Ondata Research

Physics Mentoring Project Annual Evaluation Report

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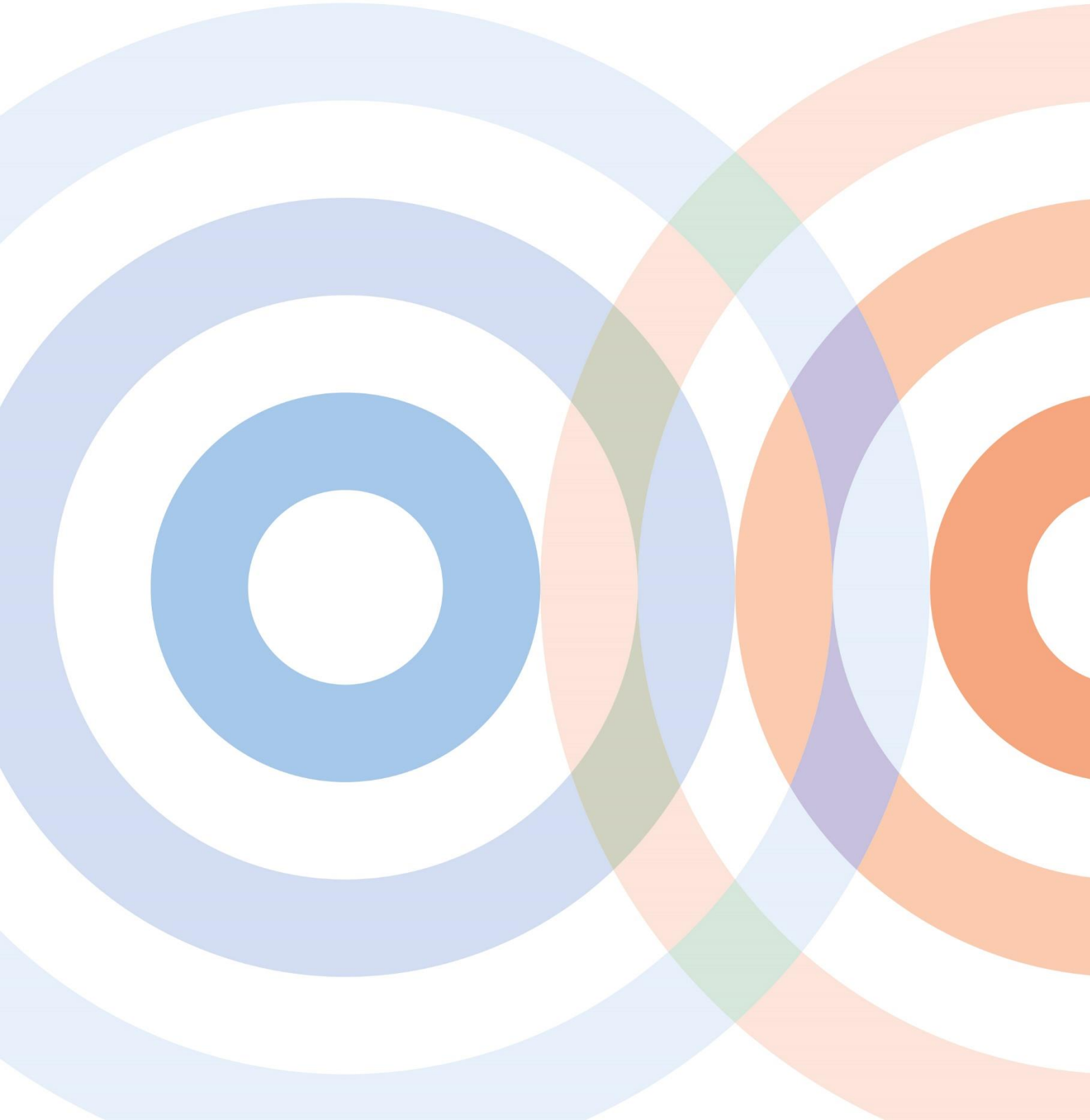

Executive summary

Introduction

The Physics Mentoring Project (PMP) aims to improve the uptake of Physics A-level amongst participants and to have a positive impact on their attitudes towards physics. The project also provides comprehensive training and support for mentors, aiming to further their own personal development and improve their employability skills. Schools take part in around six sessions led by mentors recruited from universities across Wales. The mentors were drawn from Aberystwyth, Bangor, Cardiff, Swansea and University of South Wales. They were undergraduate or postgraduate students who had Physics A-level or equivalent and studied a range of physics-related or STEM subjects.

This annual evaluation report examines the evidence of impact of the fifth and sixth cycles of mentoring, taking place in the 2021-2022 school year. Around three hundred mentees from twenty five schools took part. Face to face mentoring was available to schools within 45 minutes of a university partner. Online mentoring allowed the project to reach schools in remote locations across the whole of Wales. Fifteen took part in online mentoring and ten for face to face. Regardless of the delivery mode, the underlying approach, the support available to schools and training for mentors were consistent.

The near-peer mentoring model used by the project is an effective one. It is targeted at those who are unsure about whether they will study physics and having a targeted approach has been found to be more effective than mentoring projects with less specific aims[1]. The project also provides high quality training to mentors and has an ongoing high level of involvement from the project team, both aspects which have been found to increase the effectiveness and impact of mentoring[2].

[1] Christensen, K.M., Hagler, M.A., Stams, G.J., Raposa, E.B., Burton, S. and Rhodes, J.E., 2020. Non-specific versus targeted approaches to youth mentoring: A follow-up meta-analysis. *Journal of Youth and Adolescence*, 49(5), pp.959-972.
[2] Burton, S., Raposa, E.B., Poon, C.Y., Stams, G.J.J. and Rhodes, J., 2021. Cross-age peer mentoring for youth: A meta-analysis. *American Journal of Community Psychology*.

