TASO Transforming Access and Student Outcomes in Higher Education

Multi-intervention outreach and mentoring evaluation report: A randomised controlled trial of Aston University's Pathway to STEM programme

May 2023

Contents

1 Summary

This report summarises the interim findings of a pilot randomised controlled trial (RCT) conducted to evaluate Aston University's Pathway to STEM programme. The final results, based on students' progression to higher education (HE) will be due for publication in 2024, following the release of destination data from the Higher Education Statistics Agency (HESA).

1.1 Aim and description of intervention

The primary aim of the Pathway to Science, Technology, Engineering and Maths (STEM) programme is to assist students who are considering a career in STEM in their journey to studying STEM subjects in HE. The 12-month programme comprises an induction session, careers advice sessions, a UCAS personal statement day, a summer school, and a graduation and transition event.

1.2 Target group

The target group are Year 12 students from widening participation (WP) backgrounds in the West Midlands who are interested in pursuing a STEM career.

1.3 Number of students involved

The capacity of the Pathway to STEM programme is approximately 80 students each year.

1.4 Implementation

Events on the Pathway programme are run by outreach experts. Academic staff and student ambassadors also assist in the delivery of some of the events. Usually, events are run on campus, but due to COVID-19 restrictions events for students who began the programme in the 2020-21 academic year were moved online.

1.5 Brief description of IE

The impact evaluation (IE) trial is a pilot two-armed RCT, run over two cycles of the Pathway programme, where students are allocated to one of two versions of the programme, the ***standard*** programme, or the ***flexible*** programme. Students received broadly the same information in each version of the programme, but the flexible version was delivered with fewer events and sometimes virtually. The Pathway to STEM programme typically attracts approximately 100-150 applicants. Eligible applicants were randomly allocated to the standard or flexible programme subject to the constraint that the standard programme is filled to capacity.

The primary outcome measure is whether students enrolled in a STEM-related course at HE in the October following the end of the programme. Whether students enrolled in HE generally was also observed. The secondary outcome measures are the number of applications to HE and the number of offers received. Exploratory

analysis of survey data was conducted to determine any changes in attitude to HE or changes in knowledge about the application and funding process.

1.6 Brief description of IPE

The implementation and process evaluation (IPE) used event attendance lists, event reports, and student evaluations to determine whether the programme was delivered as intended.

For online events the quality of the student experience was additionally determined by a set of questions relating to audio-visual quality and study space.

Participants were invited to take part in focus groups to help determine which aspects of the programme and outreach in general made the programme effective.

1.7 Key findings

Results for 2020-21 cohort

The findings in this report are based on an interim analysis of UCAS and survey data, a proxy measure for our stated outcomes while we wait for the long-term outcome data to become available in 2024. Overall, UCAS application, offer, and acceptance data indicate that, in comparison with the flexible group there is no evidence that the standard Pathway to STEM programme was more effective than the flexible programme in improving students' chances of applying or making a firm acceptance to study STEM subjects at HE. However, the data indicates that students on the standard programme may have received more offers for every application made than those on the flexible programme.

As noted in this report, difficulties in achieving intended delivery and reporting due to COVID-19 meant that the 2020-21 programme was not delivered as planned and changes have been made such that the 2021-22 programme could be delivered as planned.

Survey data indicated that students were more confident that they could successfully apply to and fund HE by the end of the programme.

At the beginning of the programme students were highly likely to report that HE was a place for them and that they would fit in. There was no significant improvement in their attitudes by the end of the programme.

Results for 2021-22 cohort

The report will be updated once data for this cohort becomes available. This data is expected to arrive in 2025.

1.8 Key conclusions

For the 2021-22 cohort there is no evidence that the standard programme improves the likelihood of students attending HE over those on the less resource intensive flexible programme.

The flexible programme cost less to run than the standard programme. As the immediate outcomes for students appear to be broadly similar regardless of the pathway, the flexible programme may offer a less expensive, but equally effective, alternative to the in-person approach.

2 Introduction

2.1 Project team

This local evaluation of the Pathway to STEM Programme was a collaboration between The Centre for Transforming Access and Student Outcomes in Higher Education (TASO) and Aston University. The project team is outlined in Table 1 below.

Table 1: Project team, roles, and responsibilities.

Organisation	Name	Role and responsibilities
Aston University	Liz Moores	Professor and Deputy Dean - School of Psychology ● Principal Investigator for the project
Aston University	Robert Summers	Research Assistant ● Impact evaluation ● Implementation and process evaluation ● Overseeing collection of data ● Data storage protocols (using HEAT) ● Recording data on HEAT
Aston University	Hope Nightingale	STEM Pathway Programme Manager (until November 2021) ● Running the programme ● Recording data on HEAT
Aston University	Sarah Fullwood	Pathway Programme Manager (from November 2021) ● Running the programme ● Recording data on HEAT
Aston University	Lydia Runham	Pathway Programme Assistant (from November 2021) ● Assisting with delivery of the programme ● Recording data on HEAT
TASO	Eliza Kozman	Deputy Director of Research ● Quality assure the design and implementation of the trial from the TASO side
TASO	Rain Sherlock	Evaluation Manager ● Oversee the design and implementation of the trial from the TASO side

TASO	Helen Lawson	Research Programmes Manager ● Lead project management on the broader project
TASO	Sarah Chappell	Research Officer ● Support on design and implementation of trial from TASO side

2.2 Background and rationale for the local evaluation

A recent literature review into the evidence base of UK widening participation (WP) activities identified multi-intervention outreach as among one of the most common approaches used by HE providers (Robinson and Salvestrini, 2020). While the review found evidence that these programmes are associated with positive outcomes for participants (see for example Chilosi et al, 2010; Emmerson et al, 2005, Kettlewell and Aston, 2012), the literature has two key limitations. First, most of the existing evidence is focused on whether these programmes impact student aspirations/attitudes rather than long-term behavioural outcomes such as HE attendance. Second, due to the methodologies used, the current literature provides only correlational and contextual evidence on the efficacy of these programmes, particularly in a UK context.

The aim of the Aston University Pathway to STEM programme, delivered to Year 12 and Year 13 students from WP backgrounds, is to empower learners to make confident decisions about their progression to higher education (HE), and raise student aspirations for STEM courses, improve motivation, and provide them with the knowledge, skills and experience that will enhance their UCAS application.

Currently, the success of these existing programmes is measured through pre- and post-programme evaluations, individual event evaluations, and by reviewing applications and enrolments to Aston University, and other universities where data is available.

Multi-intervention outreach is a resource-intensive activity and requires significant investment of time and effort from HE providers and students alike. Therefore, there is a need to establish clear causal evidence on the efficacy of this approach.

To address this TASO have commissioned and overseen a series of evaluations, partnering with three HEPs to explore the different ways in which multi-intervention outreach and mentoring programmes could be evaluated. In this local evaluation, a pilot randomised controlled trial (RCT) is used to evaluate the Pathway to STEM programme, students are allocated to one of two versions of the programme, the standard programme or the flexible programme (see Section 2.3 below).

2.3 Pathway to STEM programme

The Pathway to STEM programme runs over approximately 12 months, beginning in April of Year 12 and ending just prior to A-level exams in Year 13. Two versions of the programme, *standard* and *flexible* are being evaluated in an attempt to assess different methods and/or costs of delivering structured WP Pathway programmes.

A combination of the results of the implementation and process evaluation on the 2020-21 cohort and changes in the staffing and management of the Pathway programme mean that the structure and programme of each cohort's standard and flexible Pathway programmes are quite different.

An overview of the programmes for both the 2020-21 and 2021-22 cohorts can be found in Table 2.

The full programme for the 2020-21 cohort is in Appendix 2 but briefly, the standard programme comprises an induction session, structured e-mentoring, subject taster days, careers advice sessions, a UCAS personal statement day, a summer school, and a graduation and celebration event. The flexible programme is similar but has no summer school, uses a student-demand-driven mentoring platform (unibuddy) and an online UCAS personal statement checking session.

In each case the RCT can be seen as evaluating a high-cost vs low-cost version of an outreach programme. Additionally, for the 2020-21 cohort, the standard and flexible programmes test different modes of delivery.

Table 2: Overview of the programmes for each cohort.

	2020-21 standard programme	2020-21 flexible programme	2021-22 standard programme	2021-22 flexible programme
Live launch event + Study Skills Session	Online	Online	In-person	
Summer school	Virtual/online	-	Residential	-
Summer School Parents Evening	Online	-	Online	-
E-mentoring	Structured (Brightside)	Unibuddy	-	

UCAS and personal statement day	In person		-	
Study skills conference	In person		-	
Subject taster day	-	Online	-	
Online personal statement checking	-	Cancelled (students took part in UCAS personal statement day)	-	
UCAS application day	-	-	In person	
HE Interviews	-	-	In person	
Academic Tutoring	-	-	Online	-
A-level revision bootcamp	-	-	In person	

2.4 Evaluation aims and objectives

The evaluation aims to provide evidence on the efficacy of the *standard* Pathway to STEM programme in comparison with a *flexible* (i.e., lower cost) version of the programme via a two-armed pilot RCT. To achieve sufficient statistical power in the analyses (see the evaluation protocol) the evaluation is taking place over two cycles of the cohort; one cohort beginning in April 2021 (the 2020-21 cohort) and the second in April 2022 (the 2021-22 cohort).[1]

The evaluation will be achieved by tracking students' interaction with the programme's outreach activities and linking this data with enrolment to STEM-related courses at HE (primary outcome), application and offer data (secondary outcomes), and knowledge and attitude changes as obtained from survey data (exploratory outcomes).

[1] The cohort names denote the academic year that the participants were in Year 12 and simplifies comparison between the Pathway to Healthcare which starts in October of Year 12.

As the trial of the Pathway programme is comparing the standard programme (relatively high intensity and cost) with the flexible programme (relatively low intensity and cost) this is a test of the relative costs of each intervention per successful enrolment at HE.

2.5 Theory of Change

The Theory of Change can be found in Appendix 1.

2.6 Ethics

Ethical approval for running the RCT of the Pathway to STEM programme was given by Aston University Ethics committee (*ref* UREC1675). Eligible applicants for the Pathway programme were given the option to opt out of the research component (i.e., the RCT) of the programme. Given that opt-out consent was used to take part in the RCT the ethical approval centred around the participant information sheet that was emailed to every eligible applicant on completion of the randomisation to each arm of the trial.

