using RStudio v2022.7.2.576 (RStudioTeam, 2020). We used the packages *dplyr* (Wickham et al., 2023), *ggplot2* (Wickham, 2016), *ggbeeswarm* (Clarke et al., 2023), *RcolorBrewer* (Neuwirth, 2022), *shades* (Clayden, 2019) and *introdaviz* (Nordmann et al., 2021) for data visualisation, and *lme4* (Bates et al., 2015) for data analysis.

Linear (mixed) models were used for all response variables, and fixed effects included school of student and their student ID. We removed non-significant terms, starting with interactions between focal terms and experiment, and compared resulting final models with full models to check for biasing effect sizes through removal of non-significant terms (Forstmeier & Schielzeth, 2011). We obtained p-values for fixed effects in LMMs from Type II Wald Chi-square tests.

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Results

Students from low HE participation areas have lower attainment at the module level

This found that P4q1 students exhibited significantly lower module marks (gaussian LMER: 6.2163, $\chi^2 = 8.9232$, $p = 0.002816$) compared to P4q2-5 students. This pattern was seen across both their semester 1 (paired Tukey Gaussian LMER: -6.47993, $p = 0.0219$) and semester 2 (paired Tukey Gaussian LMER: -5.89954, $p = 0.0473$) biology modules in this study (**Figure 1**).

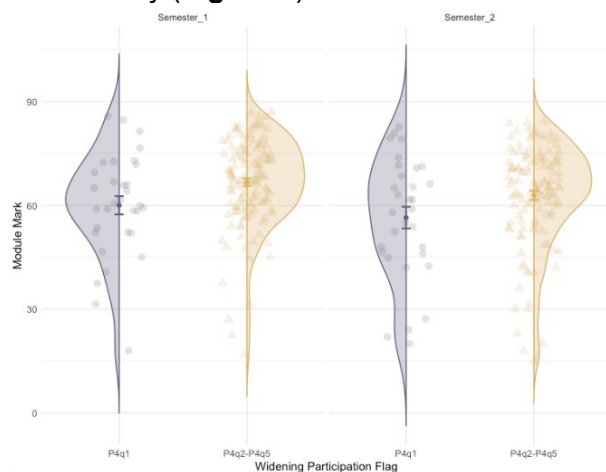


Figure 1 Effect of POLAR4 quintile background on Foundation Year module grade per semester (semester 1, $n = 166$; semester 2, $n = 161$). Quintiles were sorted into two groupings, P4q1 as one grouping and P4q2-5 into another. Mean module mark attained for each student within quintile grouping per semester are in bold, with mean standard error for error bars indicated.

As expected, engagement with VLE-hosted resources significantly influenced module marks (gaussian LMER: $\chi^2 = 48.1824$, $p < 0.0001$). Regardless of engagement levels, weighted or unweighted, P4q1 students seem to consistently maintain lower average module marks than P4q2-5 students (Figure 2). Notably, while we observed an increase in module marks associated with engagement in semester 2 for P4q2-5 students, there was no such link seen for P4q1 students in the same semester (**Figure 2**).

Module marks for P4q2-5 students showed a strong positive correlation with engagement in semester 1 ($r(132) = 0.62$, $p < 0.0001$) and a slightly weaker correlation in semester 2 ($r(128) = 0.45$, $p < 0.0001$). In contrast, P4q1 students exhibited a weaker correlation with

engagement in semester 1 ($r(30) = 0.42$, $p = 0.01801$) and no correlation in semester 2 ($r(27) = 0.27$, $p = 0.1458$), suggesting a widening gap in module marks between P4q1 students and P4q2-5 students regardless of engagement (Figure 2).

We explored the impact of different approaches to weighing engagement, including weighting based on likely contribution to a subsequent graded assessment or a 1:1 weighting, but found no significant difference in the correlations (Figure 2). Surprisingly, the inclusion of mock exams did not significantly affect module marks (gaussian LMER: 0.9101, $\chi^2 = 0.6127$, $p = 0.43376$).

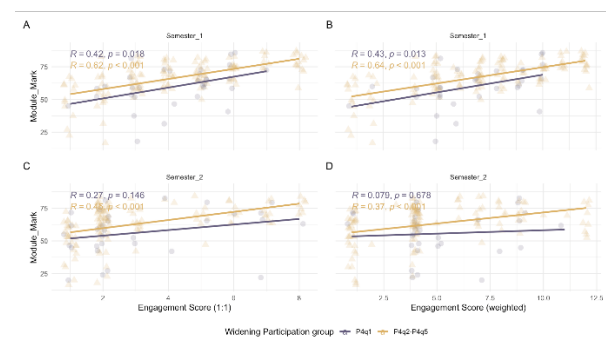


Figure 2 Correlation of engagement score and Foundation Year module grade per semester (semester 1, $n = 166$; semester 2, $n = 161$) between POLAR4 quintile groups; P4q1 as one grouping and P4q2-5 the other. Figures A) and C) represent engagement measured at a 1:1 ratio, while figures B) and D) represent engagement where certain activities were weighted according to the impact that they had on future summative assessments.

We anticipated that the school of study would have an impact on module marks, as the entry and progression criteria vary between the different schools of study. Indeed, we found a significant school-specific effect when looking at the difference between P4q1 and P4q2-5 students (gaussian LMER: $\chi^2 = 23.8689$, $p = 0.0002301$). The School of Biological Sciences (BIO) was the only school with significantly different module marks between P4q1 and P4q2-5 students in both semesters, where P4q1 students achieved significantly lower module marks than P4q2-5 counterparts (**Figure 3, Table 2**).