Key findings

Impact on Mentees

The project has been successful in developing more positive attitudes towards Physics A-level amongst mentees. There has been a shift away from those who are unsure and an increase in those indicating they 'definitely will' choose Physics A-level. Those indicating they 'definitely will' choose Physics A-level rose from 5.6% to 11.3%:

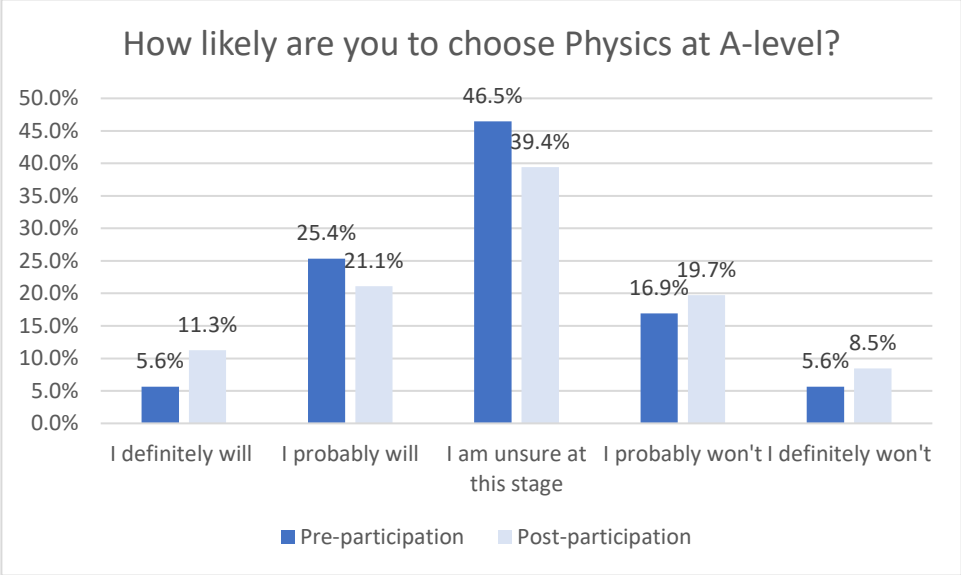

Figure A. Pre- and post-participation responses from mentees to the question 'How likely are you to choose Physics at A-level?'

	I definitely will	I probably will	Unsure at this stage	I probably won't	I definitely won't
Pre-participation	5.6% (n=4)	25.4% (n=18)	46.5% (n=33)	16.9% (n=12)	5.6% (n=4)
Post-participation	11.3% (n=8)	21.1% (n=15)	39.4% (n=28)	19.7% (n=14)	8.5% (n=6)
Difference	+5.6%	-4.2%	-7.0%	+2.8%	+2.8%

Table A. Mentees' responses to "How likely are you to take physics A level?" pre- and post-participation

Additional impacts included broadening awareness of STEM pathways and contributing to a growth in science capital, as well as building enthusiasm, with one teacher reporting *"one [pupil] in particular absolutely loved it and was very enthusiastic following the sessions"* (Teacher survey). Schools have reported instances where learners have grown in terms of self-confidence, another key deliverable for the PMP.

Mentees were encouraged to carry out a weekly reflection following a session in order to record their thoughts on the content, including anything they particularly enjoyed or would like to change. This information was used by mentors to help shape the following sessions and was reviewed by the evaluation team in order to gain insight into the sessions from the

perspective of the mentees. In particular, this has helped to provide evidence for one of the key project deliverables, namely increased confidence/sense of belonging/engagement related to STEM in mentored students. Examples of this impact include:

- Opportunities to make connections between the content and own lives: *"I enjoyed watching the videos and thinking about how much physics is used in our daily lives".*
- Learners could identify several transferable skills needed in physics-related jobs *("I have learned that collaboration and communication are very important", "How to think like a physicist")* as well as the importance of teamwork (*"Teamwork for everything"*).
- The sessions successfully challenged some perceptions around what being a physicist means, *"You don't have to be the brightest in physics now to include it in your future plans",* and learner comments demonstrated the sessions had broadened their perception of physics, *"That I use physics everyday loads*", and their awareness of careers that involve physics *"Different jobs to do with physics".*

Impact on teachers and schools

Schools reported becoming involved with the project as it was a way in which to provide opportunities to broaden students' awareness of opportunities beyond compulsory education and as a way of bringing in external experts. Word of mouth played an important role in encouraging schools to participate as several reported hearing about the project from colleagues in other schools.

Many teachers commented that a key benefit of engaging with PMP was the introduction and development of relationships with local universities. One teacher also appreciated the validation of mentors promoting the same messages they taught in lessons: *"It was encouraging and heart-warming to see mentors, not that much older than the students, share the same messages that I am in class" (teacher survey)* commenting *"Students often take our word with a pinch of salt but I think hearing it from people who are "closer" to them, gives what we're saying a bit more weight"* (teacher survey).

Impact on mentors

Year-on-year, the PMP is continuing to positive impact on mentors and the evidence continues to show increased confidence of mentors, development of mentors' employability skills and that the experience of mentoring is an extremely positive one.

In addition to the current set of mentors, feedback was gathered from mentor alumni to look at longer term impact of participation. The mentor alumni were then asked to consider what

had the most impact on them and why. Science capital and awareness of equality, diversity and inclusion issues were the aspects most commonly reported as having a longer term impact, for example, one mentor alumnus commented: *"The biggest impact for me was an increased awareness of equality, diversity and inclusion issues. I was aware of an imbalance but this project really emphasised the issues and made me realised how much work there still is to do. This has had a continued effect on me and as such I went on to tutor multiple female GCSE pupils in physics throughout the pandemic in the hope of changing the stigma around this subject, and also attend CUWIP 2021, the 'Conference for Women in Physics', which also explored these issues and was truly inspiring."*

In some cases, the positive experience of the mentor alumni resulted in them wanting to continue taking part in youth volunteering, which is especially important with graduates going into industry. If they are able to carry this positive mentoring experience with them they are likely to continue to be a role model for other young people, thus continuing to encourage participation in science-related careers.