Ethical approval to run focus groups as part of the implementation and process evaluation was given by Aston University's College of Health and Life Sciences ethics committee (*ref* HLS21018). All eligible applicants from the 2020-21 cohort of STEM students were invited to take part in the focus groups.

3 Methodology

3.1 Impact evaluation - RCT

3.1.1 Impact evaluation research questions

The impact evaluation is designed to test 8 research questions:

- H1: A greater proportion of students on the *standard* programme than on the *flexible* programme will progress to a STEM course at HE in the year following the programme.
- H2: A greater proportion of students on the *standard* programme than on the *flexible* programme will progress to HE in the year following the programme.
- H3: Students on the *standard* programme will make more applications to study at HE than students on the flexible programme.
- H4: Students on the *standard* programme will receive more offers to study at HE than students on the flexible programme.
- H5: Students who attend more pathway (and non-pathway) events during the programme are more likely to enrol in HE.

Additionally, exploratory analyses of survey data will be used to inform the optimal methods to aggregate survey data to assess the following questions for future trials:

- H6: At the end of the Pathway to STEM programme students report greater confidence that they can make a successful application to HE.
- H7: At the end of the Pathway to STEM programme students report greater confidence that they can fund HE.
- H8: At the end of the Pathway to STEM programme students report greater belief that HE is a place for them.

As the trial of the Pathway to STEM programme is comparing the standard programme (relatively high intensity and cost) with the flexible programme (relatively low intensity and cost) this is a test of the relative costs of each intervention per successful enrolment at university.

3.1.2 Research methods

Students who made an application to the Pathway to STEM programme were informed that they could be part of a research study to help determine the Pathway programme's efficacy. Consent was obtained through an opt-out procedure whereby students could email the principal investigator to withdraw from the research component of the Pathway programme; opting out of the research component did not affect the chance of eligible applicants being assigned to the standard or flexible group through random allocation, merely whether their data would be included in the analysis. To establish the impact of the Pathway programme the outcomes for students assigned to the standard group were compared with those in the flexible group. All data relating to Pathway programme activities and the eligible applicants is stored on the Higher Education Access Tracker (HEAT). A combination of student application, offer and destination data (to be provided by HESA through the HEAT service and linked to each students' activity participation), activity attendance data, and milestone (MS) survey data is used to answer the research questions.

All Pathway programme events were added to HEAT and categorised according to Aston University's typology (see Appendix 3). All outreach events organised by Aston University were routinely added to HEAT and, where possible, individual attendance at these events was tracked and added to the HEAT database. Typically, it will be possible to identify Pathway programme students who have attended non-pathway to STEM programme events.

All eligible Pathway programme applicants who do not opt out of the research aspect of the programme evaluation were added to HEAT. The applicants' group membership (flexible or standard) is specified in one or both of two ways; through the attendance field and through the evaluation group field. The evaluation group field is a recent addition to HEAT and was not available when the 2020-21 cohort was added to HEAT hence the use of the attendance field.

For the 2020-21 cohort, and because the standard and flexible groups had different launch events a placeholder *Successful Applications* activity was added to HEAT to

record group membership. Group membership in this placeholder event was recorded in the following manner:

1) Using the attendance field: students on the standard programme were marked as *attended* and students on the flexible programme were marked as *unknown*, and
2) Using the evaluation group field (once it became available): students on the standard programme were marked as *Participant* and those on the flexible programme were marked as *Control*.

For the 2021-22 cohort, where each version of the programme shared a common launch event, students were added to that activity but only the evaluation group field was used to determine group membership. Students on the standard programme were marked as *Participant* and those on the flexible programme were marked as *Control.*

For each cohort, three milestone surveys (MS1, MS2 and MS3; see Appendix 4 for the full list of the questions) were conducted using the survey tool in HEAT. This survey tool has the advantage of keeping survey data with the student record and is accessible to future researchers. The milestone surveys were carried out at strategic points over the duration of the Pathway programme. At the beginning of the programme, in the autumn of Year 13 (after the summer school and prior to UCAS applications closing) and at the end of the programme (after the Study Skills conference).

Table 3: Timeline of milestone surveys for each cohort

Survey	2020-21 Cohort	2021-22 Cohort
MS1	April 2021	April 2022
MS2	October 2021	September 2022
MS3	February 2022	February 2023

Alterations to the programme for the 2021-22 cohort, such that UCAS application day was held prior to the summer rather than in the middle of the UCAS application window, has enabled the second milestone survey to take place prior to the UCAS application window opening.

The milestone surveys were designed to obtain students' self-reported knowledge around the application process, career choices and funding of university, as well as their self-reported confidence and belief they could succeed at HE and felt they would belong in a HE setting.

For the final milestone survey, a series of questions was added to ask students about their experience of outreach activities more generally, in terms of how often students experienced each type of outreach activity regardless of who delivered it.

3.1.3 Primary outcomes

The primary outcome measures are:

- whether students enrol in a STEM-related course
- whether students enrol at HE

This data is provided to us by HESA through the HEAT tracking service but is unavailable until 18 months after students begin their studies. This data can be linked back to individual students and hence to their participation in outreach activities tracked on HEAT.

A limited amount of aggregated data is provided by UCAS through their Strobe service approximately two to three months after students enrol that may assist in making preliminary judgements about whether students on the Pathway programme are more likely to go to HE than a “benchmarked” cohort of potential applicants.

The UCAS Exact service provides data similar to HESA data (course information) and includes predicted A-level grades and achieved A-level grades. This data is available in the January following a students’ enrolment. This data, is unfortunately, subject to deliberate rounding and suppression to prevent the identification of individual students and the linking of it to data stored on local tracking services. However, this data allows a preliminary comparison between both arms of the RCT over 12 months in advance of the HESA data being available.

3.1.4 Secondary outcomes

Secondary outcomes are:

- the number of UCAS applications made (zero to five),
- the number of offers received from higher education providers (zero to five), and
- the number of Pathway programme and non-Pathway programme events attended.

The data for offers and applications are available in an aggregate form (see Section 3.1.3 above) from the UCAS Exact service. Alternatively, analysis provided by the UCAS Strobe service, can report on whether students on the Pathway programme are more likely to apply or receive offers from university in comparison with a benchmarked cohort of potential applicants.

Data on the number of Pathway programme and non-Pathway programme events attended is available via the HEAT tracking service from outreach activity attendance data entered into the system by the Aston University Outreach team.

3.1.5 Exploratory outcomes

The exploratory outcomes are:

- self-reported knowledge of how to apply to HE
- self-reported confidence in the ability to apply to HE
- self-reported confidence to fund university
- self-reported sense of belonging in HE

The data that provide this information is from the first two milestone surveys (for H6) or all three milestone surveys (H7 and H8) sent out to all the Pathway programme students at key points during the programme (see Appendix 2); because MS3 was sent out after the UCAS application window had closed there were no questions about the likelihood of applying to HE in MS3.

There are seven survey questions related to the hypotheses H6 to H8 (see Section 3.1.1 for hypotheses). As shown in Table 4, questions one, two and three are used to inform the application-related outcome (H6); questions four and five are used to inform the finance-related outcome (H7); and both parts of question six are used to inform a sense of belonging (H8). Each question is analysed separately.

Table 4: Milestone survey questions used to determine the success of the hypotheses H6, H7 and H8. Don't know was a response option for all the scales.

Hypothesis	Question number	Statement	Response options
H6	1	How confident are you that... you know how to apply to university?	Not confident Not that confident Neutral Quite confident Extremely confident
	2	How confident are you that... you could make a successful application to university?	
	3	How confident are you that... you could make a successful application to study a STEM subject at university?	
H7	4	How much do you know about... how to fund university?	Almost nothing A little Something Quite a bit A great amount
	5	How confident are you that... you can afford to go to university?	Not confident Not that confident Neutral Quite confident Extremely confident
H8	*How much do you agree with the following statements?*		
	6a	I would enjoy university.	Strongly Disagree Disagree Neutral Agree Strongly Agree.
	6b	University is for people like me.	

3.1.6 Sample

Recruitment

Recruitment to the Pathway to STEM programme begins in January ready for an April start. Promotion is carried out through social media and through making contact with existing school partnerships when delivering outreach events at schools or on campus.

Eligibility

The eligibility criteria for the Pathway to STEM programme are:

1. Year 12 students:
    - **a.** who are not part of another Aston University WP programme, **and**
    - b. are studying at a school or college in the Midlands (2020-21 cohort) or West Midlands (2021-22 cohort), **and**

   c. have attained at least 5 GCSEs at grade 4 or above in Maths, English and Science, **and**
   d. whose predicted grades at A Level/BTEC/IB would also match the entry requirements of their chosen course at Aston University.

2. **And** meet at least one of the following WP criteria:
   a. Live in a POLAR4, Quintile 1 or 2 area, **or**
   b. Attend a school or college in a POLAR 4, Quintile 1 or 2 area, **or**
   c. Come from a home where neither parent has attended HE in the UK or abroad, **or**
   d. Have a disability or are in receipt of a personal independence payment, **or**
   e. Are in care or have been in care in the past.

Sample size and randomisation

All eligible applicants were randomly allocated to the standard or flexible groups subject to the standard Pathway programme being filled to capacity.

For the 2020-21 cohort the capacity of the standard programme was 80 with the expectation, based on historical data, that the flexible programme would number around 30-50 students. In total there were 114 eligible applicants for the Pathway to STEM programme in 2020-21. After random allocation to the standard and flexible programmes one student transferred to another of Aston University's Pathway programmes and another student withdrew entirely from both the programme and the research component. Following these withdrawals, 78 students were left on the standard programme and 34 on the flexible programme.

For the 2021-22 cohort, and because of a reduction in capacity of the residential summer school and a limit to the capacity of the newly added academic tutoring, the maximum size of the standard programme was limited to 45. In total there were 87 eligible applicants for the Pathway to STEM programme in 2021-22 such that there were 45 on the standard programme and 42 on the flexible programme. The reasons for the reduction in applications are not clear, although the area that eligible applicants were recruited was smaller (West Midlands rather than the Midlands) this only accounted for a handful of participants. It is possible that, due to two years of disrupted schooling due to COVID-19 students were less inclined to spend time outside of classroom hours to participate in HE outreach programmes. A full table which summarises the randomisation and the demographic breakdown of the standard and flexible group is presented in Table 5.