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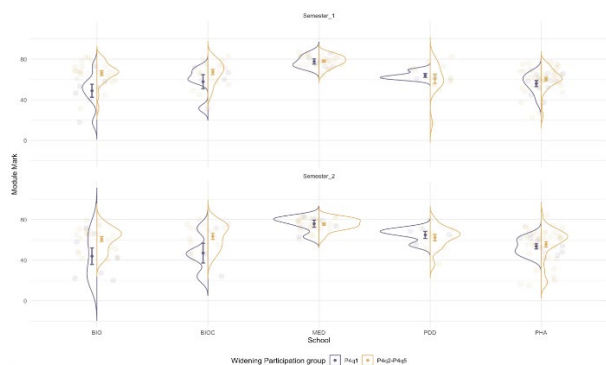


Figure 3 Effect of school of study of POLAR4 quintile students on module mark per semester (semester 1, n = 166; semester 2, n = 161). POLAR4 quintiles were sorted into two groupings; P4q1 and P4q2-5.

Relationship	Estimate	P-value	Semester
BIO P4q1 - (BIO P4q2-5)	-18.912	0.0008*	1
BIOC P4q1 - (BIOC)	-8.347	0.8841	1
MED P4q1 - (MED P4q2-5)	0.137	1.0000	1
PDD P4q1 - (PDD P4q2-5)	-0.830	1.0000	1
PHA P4q1 - (PHA P4q2-5)	-4.307	0.9882	1
BIO P4q1 - (BIO P4q2-5)	-17.8481	0.0511*	2
BIOC P4q1 - (BIOC)	-17.0112	0.3881	2
MED P4q1 - (MED P4q2-5)	0.0204	1.0000	2
PDD P4q1 - (PDD P4q2-5)	2.0665	1.0000	2
PHA P4q1 - (PHA P4q2-5)	-2.1720	1.0000	2

Table 2 Significant different between two POLAR4 quintile groups (P4q1 and P4q2-5) within the different schools of science between both semesters. *denotes significance

Discussion

This study explored the engagement with VLE-hosted resources deployed for 168 students studying on two Foundation Year biology modules. Engagement with VLE-hosted resources is lower in the second semester for all students in this study. Students were grouped according to the POLAR4 quintiles which classify local areas across the UK according to the young participation rate in HE within that area. Students from POLAR4q1 areas are from the 20% of areas within the UK which are least represented by students studying in the UK HE system. In this study we

found that students from low participation areas (POLAR4q1), generally achieve lower marks in their Foundation Year biology modules compared to their POLAR4q2-5 counterparts, with the gap widening in the second semester of study. Even when they are engaging with the VLE-hosted resources more regularly than their POLAR4q2-5 peers, POLAR4q1 students tend to achieve lower marks in their modules. We were also surprised to find that attempting a mock exam did not change the module mark achieved by this student cohort.

Student engagement and its impact on student success is complex (Tinto, 2023) and dynamic but growing numbers of students in the UK remain committed to pursuing a university education (UCAS, 2023). Record high numbers of students from lower participation areas enrolled in HE in 2022 (UCAS, 2023) during a cost-of-living crisis. Financial pressures disproportionately impact on students from lower participation areas and make them more likely than their counterparts, to withdraw from their courses (Million Plus, 2022).

A person with a family member who has experience of a studying a university degree is more likely to consider university as a study option than a person without (Manstead, 2018). Those living in disadvantaged neighbourhoods are also more likely to have had disrupted education journeys than their peers from other quintiles, plus students living in a disadvantaged neighbourhood are much less likely to study A-levels (Sammons et al., 2015). This means that the average student from a POLAR4q1 area will arrive at university most likely less aware of the journey and challenges ahead of them and with less education capital than their POLAR4q2-5 peers (Holt-White & Cullinane, 2023). However, having faced challenges during their previous education, they may also be arriving at university with more experience of overcoming challenges and adversity and equipped with a growth mindset.

The findings of this study suggest that supporting POLAR4q1 students to close the gap in education capital and reduce the attainment gap seen in this study, is likely to require more than one intervention. This study

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has identified that students from low participation areas (POLAR4q1) students, generally achieve lower marks in their Foundation Year biology modules compared to their POLAR4q2-5 counterparts. As a result of these findings, steps have been taken to further support students from POLAR4q1 areas. The specific details of these initiatives are beyond the scope of this paper; however, two examples are briefly highlighted. Firstly, a transition support Blackboard module has been introduced which students can access from two weeks prior to their Biology with a Foundation year degree starting and access throughout their studies. The content focuses on supporting academic learning, studying and the transition into HE and makes no assumptions about the prior knowledge, background or experiences of the student. Whilst targeting all students, it aims to be particularly valuable to students unrepresented in HE, such as those mentioned in this study. Secondly, we have expanded the Peer-Assisted Learning (PAL) scheme across the Foundation Year to enable students to receive support and guidance from students who have been already engaged with and progressed beyond, FY study.

Conclusions and Recommendations

It is imperative that we understand how we can enable all students, particularly those from underrepresented groups who are already experiencing unequal education opportunities, to have the best chance of success in their HE journey. This study adds to our knowledge of how students from low participation neighbourhoods are engaging with online resources that support their studies within HE and the impacts of this on their attainment. Whilst this study helps to identify gaps and support intervention methods, it is difficult to draw conclusions based on a single measure, however it will require more than a single intervention to overcome the disproportionate influence of background prior to entering HE.

This study looks at POLAR4 quintiles, but other widening participation groups exist including students who define themselves as having a disability, those from black or mixed-race heritage and mature students. It would be interesting to compare these too.

Intersectionality may also influence the patterns seen here as students may also fall under more than one WP group, adding to the complexity.

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