Conclusion

The project has been able to increase the numbers intending to take physics. The proportion of mentees indicating they would choose Physics A-level have increased following participation, compared with a drop in the level of interest from non-mentored learners. Unfortunately there is limited data available, therefore we are unable to make a quantitative assessment of impact on the intentions of mentees by gender. However, there were several observations from teachers and comments directly from mentees about the importance of female role models both as mentors and within the session content itself. In addition to the increase in positive intentions in relation to Physics A-level, there was also an increase in the proportion of mentees interested in science-related careers. There were many examples where mentees developed their self-confidence in relation to physics and there is clear evidence of an impact on perception of physics well beyond the sessions themselves.

Both current mentors and alumni reported increased confidence as a result of their participation in the project. There was also a clear development of employability skills, ranging across teamworking, organisation and communication. Importantly, there was also an increased awareness of equality, diversity and inclusion issues, with the impact of this continuing beyond the mentors' experiences with schools. There is evidence that the project has positively impacted on mentors' career interests in relation to both teaching and roles in outreach and science communication.

Contents

1. Introduction

The Physics Mentoring Project (PMP) aims to improve the uptake of Physics A-level amongst participants and to have a positive impact on their attitudes towards physics. The project also provides comprehensive training and support for mentors, aiming to further their own personal development and improve their employability skills.

The PMP team is based at Cardiff University but the project is a collaboration between Aberystwyth, Bangor, Cardiff, Swansea and University of South Wales. The project recruits schools and supports teachers in identifying learners to participate.

Schools take part in around six sessions led by mentors recruited from universities across Wales. The mentors were drawn from Aberystwyth, Bangor, Cardiff, Swansea and University of South Wales. They were undergraduate or postgraduate students who had Physics A-level or equivalent and studied a range of physics-related or STEM subjects.

The mentor training introduces aspects of mentoring theory and provides a comprehensive look at the project's underlying theoretical framework, which is based on the Science Capital Teaching Approach[3]. This approach ensures mentors are able to tailor the content to the interests of their mentees and encourages ongoing reflection on how the sessions are going. The training was conducted online and consisted of 22.5 hours of training across cycles five and six of mentoring.

This annual evaluation report examines the evidence of impact of the fifth and sixth cycles of mentoring, taking place in the 2021-2022 school year. Around three hundred mentees from twenty five schools:

- Thirteen schools took part in cycle five and fifteen in cycle six, with three of the cycle five schools continuing into cycle six.
- In terms of the school locations, these came from across Wales in both urban and rural settings. Seven schools were from the CSC consortia, six from EAS, seven from ERW and five from GwE.

[3] Godec, S., King, H., & Archer, L (2017). The Science Capital Teaching Approach: engaging students with science, promoting social justice. London: University College London.

- Nine of the schools had above average proportions eligible for free school meals, with the average across all participating schools being 22.5%, slightly below the national average of 23.6% in the latest available data from 2021[4].
- Twenty one schools are English medium, with two Welsh-medium and two bilingual, with a significant proportion of classes available in either English or Welsh.

Face to face mentoring was available to schools within 45 minutes of a university partner. Online mentoring allowed the project to reach schools in remote locations across the whole of Wales. Fifteen took part in online mentoring and ten for face to face. Regardless of the delivery mode, the underlying approach, the support available to schools and training for mentors were consistent.

The near-peer mentoring model used by the project is an effective one. It is targeted at those who are unsure about whether they will study physics and having a targeted approach has been found to be more effective than mentoring projects with less specific aims[5]. The project also provides high quality training to mentors and has an ongoing high level of involvement from the project team, both aspects which have been found to increase the effectiveness and impact of mentoring[6].

The educational environment in Wales in both schools and universities continued to be challenging as all settings began emerging from COVID restrictions. The PMP team continued to be responsive and flexible in order to meet the needs of schools, mentors and other stakeholders. This evaluation report discusses the impact on mentors, mentees and teachers. The evidence collected and the evaluation approach in general is discussed in the following section.

[4] Welsh Government (2022) *Schools census results* Available: https://gov.wales/schools-census-results-february-2022-provisional
[5] Christensen, K.M., Hagler, M.A., Stams, G.J., Raposa, E.B., Burton, S. and Rhodes, J.E., 2020. Non-specific versus targeted approaches to youth mentoring: A follow-up meta-analysis. *Journal of Youth and Adolescence*, 49(5), pp.959-972.
[6] Burton, S., Raposa, E.B., Poon, C.Y., Stams, G.J.J. and Rhodes, J., 2021. Cross-age peer mentoring for youth: A meta-analysis. *American Journal of Community Psychology*.

2. Methodology

Ondata Research have been evaluating the PMP since its inception and has consistently used a Mixed Methods approach. This has been favoured due to its flexibility in allowing a range of sources of evidence to be considered. Given the complex educational environment this has been especially important. Table 1 below summarises the sources of data used for cycles five and six.

	Method	Purpose	Description
Mentors	Post-session reflections	To provide mentors a structured space in order to reflect on how the session went and what they could do to improve for next time.	Set of questions completed after delivering the session.
	Semi-structured interviews	To gain insight into the experience of the mentors, with a specific focus on the usage of films produced.	Three mentors were interviewed following the completion of their set of sessions with schools.
	Alumni survey	To provide information on the aspects of the project which have had a longer term impact on mentors.	Mentors who worked with the project in cycles one to four completed a survey on their experiences of the project.
Mentees	Pre- and post-participation surveys	To track any changes in attitudes and intentions in relation to Physics A-level and STEM careers.	Pre-participation survey used to identify learners who are unsure about taking physics. Similar set of questions used at the end of the project to identify any change. Natural control group of non-participating learners used within schools to allow a comparison.
	Post-session reflections/feedback	To gain an understanding of their impressions of the sessions in terms of what they liked, what could be improved and what the key messages were that they took away.	Short set of questions on the session were completed at the end of the session or immediately afterwards.
	Focus group	To gain further insight into their experiences of the PMP.	Six learners from two different schools attending one of the Awards and Recognition ceremonies participated in a focus group.
	Vox pops	To capture some short descriptions of impact of the sessions on mentees.	A short set of questions was prepared for mentees and responses to these were recorded by mentors at two of the Awards and Recognition ceremonies,

			with 12 being recorded in total.
Teachers	Post-participation survey	To provide feedback on their experiences of the project in terms of the logistics and also the impact of participation on schools.	Survey was sent to teachers following the completion of the project.
	Focus group	To gain insight into the impact of participation in the PMP with themselves and their learners.	A group of teachers attending one of the Awards and Recognition ceremonies took part in a focus group.