Table 5: Demographics of each cohort of the Pathway programme

	2020-21			2021-22		
	Standard	Flexible	Total	Standard	Flexible	Total
Overall	78	34	112	45	42	87
Sex						
Female	49 (62.8%)	27 (79.4%)	76 (67.9%)	25 (55.6%)	21 (50.0%)	46 (52.9%)
Male	29 (37.2%)	7 (20.6%)	36 (32.1%)	20 (44.4%)	21 (50.0%)	41 (47.1%)
Ethnicity						
Asian	39 (50.0%)	19 (55.9%)	58 (51.8%)	28 (62.2%)	25 (59.5%)	53 (60.9%)
Black	22 (28.2%)	7 (20.6%)	29 (25.9%)	10 (22.2%)	9 (21.4%)	19 (21.8%)
White	9 (11.5%)	4 (11.8%)	13 (11.6%)	4 (8.9%)	5 (11.9%)	9 (10.3%)
Mixed	7 (9.0%)	3 (8.8%)	10 (8.9%)	-	2 (4.8%)	2 (2.3%)
Other	1 (1.3%)	1 (2.9%)	2 (1.8%)	3 (6.7%)	1 (2.4%)	4 (4.6%)
Student has Family History of HE						
Yes	21 (26.9%)	12 (35.3%)	33 (29.5%)	15 (33.3%)	9 (21.4%)	24 (27.6%)
No	57 (73.1%)	22 (64.7%)	79 (70.5%)	30 (66.7%)	33 (78.6%)	63 (72.4%)
Student has a disability						
Yes	6 (7.7%)	1 (2.9%)	7 (6.2%)	3 (6.7%)	-	3 (3.4%)
No	72 (92.3%)	33 (97.1%)	105 (93.8%)	42 (93.3%)	42 (100.0%)	84 (96.6%)
Student has experience of the care system						
Yes	2 (2.6%)	-	2 (1.8%)	-	2 (4.8%)	2 (2.3%)
No	76 (97.4%)	34 (100.0%)	110 (98.2%)	45 (100.0%)	40 (95.2%)	85 (97.7%)
Prior eligibility for Free School Meals (a)						
Yes	-	-	-	15 (33.3%)	16 (38.1%)	31 (35.6%)
No	-	-	-	29 (64.4%)	23 (54.8%)	52 (59.8%)
Unknown	-	-	-	1 (2.2%)	3 (7.1%)	4 (4.6%)

a) Eligibility for free school meals was not part of the widening participation criteria for entry onto the Pathway to STEM programme and unfortunately this data was not collected for the 2020-21 cohort.

3.1.7 Analytical approach

Primary outcome

The primary method of analysis for enrolment to STEM-related HE courses and progression to HE generally (H1 and H2) was through binary logistic mixed-effects regression. For mixed effects logistic regression the model is:

$$Y_i \sim bernoulli(p_i)\ ;\ logit(p_i) = \alpha + \beta_0 T_{ij} + \beta_k X_{kij} + \mu_j$$

where

$$logit(p_i) = log\left(\frac{p_i}{1-p_i}\right)$$

and

- Y_{ij} is whether or not the i-th student in school j enrolled at HE (1) or did not enrol at HE (0).
- p_i is the probability of Y_i;
- T_{ij} is a treatment indicator, set to 1 for participants in the standard group and 0 for those in the flexible group;
- X_{kij} is a vector of k demographic covariates (sex, family history of HE, mean KS4 grades, and ethnicity);
- β_k are the coefficients for each covariate;
- μ_j represents each school as a random effect in the model thus allowing a different intercept to be fitted for each participant's school.

Secondary outcome

For outcomes H3 (number of applications) and H4 (number of offers) a mixed effects linear regression is used, where

$$N_{ij} = \alpha + \beta_0 T_{ij} + \beta_k X_{kij} + \mu_j + \epsilon$$

Where N_{ij} is the number of applications (H3) or offers (H4) the i-th student in school j received, ϵ is a set of normally distributed residuals, and the remaining terms are as above.

The relationship between number of Pathway programme events attended and enrolment at HE (H5) will be analysed using the logistic framework above with an extra term for the number of Pathway programme events attended.

Exploratory analyses of survey data

An exploratory approach to the analysis of survey data has been implemented and tested on the 2020-21 cohort.

Given that there is a large amount of missing data, due to poor response rates and students not responding to every survey, a statistical method was required to handle missing data. Wittkowski's (1988) modification to Friedman's non-parametric one-way analysis of variance by ranks can be used to compare results across participants who respond to at least two of the three milestone surveys. This analysis was computed using *R* with the package *muStat*. Post-hoc pairwise tests were carried out using the Conover test implemented by *frdAllPairsConoverTest* from the *PMCMRplus* package but could only be carried out where there is no missing data.

3.2 Implementation and process evaluation

3.2.1 Implementation and process evaluation research questions

There are two research questions (RQs) for the IPE:

RQ1. Was the programme delivered as intended?
RQ2. Do students who take part in the events report changes in attitude, knowledge, or awareness in the subject area targeted by the events?

Note that RQ2 seeks to understand whether students participate in programme events and how this participation influences students' attitudes, knowledge and awareness.

3.2.2 Research methods

To answer RQ, event reports, attendance data and, where applicable, student reports of the quality of the online presentation (video/audio quality and the appropriateness of the study area) were used.

To answer RQ2 specific questions from post-event student evaluation data and the data from focus-groups were used. These specific questions were used to determine self-reported levels of attitude, knowledge, or awareness in the targeted domain of the event. For example, for a UCAS application event an appropriate question would be 'After today, I feel more confident that I could make a successful application to university'. Suitable post-event questions were identified in the implementation and process evaluation and are reproduced in Appendix 5. Additionally, milestone survey data from those students who take part in the focus groups was available for comparison with the focus group data.

For the analysis of survey questions, RAG (red-amber-green) ratings of the responses were used. RAG ratings were based on the percentage of respondents who respond positively or strongly positively (e.g., 'Agree'/'Strongly Agree', 'Know a bit'/'Know a lot', etc.) to a question or set of survey questions. A RAG rating of red is

≤50% respond positively, amber <75% respond positively, and green ≥75% respond positively.

3.2.3 Sample, data sources

In addition to the data sources noted above the following questions will be asked in post-event surveys of online events to help determine the quality of the online experience:

1. How would you describe the audio quality (e.g., in terms of clarity, dropouts, freezes etc.) of the event? [*Possible responses: 'Very Good', 'Good', 'Okay', 'Poor', 'Very Poor'*]
2. How would you describe the video quality (e.g., in terms of clarity, dropouts, freezes etc.) of the event? [*Possible responses: 'Very Good', 'Good', 'Okay', 'Poor', 'Very Poor', 'Did not use video'*]
3. How would you describe your study environment during the event? [*Possible responses: 'Very Good' – No distractions/interruptions, 'Good', 'Okay' – A few distractions/interruptions, 'Poor', 'Very Poor' – Frequent distractions/ interruptions*]

Focus groups or one-to-one interviews of students from the standard and flexible groups were used to help identify aspects of the outreach programme, and outreach activities more generally, that did or did not work for the students. For the focus groups 106 students (72 standard, 34 flexible) had responded to at least one milestone survey and were invited to take part. Seven students, six from the standard group, consented to take part but only three students (all from the standard group) responded when asked to participate. Of those three only two students attended a focus group. During the COVID-19 pandemic, students were being asked to participate in multiple online activities, including research and evaluation activities, which led to students being overwhelmed with requests and made recruitment to the focus groups more difficult than in previous, typical years. The small sample size limits the conclusions that can be reached from the focus group data.

3.2.4 Details of fidelity, dosage, compliance, and usual practice

Fidelity

An event is assumed to have been delivered if the practitioner's post-event report did not indicate that any changes were made to the planned programme.

For online events, the additional requirement was that a green RAG rating was obtained for each of the three post-event questions relating to audio/visual quality and study space quality.

Dosage

If more than 60% of students attended the event then the event was considered to have been received by the students. For events with multiple sessions (e.g., online

summer school) attendance was defined as turning up to more than 50% of the sessions. For Brightside mentoring, following Brightside's own definitions, attendance was defined as having sent more than two messages.

Compliance

Students were judged as having completed the Pathway programme if they attended more than 50% of the events on the programme.

Usual practice

Usual practice would be to deliver all the events in a face-to-face setting, however, the onset of COVID-19 meant that the summer school for the 2020-21 academic year was delivered online in summer 2021 rather than as a residential. No specific training was given to the practitioners' in order to run the Pathway programme online.

The residential summer school is usually considered to be a compulsory event and students are only usually allowed to miss it in exceptional circumstances. For the 2021-22 cohort, however, an exception was made due to the long-lasting effects of the pandemic.

3.2.5 Analytical approach

Thematic analysis (Braun and Clarke, 2006) was used to analyse the focus group transcriptions. The analysis was inductive and linked to the Theory of Change through the key themes:

1) the support which was provided to students on the Pathway programme and
2) the attitudes to HE in terms of sense of belonging (both academic and social).

Data from the focus group participants was linked with their milestone survey data to determine the extent of agreement between them.

4 Results

4.1 Summary of findings from the impact evaluation – RCT

A summary of data from the UCAS Outreach Evaluator is presented in Table 6.

4.1.1 Enrolment to HE

Until the HESA data is available, data on acceptances from UCAS is the closest achievable data to enrolment where acceptance is defined as *an applicant who has been placed for entry into higher education*. In other words, the applicant has been offered and allocated a place at HE but it is not known if they have enrolled on the course or entered HE.

Data provided by the UCAS Outreach Evaluator (formerly Strobe) and Exact service provide a tabulated comparison of the standard group and flexible group for number of firm acceptances that is subject to rounding errors (to the nearest five).

The data reveal that of those who made an application approximately 86% (possible range due to rounding and suppression checks: 81%-91%, n=60±2) of the standard group and 83% (possible range: 72%-96%, n=25±2) of the flexible group had a firm acceptance for study in the 2022-23 academic year.

The data from the UCAS Exact request reveal that between 16 and 34 students in the standard group held a firm acceptance for study in a STEM course for the 2022-23 academic year, the equivalent range for the flexible group is 9-23. That is 21%-43% in the standard group held a firm acceptance for a STEM course compared with 26%-68% of students from the flexible group.