Table 1. Summary of evaluation methods and evidence used

Data collection and analysis was carried out by both report authors over the course of several months. All work being undertaken conformed to BERA's code of ethics[7] and informed consent was gained from all participants with data being stored according to Ondata's GDPR and IT policies. Reflexive thematic analysis[8] was used to analyse qualitative data and the process for analysing the quantitative survey data is outlined below.

- General summaries (descriptive statistics) of all responses to the pre-participation survey were prepared. These have been reported in order to provide a broader context for the attitudes in relation to Physics A-level and STEM careers. These have been grouped in terms of gender, regional consortia and proportion of free school meals.
- A further step was taken in order to use inferential statistics (paired t-tests) on responses to the pre- and post-participation surveys. This meant matching pre- and post-survey responses. These were available for mentees and a group of non-participating learners, providing a natural control group. There was an increase in the numbers responding to the post-participation survey but this is still considered to be low (just over 20% of mentees responded compared with around one third in the previous year).

[7] British Educational Research Association (BERA) (2018) Ethical Guidelines for Educational Research, fourth edition, London. Retrieved from https://www.bera.ac.uk/researchers-resources/publications/ethical-guidelines-for-educational-research-2018

[8] Braun, V., Clarke, V. (2019) Reflecting on reflexive thematic analysis, Qualitative Research in Sport, Exercise and Health. 11:4, 589-597

The following tables summarise the respondents of the pre- and post-participation surveys.

	Pre-participation		Post-participation			
	All		Mentees		Non-participating learners	
	n	%	n	%	n	%
Female	955	48.4%	31	44.9%	95	49.7%
Male	945	47.9%	37	53.6%	93	48.7%
Prefer not to say	57	2.9%	1	1.4%	3	1.6%
Genderfluid	3	0.2%	0	0	0	0
Non-Binary	13	0.7%	0	0	0	0
Total	1973		69		191	

Table 2. Responses to the question ' What is your gender?' in pre- and post-participation surveys

The gender balance between male and female across the different groupings is consistent, with only a slight difference appearing in the mentee responses post-participation. The responses available to this question were a mixture of options provided and an open-ended description which many respondents used.

	Pre-participation		Post-participation			
	All		Mentees		Non-participating learners	
	n	%	n	%	n	%
Year 8	1	0.1%	0	0	0	0
Year 9	497	25.2%	25	35.2%	148	77.5%
Year 10	790	40.1%	31	43.7%	28	14.7%
Year 11	683	34.7%	15	21.1%	15	7.9%
Total	1971		71		191	

Table 3. Responses to the question ' Which year group are you in?' in pre- and post-participation surveys

Since cycle four, the year group being targeted has shifted from Year 11 towards Year 9 and this is reflected in the mentees selected for participation this year.

	Pre-participation		Post-participation			
	All		Mentees		Non-participating learners	
	n	%	n	%	n	%
Triple Award Science/Separate Science	852	43.2%	50	71.4%	62	32.5%
Double Award Science	785	39.8%	15	21.4%	97	50.8%
Single Applied Science	127	6.4%	3	4.3%	12	6.3%
Double Applied Science	99	5.0%	1	1.4%	11	5.8%
Unsure - not made options choices yet	63	3.2%	1	1.4%	6	3.1%
BTEC Science	25	1.3%	0	0	1	0.5%
None	17	0.9%	0	0	2	1.0%
Other - Engineering	1	0.1%	0	0	0	0
Total	1970		70		191	

Table 4. Responses to the question ' Which science course are you taking?' in pre- and post-participation surveys

There are clear differences between the science qualifications being taken by the mentee and the non-participating learners. This is unsurprising given the targeted nature of the mentoring programme, therefore we would expect to see a high proportion of mentees taking Triple Award Science. It is interesting to note the low proportion of other qualifications mentioned in the pre-participation survey with only a very small proportion taking BTEC Science. All of these proportions for mentees continue a pattern observed in all previous cycles of mentoring.

The following discussion section now goes on to examine the evidence of impact on the different participants.

3. Findings

3.1 Mentees

The key deliverables for the project in 2021-2022 in relation to the mentees was to:

1. Increase the number of year 9-11 students intending to study physics-related subjects post-16.
2. Increase the number of year 9-11 girls intending to study physics-related subjects post-16.
3. Increased numbers of year 9-11 students intending to pursue STEM careers.
4. Increased confidence/sense of belonging/engagement related to STEM in mentored students.

The evidence examined in this section includes the pre- and post-participation surveys, post-session reflections, teacher survey responses and mentee focus group.

3.1.1 The post-COVID context

The current cohort of PMP mentees appear to have been particularly affected by the lockdowns of 2020-2021 and the resulting high levels of disruption to their education. Before reporting on the impact of the project on this year's mentees, we have summarised feedback from the teacher survey in order to provide context for the findings. This was completed by teachers in summer 2022 once the cycles of mentoring were complete.

Teachers commented that learners' subject knowledge of physics had perceptibly reduced. *"Nearly all learners are very fragile in their understanding and [make] slow progress due to disruption"* (teacher survey) and that there was a *"huge content and skills deficit in Year 12 students"* (teacher survey), with many struggling with the step change in workload: *"Pupils who have chosen the subject are having more difficulty responding to the workload"* (teacher survey).

The lack of time in school was felt to also have contributed to increases in negative perceptions of physics in general: *"Physics is viewed negatively and routinely considered 'hard' which prevents students from trying. Not being able to do any practical work enhanced this"* (teacher survey).

Learners were perceived as less resilient: *"it has impacted on how willing students are to take risks or to work at something. They can be quick to give up or feel that a task is beyond them"* (teacher survey) and alongside changes in examination methods, this aspect is likely to have

a long term effect on learners, with some feeling *"disconnected"* and struggling to *"see the point of doing set tasks or even exams"* (teacher survey).

However many teachers remain optimistic that this will be a short term issue with regards to uptake: *"we have good potential numbers for September"* (teacher survey) and *"[we had a] one year dip that has recovered"* (teacher survey). Teachers see PMP as a strong support in encouraging students back to the subject: *"I'm looking forward to working with yourselves and other groups to promote science and physics even further"* (teacher survey).

3.1.2 Intentions to study physics

The first set of figures examines the attitudes and intentions towards physics and science by gender. This data is drawn from all responses to the pre-participation survey, which was used to help identify who should participate in the mentoring project. This had almost 2,000 responses from the twenty five schools taking part, providing an opportunity to get a broader sense of attitudes and aspirations of learners. The first figure examines the Physics A-level intentions by gender. This shows clear differences between male and female learners, with females being over-represented in the 'probably won't' and 'definitely won't' categories, whereas as males are over-represented in the 'probably will' and 'definitely will' categories.

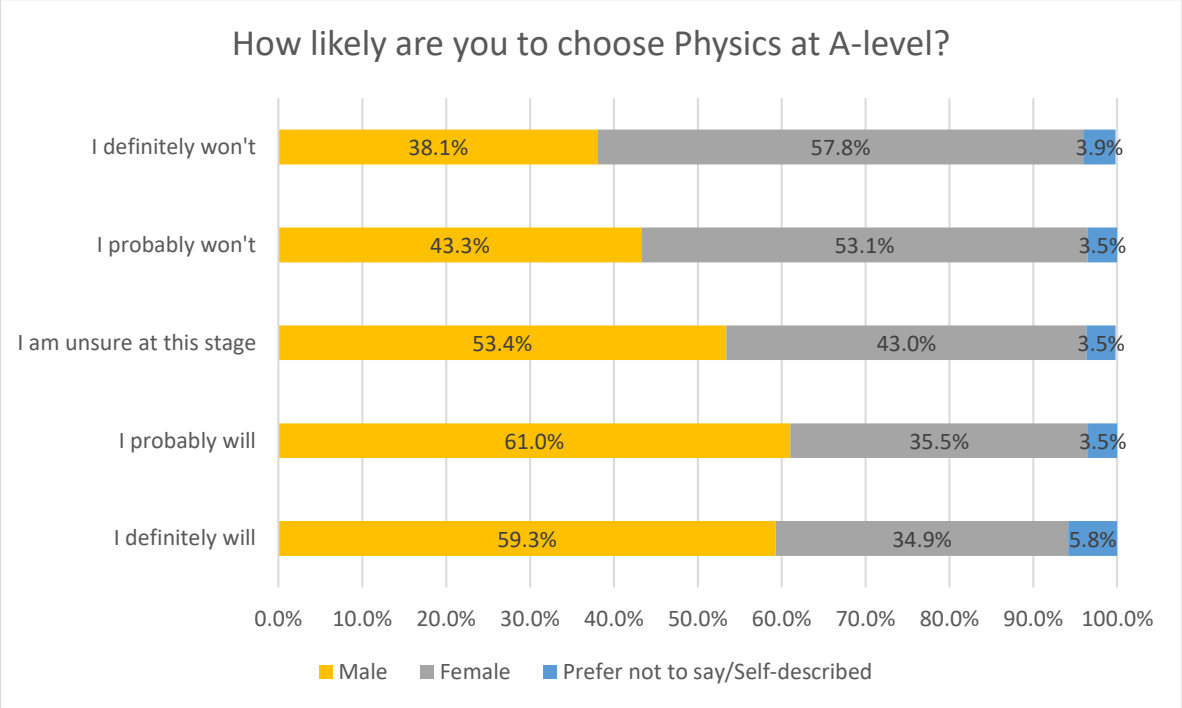

Figure 1. Pre-participation survey responses (n=1971) to the question 'How likely are you to choose Physics at A-level?'

We can examine the pre-participation intentions towards A-level for all cycles up until now to see any changes or trends emerging. Figure 2 and Table 5 summarises the results.