Notwithstanding the limitations of this data it is not likely that either H1 or H2 is supported. That is, students in the standard group are no more likely to progress to HE for a STEM course (H1) or HE in general (H2) than those in the flexible group. Due to the ranges provided in line with the rounding and suppression of UCAS data, this is a proxy measure rather than an accurate test of significance which will be conducted when HESA data becomes available.

Table 6: Results from the UCAS Outreach Evaluator report

	Standard (2020-21 cohort)	Flexible(2020-21 cohort)
Firm acceptance (any subject)	86% (possible range: 81%-91%, n=60±2)	83% (possible range: 72%-96%, n=25±2)
Firm acceptance - STEM or subjects allied to STEM	21%-43% (n=16 to 34)	26%-68% (n=9 to 23)
Applications (% who made at least one application)	90% (possible range: 87%-92%, n=70±2)	88% (possible range: 82%-94%, n=30±2)
Applications per student	5 (4.8-5)	5 (4.6-5)
Offers	100% (possible range: 94%-100%, n=70±2)	100% (possible range: 88%-100%, n=30±2)
Offers per Applicant	3.4 (3.2-3.5)	2.8 (2.6-3.1)
Attendance	HESA data available spring 2024	HESA data available spring 2024

4.1.2 Applications and offers

Data provided by the UCAS Outreach Evaluator (formerly Strobe) and Exact service provide a tabulated comparison of the standard group and flexible group for the total number of students who have made at least one application to HE and the number of students who have received at least one offer. As for acceptances, these numbers are subject to rounding errors (to the nearest five).

In terms of applications, 90% (possible range: 87%-92%,[2] n=70±2) of students in the standard group made at least one application to HE in comparison with 88% (possible range: 82%-94%, n=30±2) for the flexible group.

In terms of offers, 100% (possible range: 94%-100%,[3] n=70±2) of students in the standard group who applied to HE received at least one offer in comparison with 100% (possible range: 88%-100%, n=30±2) for the flexible group.

The total number of applications made by students in the standard group was 350±2 and 150±2 in the flexible group. The number of applications per student was approximately 5 (4.8-5) for both the standard group and flexible group (4.6-5).

The total number of offers made to students who had applied to HE in the standard group was 235±2 and 85±2 in the flexible group. The number of offers per student who had applied was approximately 3.4 (3.2-3.5) for the standard group and 2.8 (2.6-3.1) for the flexible group.

It is unlikely that the data are consistent with H3 – students in the standard group make more applications than those in the flexible group. However, it is possible that H4 is supported, students in the standard group receive more offers than students in the flexible group.

4.1.3 Relationship between attendance and enrolment

Please note that this report will be updated with the final outcome data when the HESA data is returned in spring 2024.

4.1.4 Milestone surveys (2020-21 cohort)

The response rates for the three milestone surveys can be found in Table 7. They were initially high (91-100%) because completion of MS1 was required to accept the students' place on the programme. In subsequent surveys, a prize draw for £100

[2] The range of percentages is computed by taking the minimum or maximum possible value of the returned number (which has been rounded to the nearest 5) and dividing it by the number of students in the standard group (78) or flexible (34) group where relevant.
[3] The range of percentages is computed by taking the minimum or maximum possible value of the returned number (which has been rounded to the nearest 5) and, respectively, dividing it by the maximum or minimum possible value of the number of students in the standard or flexible group who made at least one application to HE

vouchers was used as compensation for students' time to complete them but the response rates were much lower (20.6% for MS2 and 35.3% for MS3).

Table 7: Number of responses and the response rates for the three milestone surveys (MS1 – MS3) by group (Standard or Flexible) for the 2020-21 cohort.

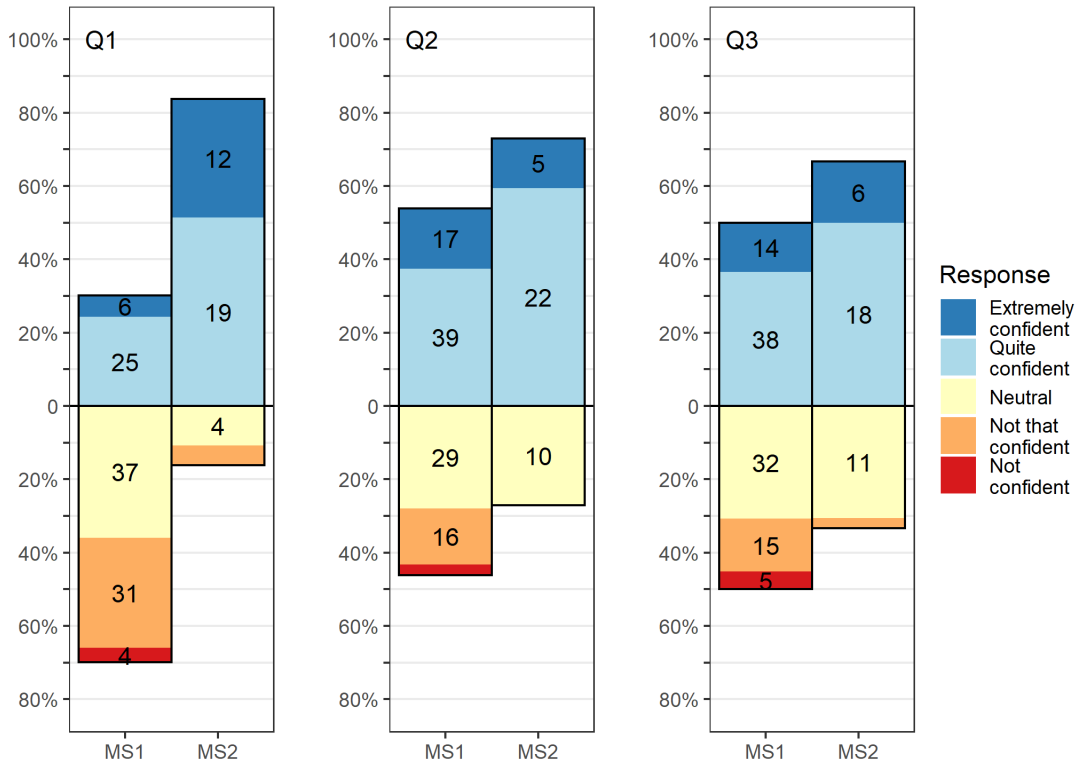
Group	MS1		MS2		MS3	
	n	Response Rate	n	Response Rate	n	Response Rate
Standard	71	91.0%	25	32.1%	25	32.1%
Flexible	34	100.0%	12	35.3%	7	20.6%

After collating the data from all three surveys, 37 students completed MS1 and MS2, 31 students completed MS1 and MS3, 21 students completed MS2 and MS3, and 21 students completed all three surveys. Overall, 47 students completed two out of the three milestone surveys.

> *H6: Students report greater confidence that they can make a successful application to university*

It is clear from Figure 1 that the responses to the two relevant questions for H6 are more positive for MS2 than MS1, particularly when referring to confidence in their knowledge of how to apply to HE (82% are confident in MS2, compared with 30% in MS1). Friedman tests (Table 8) on the data from the students who completed each of the relevant questions in MS1 and MS2 (35 or 36) revealed, as the Pathway programme has progressed, significant increases in the confidence of respondents that they can successfully apply to university.

Figure 1: Diverging stacked bar charts of the responses to the three questions relevant to H6. The height of each segment is proportional to the percentage of the indicated response. The counts for each response are displayed in the bars, counts below four are suppressed for reasons of space. All students who responded to at least one survey are included in the graphs.



How confident are you that...
Q1: you know how to apply to university?
Q2: you could make a successful application to university?
Q3: you could make a successful application to study a STEM subject at university?

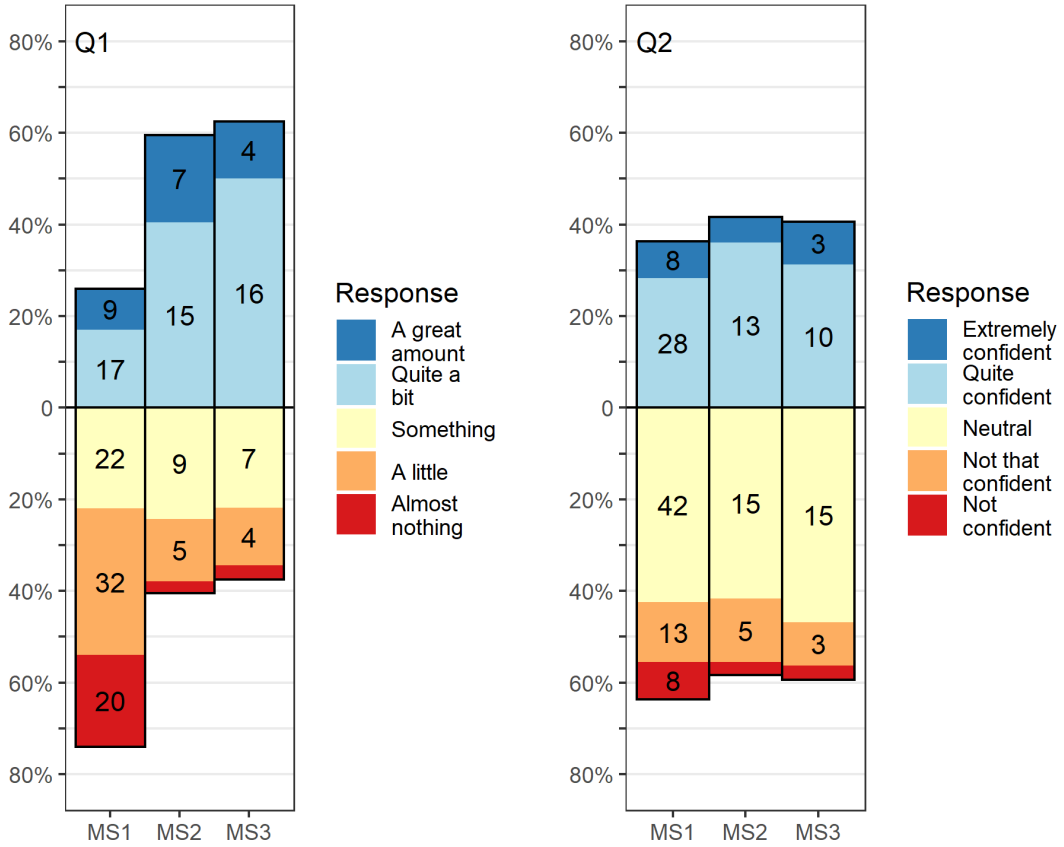
Table 8: Results of a Friedman test for the three application-related questions graphed in Figure 1. p-values have been adjusted using Bonferroni correction.