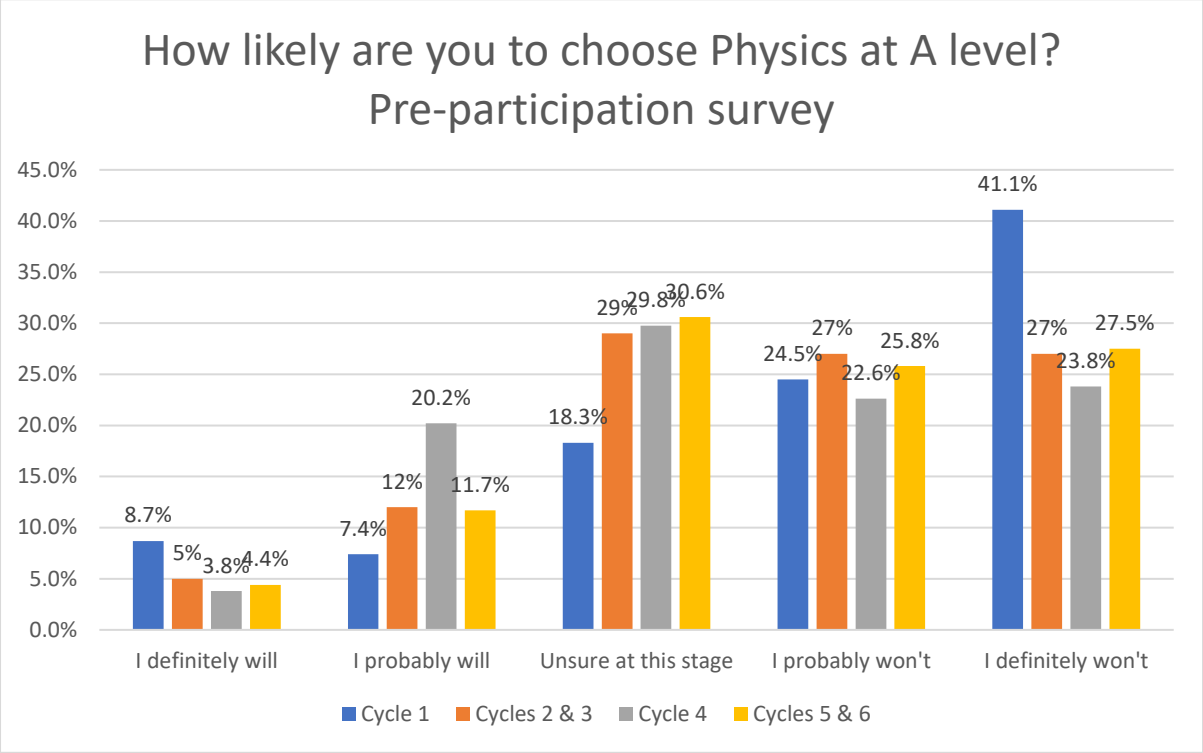

Figure 2. Pre-participation survey responses to the question 'How likely are you to choose Physics A-level?'

	I definitely will	I probably will	Unsure at this stage	I probably won't	I definitely won't
Cycle 1	8.7%	7.4%	18.3%	24.5%	41.1%
Cycles 2 & 3	5%	12%	29%	27%	27%
Cycle 4	3.8%	20.2%	29.8%	22.6%	23.8%
Cycles 5 & 6	4.4%	11.7%	30.6%	25.8%	27.5%

Table 5. Pre-participation survey responses to the question 'How likely are you to choose Physics A-level?'

Even though cycle 4 occurred during the COVID-19 pandemic there continued to be a similar proportion of those indicating they would ‘definitely’ or ‘probably’ go on to choose Physics A-level. Indeed, in cycles 5 and 6 there has been a drop in reported positive intentions and an increased levels of those unsure, and those who ‘probably’ or ‘definitely’ won’t choose Physics A-level.

3.1.3 Intentions towards a science-related career

In contrast to the results in Figure 1 on intentions in relation to Physics A-level, there are more female learners than males indicating they are interested in a career involving science, 34.5% of female respondents said 'definitely/probably will' compared with 31.9% of male respondents. However, females are still over-represented in the 'definitely won't' category.

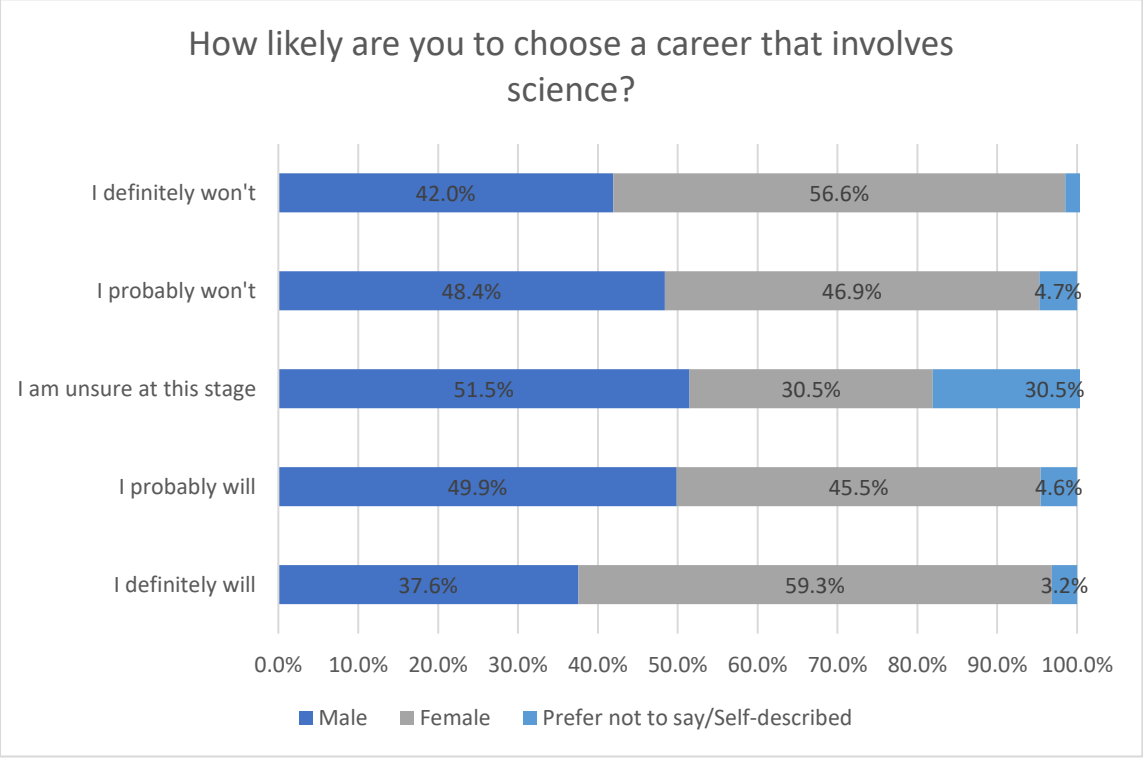

Figure 3. Pre-participation survey responses (n=1971) to the question 'How likely are you to choose a career that involves science?'

3.1.4 Impact of participation on mentees: Physics A-level

Having seen the general attitudes towards physics and science careers, we now examine the impact of participation. In order to do this, the pre- and post-participation survey responses matched to mentees (n=71) and non-mentored learners (n=92). The following figures and tables discuss the resulting findings.

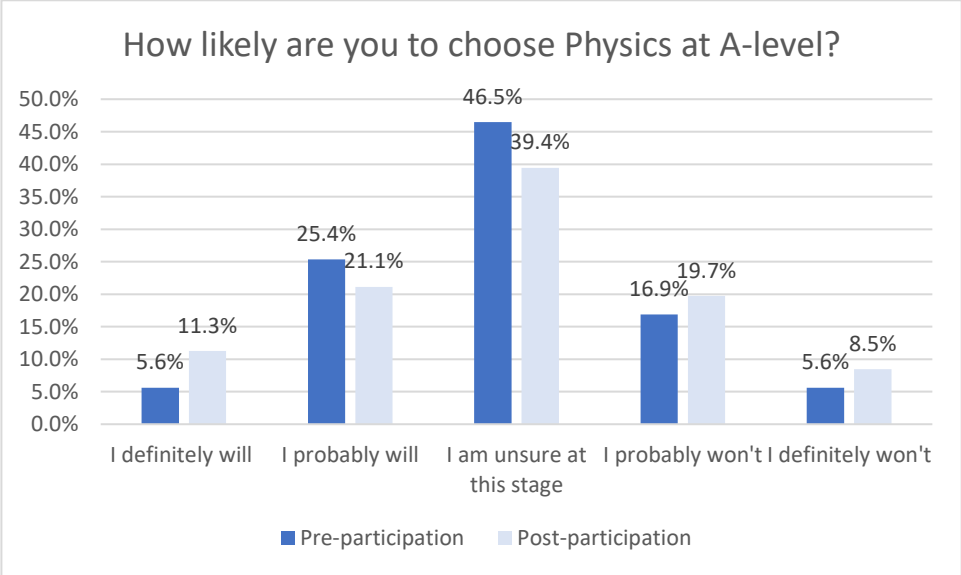

Figure 4. Pre- and post-participation responses from mentees to the question 'How likely are you to choose Physics at A-level?'

	I definitely will	I probably will	Unsure at this stage	I probably won't	I definitely won't
Pre-participation	5.6% (n=4)	25.4% (n=18)	46.5% (n=33)	16.9% (n=12)	5.6% (n=4)
Post-participation	11.3% (n=8)	21.1% (n=15)	39.4% (n=28)	19.7% (n=14)	8.5% (n=6)
Difference	+5.6%	-4.2%	-7.0%	+2.8%	+2.8%

Table 6. Mentees' responses to "How likely are you to take physics A level?" pre- and post-participation

As can be seen in Figure 4 and Table 6, there has been a shift away from those who are unsure and an increase in those indicating they ‘definitely will’ choose Physics A-level. Those indicating they ‘definitely will’ choose Physics A-level rose from 5.6% to 11.3%.

The intentions in relation to Physics A-level uptake are summarised below for all cycles. As we can see, there have been fairly consistent results in recent years in terms of the numbers indicated they 'definitely will' choose Physics A-level.

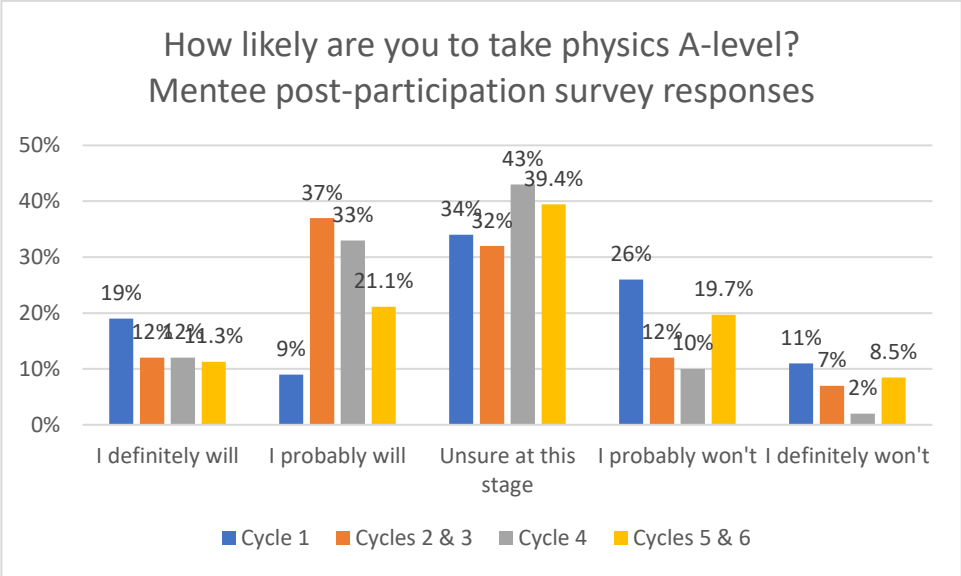

Figure 5. How likely are you to take physics A-level? Mentee post-participation survey responses, all cycles

	I definitely will	I probably will	Unsure at this stage	I probably won't	I definitely won't
Cycle 1	19%	9%	34%	26%	11%
Cycles 2 & 3	12%	37%	32%	12%	7%
Cycle 4	12%	33%	43%	10%	2%
Cycles 5 & 6	11.3%	21.1%	39.4%	19.7%	8.5%

Table 7. Mentees: how likely are you to take physics A-level? Post-survey responses for all cycles

There are slightly different patterns in terms of spread across the other categories. This is unsurprising given that cycle 4 mainly occurred during a period of lockdown. Indeed, having a consistent proportion indicating 'definitely will' is extremely positive, especially given the challenges in terms of subject knowledge of learners and their attitudes towards physics reported by teachers. The movement between categories pre- and post-participation is compared in the following figure in order to show where mentees are moving from and to in terms of the categories.