Statement	n	χ^2	*p*
How confident are you that…			
. . .you know how to apply to university?	36	34.722	<.001
. . .you could make a successful application to university?	36	8.000	.014
. . .you could make a successful application to study a STEM subject at university?	35	6.914	.026

H7: At the end of the programme students report greater confidence that they can fund university

As for H6, but this time across three MSs, it is clear from Figure 2 that the responses to the relevant questions for H7 are more positive for MS2 and MS3 than for MS1, when referring to confidence in their knowledge of how to fund HE (59% for MS2 and 62% for MS3 responded positively compared with only 26% for MS1). Friedman tests (Table 9) on the data from the students who completed each of the relevant questions in two out of the three MSs (44 or 45 students) reveal significant effects of MS on responses for knowledge on how to fund HE only. There is no significant improvement in students' confidence that they can afford to go to HE with fewer than 50% of respondents believing that they can do so. The pattern of results is consistent with much of the work in improving students' knowledge around HE finance being completed during the Summer School, two months before MS2.

Figure 2: Diverging stacked bar charts of the responses to the three questions relevant to H7. The height of each segment is proportional to the percentage of the indicated response. The counts for each response are displayed in the bars, counts below three are suppressed for reasons of space. All students who responded to at least one survey are included in the graphs.



Q1: How much do you know about...how to fund university?

Q2: How confident are you that... you can afford to go to university?

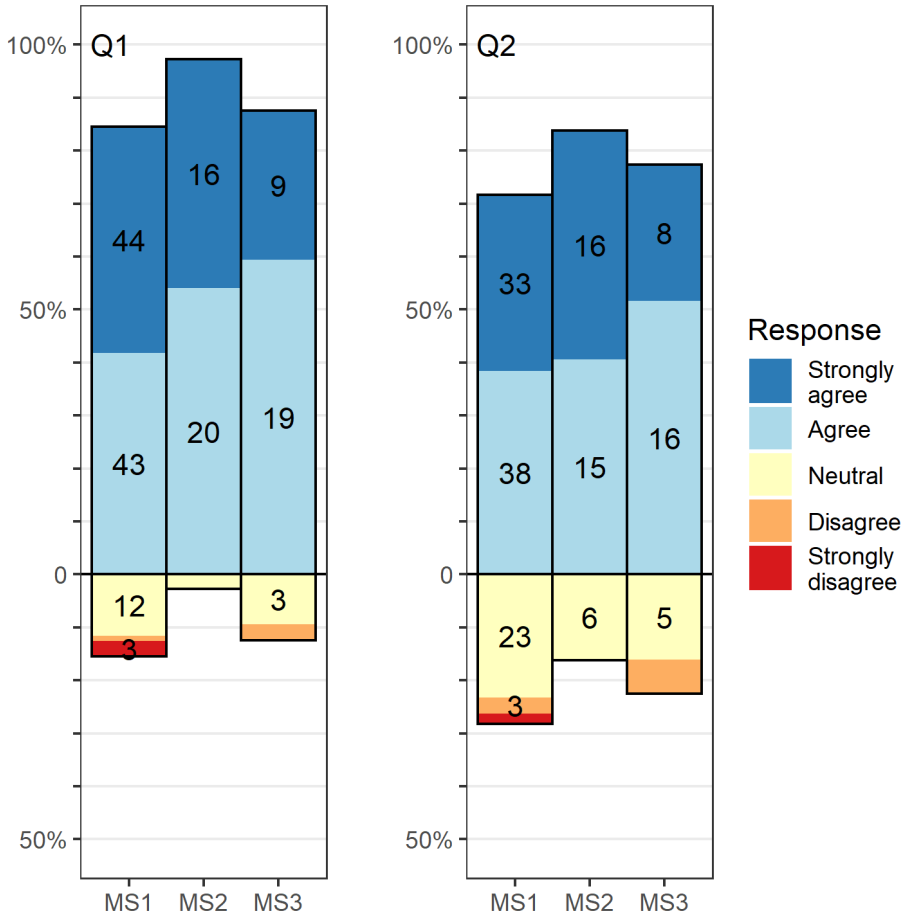
Table 9: Results of a Friedman test for the two finance-related questions graphed in Figure 2. The p-values for the individual Freidman tests have been adjusted using Bonferroni correction. The p-values between different MSs (i.e., columns headed MS1 vs MS2, etc), have not been adjusted and are based on Conover tests.

Statement	n	χ^2	*p*	MS1 vs MS2	MS1 vs MS3	MS2 vs MS3
how to fund university?	45	17.415	<.001	.013	.001	.350
you can afford to go to university?	44	4.383	.220	.459	.053	.370

H8: At the end of the programme students report greater belief that university is a place for them.

Across three MSs, it is clear from Figure 3 that there is little change in the response profile of the two relevant questions across the three MSs. This is unsurprising given that over 70% of students responded positively to both questions at the beginning of the Pathway programme and the results of the Friedman tests (Table 10) confirm the lack of change in response profiles ($p>.05$).

Figure 3: Diverging stacked bar charts of the responses to the three questions relevant to H7. The height of each segment is proportional to the percentage of the indicated response. The counts for each response are displayed in the bars, counts below three are suppressed for reasons of space. All students who responded to at least one survey are included in the graphs.



How much do you agree with the following statements...
Q1: I would enjoy university
Q2: university is for people like me

Table 10: Results of a Friedman test for the two sense-of-belonging questions graphed in Figure 3. The p-values for the individual Freidman tests have been adjusted using Bonferroni correction.

Statement	n	χ^2	p
I would enjoy university	46	3.565	.336
university is for people like me	45	3.583	.333

4.2 Summary of findings from the implementation and process evaluation

4.2.1 IPE RQ1: Was the programme delivered as intended?

For the 2020-21 STEM standard cohort the programme was not delivered as intended (see Table 11). Through the event reports practitioners noted no changes to the planned delivery of the events. However, the attendance at events was low and only reached the threshold of 60% attendance for the UCAS Personal Statement Day and Brightside e-mentoring. For the launch event, questions relating to online quality were missed from the evaluation, so it is not possible to determine the online quality of that event.

Table 11: Scheduled events for the 2020-21 Pathway to STEM standard programme and associated indications of attendance, successful delivery, online experience, and student evaluation.

Event	Attendance >60%	Event delivered with no reported change	Online Quality RAG rating	Evaluation Questions RAG rating
Launch event (standard programme)	N	Y	-	N
Summer school	N	Y	Y	Y
Brightside e-mentoring	Y	Y	N/A	N/A
UCAS and personal statement day	Y	Y	N/A	Y
Study skills conference/Finance	N	Y	N/A	Y

For the flexible programme, difficulty in tracking attendance at online events made it impossible to determine which students had taken part in subject taster days. As a result of this the online personal statement checking was cancelled and students on the flexible programme were instead invited to take part in the UCAS Personal Statement Day on campus along with students from the standard programme. Furthermore, unlike the structured e-mentoring delivered using the Brightside platform, the unibuddy platform was used by only four students on the flexible programme and even then, only one of them sent a message.

Informal discussions with the Pathway programme manager who delivered much of the programme indicated that the move to online delivery seemed to result in a demotivated student population who were less willing to attend programme events; although some of this demotivation may be due to starting the programme late in Year 12 which has resulted in changes to future delivery of the programme (see Section 5.3.2). There was frustration that the online technology used on the Pathway to STEM programme made recording attendance difficult without additional staff support that was not available. There was relief at finally being able to interact face-to-face with the students at the UCAS application day and a belief that this lack of interaction with the students would likely make the programme less effective, particularly with regards to the summer school where staff, student ambassadors and Pathway programme students spend a lot of time in each other's company over the course of three days.

4.2.2 IPE RQ2: Do students who take part in the events report changes in attitude, knowledge, or awareness in the subject area targeted by the events?

Student post-event evaluations

With the exception of the Launch event on the standard programme, all the questions identified in the implementation and process evaluation (see Appendix 5) as pertinent to the success of an event achieved a RAG rating of green demonstrating relevant changes in attitude, knowledge, or awareness.

For the launch event which included a study skills session, only 70% of respondents agreed with the statement "Today has helped me to… Identify which skills I am good at." The number of responses, however, was 10, mainly due to technical difficulties during the event which meant that the post-event survey was not conducted at the end of the event but sent out several days later.

Paired interview

Theme: Support provided to students on the Pathway to STEM programme

Theory of Change outcome: *Equip local WP learners with the necessary skills, knowledge and experience to apply to HE and to fund university*

Both students in the paired interview reported being quite confident that they could make a successful application to HE, and for one of these students this was an improvement from a neutral response in the first survey. Additionally, these students were quite confident that they could afford university. This confidence seemed to stem from the Pathway programme:

> *"I think I would have still applied somehow I would have gotten there, but it [the programme] did help a lot"*

For this student particular mention was made of the mentoring component

> *"And I think that's the thing that really helped. And she sent me her personal statement, my mentor, and it just it, like, just helped me understand what the layout was meant to be like."*

The other student also referred to the application process and specifically mentioned interviews:

> *"It has helped me quite a bit. And especially with […] the interviews …"*

In terms of financing HE both students agreed that the programme supplied them with the knowledge to obtain funding:

> *"I applied for a student loan as well and […] the programme helped me with that because there was a finance talk with it."*

> *"[…] there were quite a few events where they talked about the financial part of it and yeah. So I think I'm fine [applying for finance]."*

It was clear that one student had a full understanding of the student loan process as they talked about how it would be affected by both parents' income despite their parents being separated.

Theory of Change outcome: *Improve academic attainment of students (A-levels)*

Neither of the students mentioned academic attainment in relation to the Pathway to STEM programme. A tutoring component has been brought in for the 2021-22 cohort to supplement the study skills sessions and it will be interesting to see if those students bring this up in discussions about the Pathway programme in the future.

Theme: Attitudes to HE in terms of sense of belonging (academic and social).

Theory of Change outcome: *Increase preparedness for study at university*

Part of the e-mentoring programme was designed to prepare students for study at HE in that, because the mentors were current undergraduates, the Pathway programme students could discuss all aspects of university:

> *"And then I could also ask my mentor, like anything else. It wasn't just personal statement related. And I did ask her about, like, what the course was like and like, as like a person in Uni and not just like word of mouth from like whoever. So I think that was just a really good bit of insight that I got to help with my choice."*

Additionally, the same student discussed the Pathway programme in general as helping them to understand the changes in study behaviour that they would encounter:

> *"I think it's also like just they prepare you for like STEM […] It's a really like hard subject that you're going into so, I think that they do give you like a heads up"*

Theory of change outcome: *Students feel supported in their transition to university*

Neither of the students discussed transition to HE although, it could be argued that this is part of preparedness to study at university.

5 Discussion

5.1 Discussion of findings, linking the IE and IPE results.

5.1.1 Frame by compliance, fidelity, dosage, reach, and moderations made to the intervention (e.g., in the context of COVID-19).

2020-21 Programme

The 2020-21 Pathway to STEM programme cannot be considered to have been delivered as intended. While the practitioner's event reports indicated that events were delivered as intended, activities were not well attended (see Table 10) and pertinent changes in self-reported knowledge did not always meet the threshold defined in the implementation and process evaluation. As the Pathway to STEM programme began towards the end of Year 12, and after a gruelling year with regards to lockdowns and the imposition of online schooling, the Pathway programme organisers reported that students seemed less motivated to get involved in the programme at that point. Future iterations of the Pathway programme from the 2022-23 academic year onwards will begin in the autumn of Year 12 at the same time as the Pathway to Healthcare programme. Motivation on the Pathway to Healthcare programme is typically high throughout the duration of the programme, and it is hoped that changes to the timetable might improve motivation for students on the Pathway to STEM programme.

Difficulties in tracking online attendance at online subject taster days meant that it's not possible to know which students from the flexible programme attended them. As a result, the planned online personal statement checking was removed, and students were invited to join the UCAS Personal Statement Day instead.

5.1.2 UCAS data and H1, H2, H3 and H4.

Four hypotheses were tested by the currently available UCAS data:

- H1: A greater proportion of students on the *standard* programme than on the *flexible* programme will progress to a STEM course at HE in the year following the programme.
- H2: A greater proportion of students on the *standard* programme than on the *flexible* programme will progress to HE in the year following the programme.
- H3: Students on the *standard* programme will make more applications to study at HE than students on the flexible programme.
- H4: Students on the *standard* programme will receive more offers to study at HE than students on the flexible programme.

Of these hypotheses only H4 is consistent with the data where students in the standard group received 3.4 offers per applicant in comparison with 2.8 offers per applicant in the flexible group.

5.1.3 Evidence to support Theory of Change

Given that the programme was not delivered as intended and changes have been made to it for the 2021-22 cohort, the Theory of Change should be revisited by the Pathway to STEM programme team at Aston University.

One of the underlying assumptions in the Theory of Change is that the students eligible for the Pathway to STEM programme do not necessarily see HE as a place for them but the results of the first milestone survey indicate the opposite. This assumption feeds into the outcomes of increasing applications to HE, offers from HE and enrolment in HE (whether in STEM subjects or otherwise). If these students were going to HE anyway (notwithstanding the fact that the Pathway programme seems to be associated with an increase in confidence around applications to HE) then the outcomes around applications, offers and enrolment may need to be revised in terms of continuation and progression once in HE, i.e., students on the Pathway programme are better prepared for studying in HE than those who are not on the programme. Consequently, adjustments to the programme may be required to further support HE continuation and progression.

5.1.4 Milestone survey results and H6, H7 and H8

Three hypotheses were tested using the results from three milestone surveys. These hypotheses were:

1. (H6): At the end of the programme students report greater confidence that they can make a successful application to university.
2. (H7): At the end of the programme students report greater confidence that they can fund university.
3. (H8): At the end of the programme students report greater belief that HE is a place for them.

Of the three hypotheses tested, H6 is fully supported by the data, H7 is partially supported, and H8 is not supported at all. Overall, the data showed that the programme was successful in conferring knowledge and confidence about how to apply to HE and STEM courses in particular. It was also successful in conferring knowledge about how to fund university, but students were no more confident that they would be able to afford it. In terms of perceptions that the students would enjoy HE and that university was a place for them, the majority of the participants already agreed with these statements at the start of the programme and so any changes on these measures were not significant.

5.2 Limitations of the research

5.2.1 The use of proxy measures

The data from UCAS used to answer H1-H4 is limited because it includes firm acceptances rather than enrolments, numbers are rounded to the nearest five, and for some data (e.g., subject applied for) disclosure controls have been applied that reduce the accuracy of the data still further. Nonetheless, due to the delay in accessing HESA data, the preliminary analysis conducted using UCAS data is the best available option for short-term reporting and provides useful indicators about the impact of the Pathway programme on student applications.

5.2.2 Small sample size

For the impact evaluation, the small sample size affects the statistical power for the analysis and hinders the ability to find statistically significant results. The analysis will benefit from the inclusion of the second cohort of students from the 2021-22 Pathway programme. Furthermore, the sample is based on one higher education provider, meaning the results are not generalisable to the wider population.

Only two students from the Pathway to STEM programme consented and participated in the focus group therefore limited conclusions can be drawn from the data.

5.2.3 Conducting the evaluation during COVID-19

Conducting the evaluation during the COVID-19 pandemic meant that, not only was the evaluation investigating an atypical version of programme delivery, but it was particularly difficult to engage students in evaluation activities - such as, completing milestone surveys and participation in focus groups. Students were being asked to take part in numerous online activities during the pandemic, which may be why the usual strategies used to engage students in evaluation activity (prize draws and compensation) were less effective.

5.3 Reflections

5.3.1 Practitioners reflections on running an RCT

There was a high degree of enthusiasm for more formal evaluation of the Pathway to STEM programme but there was little appetite for a traditional RCT whereby a control group received business as usual provision (no intervention) even though demand for the Pathway programme generally exceeded capacity. Instead, a compromise was reached to provide one of two levels of support to eligible applicants for the Pathway to STEM programme; though running concurrent but very different programmes brought on other issues (see Section 5.3.2). Further the support necessary to run an RCT was a consideration. The provision of a TASO-funded research assistant at Aston University, to carry out the randomisation,

improve data recording on HEAT, develop event evaluation, and provide timely analysis and reporting on intermediate outcomes (through milestone surveys), mitigated this consideration. The results of the collaboration between the research assistant and the Pathway programme manager means that going forward, the programme is being continuously evaluated and data is recorded consistently on HEAT so that the long-term impacts of the Pathway programme can be monitored, and the programme can be changed to meet the needs of the students. However, ongoing evaluation in the absence of a TASO-funded research assistant may be more challenging.

5.3.2 Running of a high-cost/low-cost programme

The desire to run a high-cost/low-cost version of the programme (i.e., standard and flexible) was born out of a wish to make sure that all eligible applicants received some potential benefits of an outreach programme when resources are limited.

The reality of running two separate programmes (e.g., different launch events, different events for Personal statements) increased demands on staff time in terms of delivery and planning. Coupled with the difficulty in tracking online attendance at subject taster events (which were to be a large part of the flexible programme) meant that it was not possible to ascertain which students had attended which subject tasters.

Two changes have occurred such that management of the 2021-22 Pathway to STEM programme will be simpler while keeping a high-cost/low-cost version of the programme. Firstly, organisation of the programme has been streamlined such that while the programme will still be run along standard/flexible lines, both groups will share events. Due to capacity constraints of the summer school and academic tutoring, students on the flexible programme will participate in fewer events. Secondly, management of all Aston University's Pathway programmes has been assigned to a dedicated Pathway programme manager meaning that the necessary time and resources can be devoted to the running of all the programmes.

5.3.3 Improving response rates to milestone surveys

The first milestone survey on the Pathway to STEM programme was sent to applicants once they had been allocated to either the flexible or standard programmes. They were asked to complete the survey to accept their place on the programme, hence response rates were high (94% overall). Subsequent surveys, sent to all eligible applicants, were accompanied by optional entry to a prize draw for £100 of vouchers as an incentive to participate. The overall response rate for MS2 was 33% (37 students, 25 from the standard group) and for MS3 was 29% (32 students, 25 from the standard group).

The aim of the milestone surveys was to be able to track changes in student perceptions over the course of Year 12 and Year 13 for both the standard and

flexible groups. The lack of responses from the flexible group, despite the incentive, will make comparisons between the groups difficult. Nonetheless the milestone survey data for the combined responses is valuable itself as key progress in students' perception of their understanding of the application process, funding and university life can be tracked and compared with the Pathway programme events. Such comparisons may reveal whether Pathway programme events are having the desired effects.

To improve response rates, responding to the milestone surveys was built into the programme as part of the acceptance process (first survey) and the registration for the next Pathway programme event (later surveys). This was combined with continuing the strategy of offering incentives to students. As the standard and flexible groups for the 2021-22 cohort are following a more similar programme with shared events that are in-person it is hoped that this will itself lead to increased response rates.

6 Conclusions

Using the best data available to date there is no evidence that the standard Pathway to STEM programme was more effective than the flexible Pathway to STEM programme in improving students' chances of applying or making a firm acceptance to study STEM subjects at HE. The data indicates that students on the standard programme may have received more offers for every application made than those on the flexible programme.

As noted above, the programme was not delivered as intended and changes have been made for the 2021-22 cohort to ensure consistent delivery and reporting.

Survey data indicated that students were more confident that they could successfully apply to and know how to obtain funding for HE by the end of the programme. A focus group with two students from the standard programme provided some corroboration that it was responsible for this increase in confidence.

At the beginning of the programme students were highly likely to report that HE was a place for them and that they would fit in. There was no significant improvement in their attitudes by the end of the programme.

The flexible programme cost less to run than the standard programme. As the immediate outcomes for students appear to be broadly similar regardless of the programme, it may be more advantageous for HE resources to be allocated to reaching more students via the flexible programme, to achieve similar results as a fuller in-person programme.

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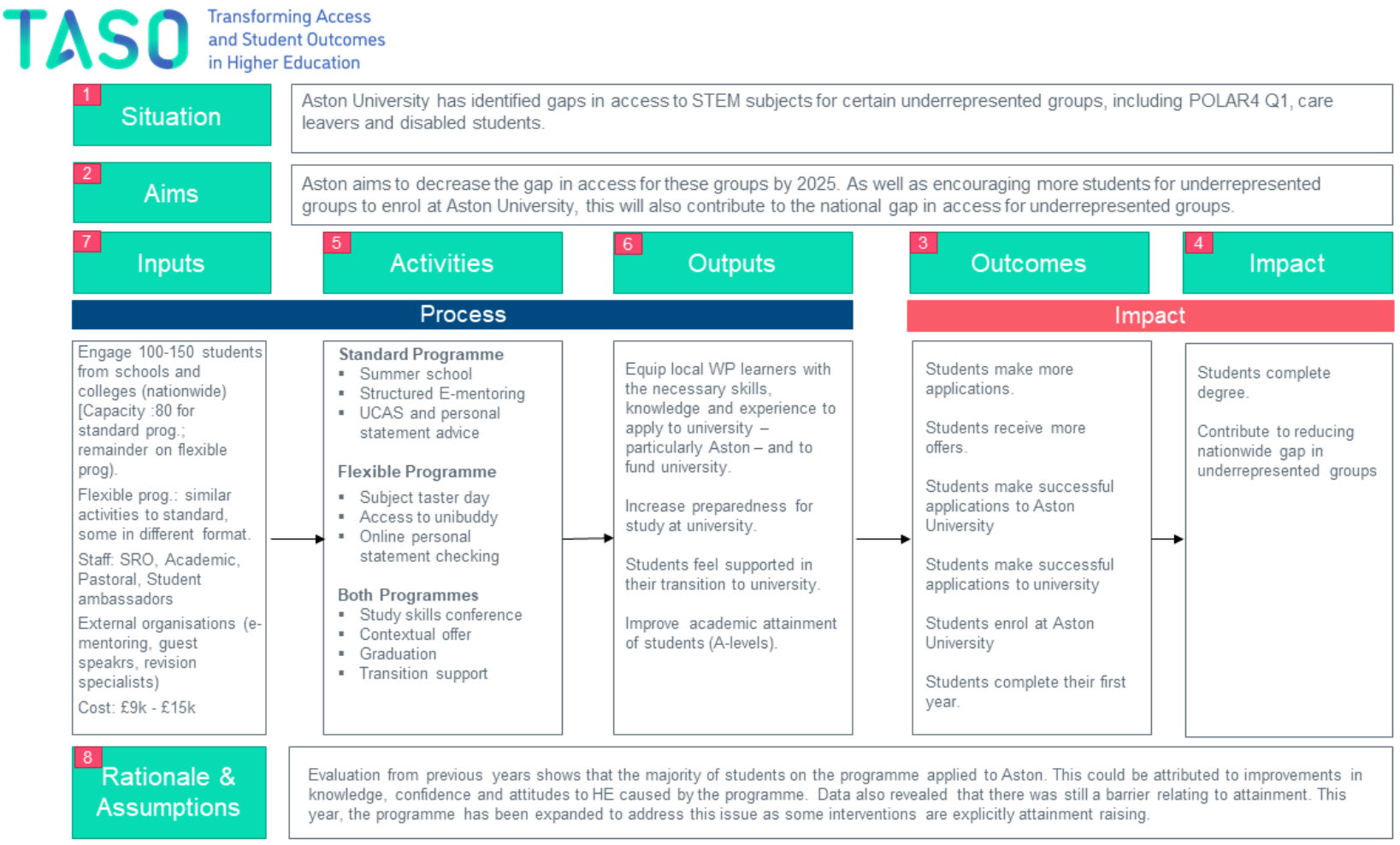
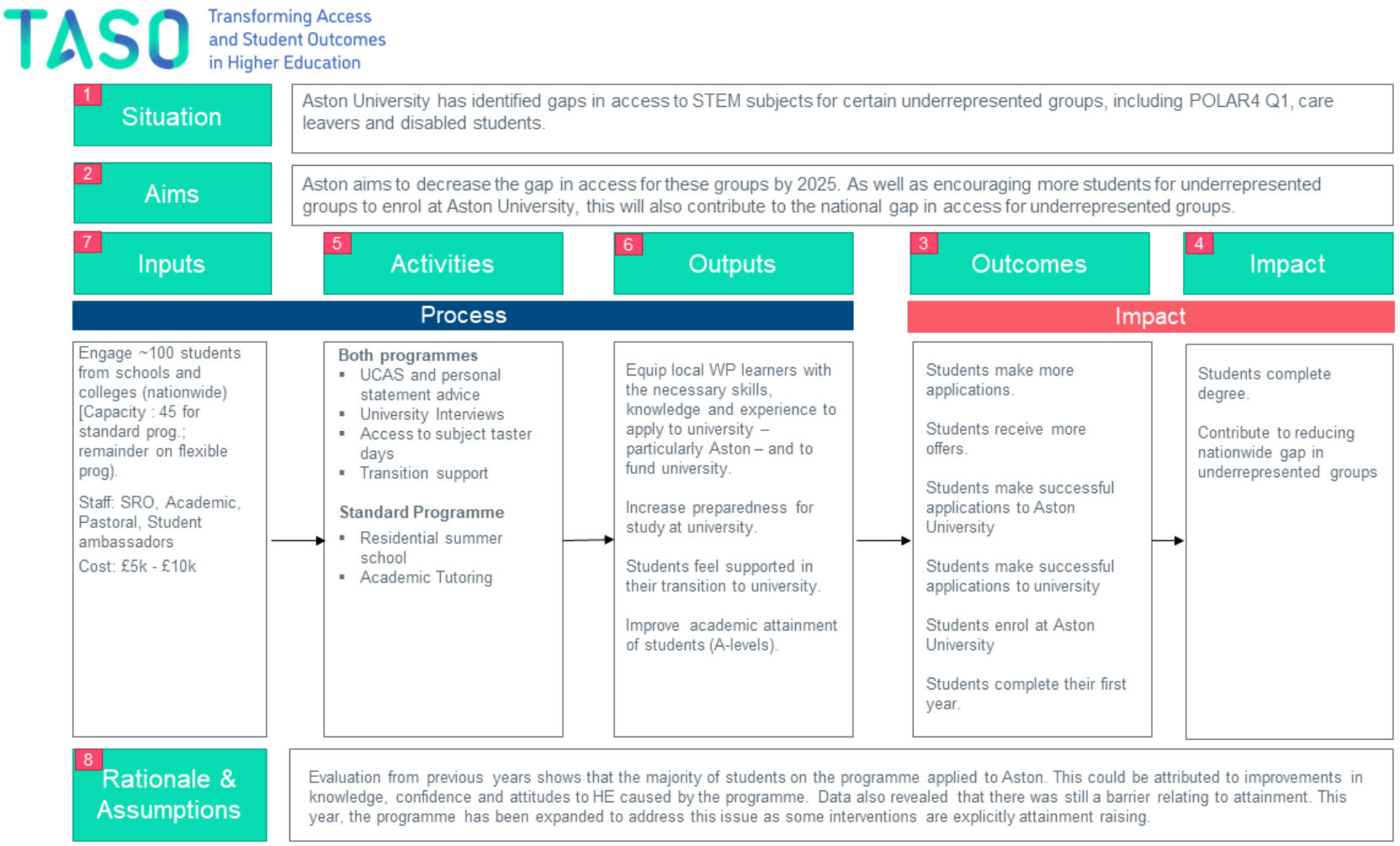
Appendix 1 – Theory of Change

2020-21 Programme



2021-22 Programme



Appendix 2 – Programme of events

2020-21 cohort

Standard programme

Date	Event	Details
17 March - 14 April 2021	Survey	Milestone survey 1
April 2021	Live launch event + Study Skills Session	The pathway launches with a welcome from the Student Recruitment and Outreach team who will give an overview and introduction to the whole programme. Elevate education will then deliver a session called “Study Sensai”. We address the question: “What is study?” This seminar breaks down the study techniques of the top students, providing students with a road-map for what work they need to be doing across the year and how to do it.
August 2021	Summer school	As part of the programme learners will attend a 3-day virtual summer school. This will compromise of social and academic tasks for the learners in attendance. The learners will work on a subject specific task which they will work on throughout the summer school, as well as taster sessions led by student ambassadors. On top of this, there will be various IAG talks from the SRO team on topics such as Student Finance as well as sessions from support services from across the university. Each day will also give the learners opportunities to interact with other learners on the programme in the form of quizzes and social activities.
Aug 2021 – January 2022	Structured e-mentoring	Learners on the programme will be paired with a current Aston University undergraduate student who is studying a course in the area they are interested in. Using the Brightside mentoring platform, the mentors and mentees will follow a guided mentoring programme, designed to ensure that learners are provided with information, advice and guidance to help them make decisions about their next steps.
October 2021	UCAS and personal statement day	Advice and guidance will be offered around personal statements through a presentation and 1-1 run throughs for personal statement drafts. Advice will also be provided around how the application system works and what students can expect on their journey to university.
27 October - 12 November 2021	Survey	Milestone survey 2
February 2022	Study skills conference	Learners will be invited onto campus for a day focused on equipping them with the right skills to help them revise for their upcoming exams. Elevate education will deliver “Ace your Exams” and the “Finishing Line”. **Ace your exams** With the arrival of exams, knowing the material is no longer enough. It now becomes a case of application. The question for many students is: “How do I take all the work I have done and turn it into the marks I deserve?” This seminar outlines the critical exam skills that will allow them to excel in the exam room, whilst also demonstrating that exams are not just about the exam room- the preparation is where the marks are. **The Finishing line**

Date	Event	Details
		The end is in sight. The last thing we want now is students stressing and forgetting the skills they've been taught over the previous few years. This seminar is the conclusion to the programme and is designed to reinvigorate students as they approach the end of year 13. Students are provided with a clear road map for the final few months and practical strategies to manage the pressure and stress that comes with it!
22 February 2022 - 11 March	Survey	Milestone survey 3

Flexible programme

Date	Event	Details
17 March - 14 April 2021	Survey	Milestone survey 1
April 2021	Launch	The pathway launches with a welcome from the Student Recruitment and Outreach team who will give an overview and introduction to the whole programme.
August 2021	Subject taster day	These subject tasters will enable student to get more of an insight into how each subject is taught at Aston University, as well as what they can expect to learn on the course.
Aug 2021 – July 2022	Access to Unibuddy	Learners will have access to the Unibuddy Mentoring platform. Here, they can ask direct questions to the students registered on there around subjects they are studying. They can also ask general questions to the Student Recruitment and Outreach team.
September 2021	Online personal statement checking	The Student Recruitment and Outreach team will deliver a 45-minute webinar on the application process and personal statement to learners. At the end of the session, they will be invited to send in their drafts of their personal statement to the team for individual feedback.
27 October - 12 November 2021	Survey	Milestone survey 2
February 2022	Study skills conference	(see standard programme)
22 February 2022 - 11 March	Survey	Milestone survey 3

2021-22 cohort

Standard Programme

Date	Event	Details
8 - 30 March 2022	Survey	Milestone survey 1
April 2022	Launch	Inform parents and students about the Pathway to STEM programme and the commitment needed from students.
April 2022	UCAS application day	UCAS application process talk Personal statement workshop Developing your brand workshop

Date	Event	Details
		Your university choice workshop
July 2022	Summer School Parents Evening	Student Session – Your summer school group Parent Session – The University Process
July 2022 (3 days)	Summer School Residential	No Limits challenge Benefits of HE Student life STEM Subject Tasters Careers and Placement Talks Student finance seminar University student support Social activities
1 September March - 16 September 2022	Survey	Milestone survey 2
October 2022	University Interviews	An overview of university interviews - the soft skills universities are looking for (30 minutes talk)
November 2022 – April 2023 (6 sessions)	Academic Tutoring	Academic Support (tutoring, revision sessions) for STEM subjects led by current undergraduate students [Optional]
February 2023 (2 days)	A-level revision boot camp	Academic Support (tutoring, revision sessions) led by current A-level teachers.
22 February - 17 March 2023	Survey	Milestone survey 3

Flexible programme

The programme for the 2021-22 flexible Pathway to STEM programme is the same as that for the standard programme with the exception that students on the flexible programme do not have the option to take part in either the summer school or academic tutoring.

Appendix 3 – Aston University Typology

Event Title	Activity Type	HEI Descriptor
Launch	HE Campus Visit	Campus Visit
Summer School	Summer School	Residential Summer School
Mentoring	Mentoring	Mentoring
UCAS Application Day	General HE Information	Talk/ workshop
Study Skills Conference	Skills and Attainment	Attainment Raising Activity
Graduation	HE Campus Visit	Campus Visit
Subject Taster Day	HE Subject Insight	Subject Taster

Appendix 4 – Milestone Survey Questions

Table 12: Milestone questions and possible responses posed to students in the standard and flexible groups of the Pathway to STEM programme. "Don't know" was generally available as a response for each question. The right-most columns indicate those questions which were asked as part of MS1 and MS2, or MS3.

Statement	Responses	MS1/ MS2	MS3
How much do you know about...?			
the benefits of university?	Almost nothing; A little; Something; Quite a bit; A great amount	Y	Y
the range of courses available at university?	Almost nothing; A little; Something; Quite a bit; A great amount	Y	Y
the range of STEM courses available at university?	Almost nothing; A little; Something; Quite a bit; A great amount	Y	Y
the different routes into university?	Almost nothing; A little; Something; Quite a bit; A great amount	Y	Y
how to fund university?	Almost nothing; A little; Something; Quite a bit; A great amount	Y	Y
the options available to me if I choose not to go to university?	Almost nothing; A little; Something; Quite a bit; A great amount	Y	Y
How confident are you that...?			
you can afford to go to university?	Not confident; Not that confident; Neutral; Quite confident; Extremely confident	Y	Y
you know how to apply to university?	Not confident; Not that confident; Neutral; Quite confident; Extremely confident	Y	N
How aware are you about...?			
which university courses interest me?	Not aware; Slightly aware; Somewhat aware; Moderately aware; Extremely aware	Y	Y
which university courses I can do with my current subject choices?	Not aware; Slightly aware; Somewhat aware; Moderately aware; Extremely aware	Y	Y

Statement	Responses	MS1/ MS2	MS3
where I could find out more about university?	Not aware; Slightly aware; Somewhat aware; Moderately aware; Extremely aware	Y	Y
How likely are you to...?			
apply to university?	Extremely unlikely; Unlikely; Neutral; Likely; Extremely likely	Y	N
apply to study a STEM subject at university?	Extremely unlikely; Unlikely; Neutral; Likely; Extremely likely	Y	N
University application			
have you applied to study a course at university?	No; Yes	N	Y
have you applied to study a STEM course at university?	No; Yes	N	Y
How confident are you that...?			
you could make a successful application to university?	Not confident; Not that confident; Neutral; Quite confident; Extremely confident	Y	N
you could make a successful application to study a STEM subject at university?	Not confident; Not that confident; Neutral; Quite confident; Extremely confident	Y	N
you could succeed at university?	Not confident; Not that confident; Neutral; Quite confident; Extremely confident	Y	Y
How much do you know about...?			
the extra-curricular opportunities available at university?	Almost nothing; A little; Something; Quite a bit; A great amount	Y	Y
the social and networking opportunities available at university?	Almost nothing; A little; Something; Quite a bit; A great amount	Y	Y
How much do you agree with the following statements?			
I would enjoy university	Strongly disagree; Disagree; Neutral; Agree; Strongly agree	Y	Y

Statement	Responses	MS1/ MS2	MS3
university is for people like me	Strongly disagree; Disagree; Neutral; Agree; Strongly agree	Y	Y
I have a clear understanding of what to expect from life whilst at university	Strongly disagree; Disagree; Neutral; Agree; Strongly agree	Y	Y
I have a clear understanding of what to expect of my social life whilst at university	Strongly disagree; Disagree; Neutral; Agree; Strongly agree	Y	Y
I have a clear understanding of what to expect whilst studying at university	Strongly disagree; Disagree; Neutral; Agree; Strongly agree	Y	Y
I have a clear understanding of the available resources to support my academic work at university	Strongly disagree; Disagree; Neutral; Agree; Strongly agree	Y	Y
People like me have the skills and experiences to actively participate in classes at university	Strongly disagree; Disagree; Neutral; Agree; Strongly agree	Y	Y
People like me can initiate contact with teaching staff at university	Strongly disagree; Disagree; Neutral; Agree; Strongly agree	Y	Y
I have received information, advice and guidance about			
university life	Never; 1-2 times; 3-6 times; 7 times or more	N	Y
the university application process (e.g., choosing a course, choosing a university, the UCAS system, etc.)	Never; 1-2 times; 3-6 times; 7 times or more	N	Y
how to write a personal statement for a university application	Never; 1-2 times; 3-6 times; 7 times or more	N	Y
student finance	Never; 1-2 times; 3-6 times; 7 times or more	N	Y
Outreach activities			
I have visited a university campus or online campus tour	Never; 1-2 times; 3-6 times; 7 times or more	N	Y

Statement	Responses	MS1/ MS2	MS3
I have taken part in tutoring run by a university to support my grades at school/college	Never; 1-2 times; 3-6 times; 7 times or more	N	Y
I have taken part in practice interviews to help with my application to university	Never; 1-2 times; 3-6 times; 7 times or more	N	Y
I have completed an assessed piece of work / project as part of a university-organised activity	Never; 1-2 times; 3-6 times; 7 times or more	N	Y
I have taken part in university subject taster sessions (e.g., a short lecture or talk from an academic staff member).	Never; 1-2 times; 3-6 times; 7 times or more	N	Y
I have received help from a university student mentor or role model (either face-to-face or online)	Never; 1-2 times; 3-6 times; 7 times or more	N	Y
I have participated in a university outreach programme - a structured programme of activities over multiple months	No; Yes	N	Y
I have participated in a university summer school - two or more days spent on campus (or online) and participating in activities related to university life	No; Yes	N	Y

Appendix 5 – Post-event survey questions
2020-21 Programme

Dimension	Element
Name	Launch
Pathway	STEM Standard
Evaluation Questions that indicate event success	• After today, I feel more confident that… I have the skills to succeed at university • Today has helped me to… Practise skills that could help me in school/college • Today has helped me to… Practise skills that could help me in my exams • Today has helped me to… Identify which skills I am good at • Today has helped me to… Identify which skills I could improve on • Today has helped me to… Think about how I could develop my skills

Dimension	Element
Name	Taster Days
Pathway	STEM Flexible
Evaluation Questions that indicate event success	• After today, I am clearer on… What career(s) I'd like to go into • After today, I am clearer on… Which university courses I could do with my subject choices

Dimension	Element
Name	UCAS and Personal Statement day
Pathway	STEM Standard (and Flexible after cancellation of the online personal statement checking)
Evaluation Questions that indicate event success	• After today, I know more about… UCAS and the application process • After today, I feel more confident that… I could make a successful application to university

Dimension	Element
Name	Summer school
Pathway	STEM Standard
Evaluation Questions that indicate event success	• The following session was useful Preparing to deliver a university video presentation • The following session was useful Student Finance • The following session was useful Careers and Placements • The following session was useful University Support

Dimension	Element
Name	Study Skills Conference
Pathway	STEM Standard and STEM Flexible
Evaluation Questions that indicate event success	• The Study Skills Conference has helped me to… Practise skills that could help me in school/college • The Study Skills Conference has helped me to …Practise skills that could help me in my exams • The Study Skills Conference has helped me to...Identify which Skills I am good at • The Study Skills Conference has helped me to …Identify which skills I could improve on

- **2021-22 programme**

Dimension	Element
Name	UCAS Application day
Pathway	STEM Standard and Flexible
Evaluation Questions that indicate event success	• Today I have…developed my knowledge of the UCAS Application Process • Today I have…developed my knowledge of how to write a good Personal Statement • Today I have… developed my knowledge of how to Choose a Course • Today I have… developed my knowledge of how to Choose a University • After today, I feel more confident that… I could make a successful application to university

Dimension	Element
Name	Summer school
Pathway	STEM Standard
Evaluation Questions that indicate event success	• After the Summer School, I know more about…How students are taught at university • After the Summer School, I know more about… How to fund university • After the Summer School, I know more about…Careers and Placements at university • After the Summer School, I know more about…the support available to students at university

Dimension	Element
Name	Interview Preparation Day
Pathway	STEM Standard and Flexible

Evaluation Questions that indicate event success	• How much do you know about…university Interviews? • Today I have… Developed my knowledge of university interviews