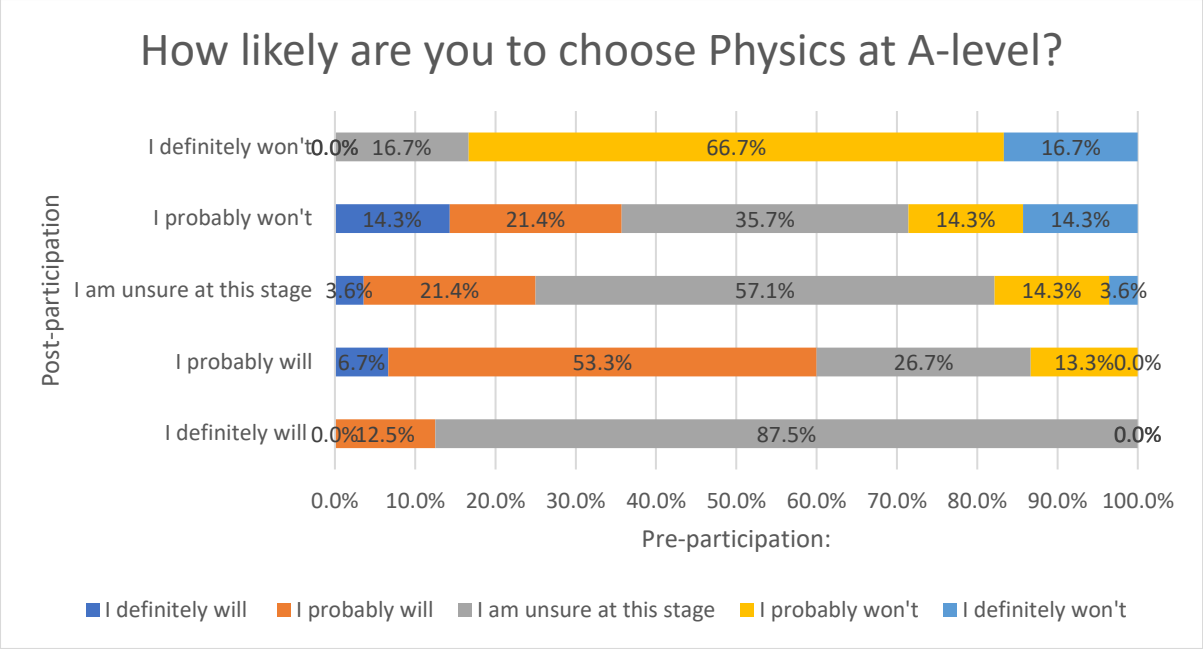

Figure 6.Movement between pre- and post-participation responses from mentees to the question 'How likely are you to choose Physics at A-level?'

This figure outlines the movement between categories, pre- and post-participation. This was constructed using matched data (n=71). The vertical axis shows the post-participation responses, whilst the colours within the key indicate which category the pupil indicated in their pre-participation survey response.

- For those who moved to ‘definitely will’, these moved mostly from ‘unsure’.
- Over 50% of those who started in the ‘probably will’ category remained there, with around one quarter coming from unsure and around 13% moving from ‘probably won’t’. However there was some slippage with 6.7% moving down from ‘definitely to ‘probably’.
- In the ‘unsure’ category, around 18% moved from ‘probably won’t’ and ‘definitely won’t’. However, this category saw the largest proportion remain, over 55% still reported they were ‘unsure’. Around 25% moved from ‘definitely will’ and ‘probably will’ to being ‘unsure’.
- For those who were in ‘probably won’t’ in the post-participation surveys, they shifted from across all other categories with movement up from ‘definitely won’t but also down from ‘definitely will’.
- Lastly, those finishing in the ‘definitely won’t’ category moved from ‘unsure’, ‘probably won’t’ or stayed in ‘definitely won’t’. Mentoring is most successful when targeted at those who have the potential to progress onto A-level but also where they are open to considering it as an option. Overall, those who started as ‘definitely won’t’ never moved higher than being ‘unsure.

In order to provide some context for the increased positive intentions towards Physics A-level, we can compare these findings to those from the non-mentored learners. These respondents are in the same school environment as those who have participated in the project. In the first instance there has been no change amongst those saying ‘I definitely will’ choose Physics A-level:

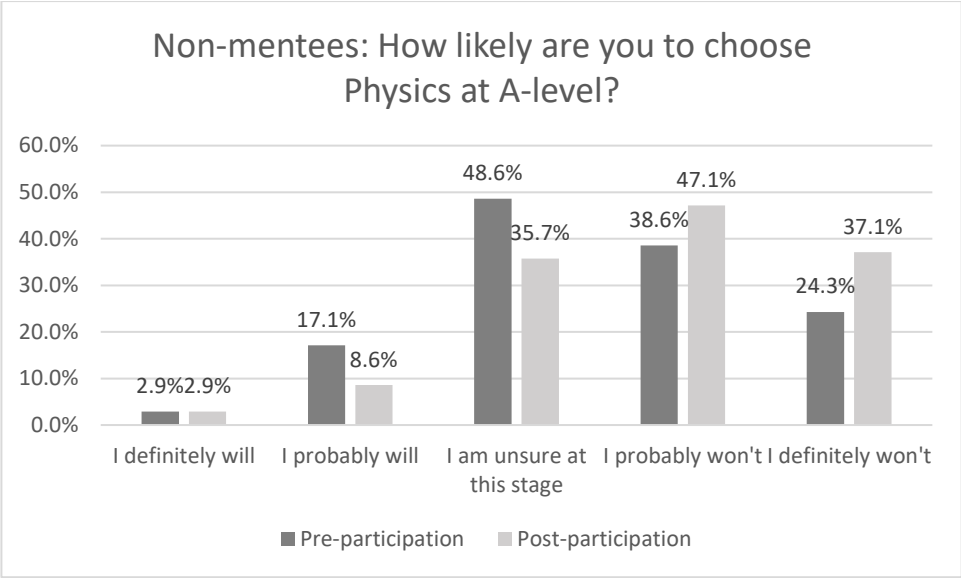

Figure 7. Pre- and post-participation responses from non-mentees to the question 'How likely are you to choose Physics at A-level?'

	I definitely will	I probably will	Unsure at this stage	I probably won't	I definitely won't
Pre-activity: non-participating pupils	2.9% (n=2)	17.1% (n=12)	48.6% (n=34)	38.6% (n=27)	24.3% (n=17)
Post-activity: non-participating pupils	2.9% (n=1)	8.6% (n=2)	35.7% (n=8)	47.1% (n=12)	37.1% (n=19)
Difference	0%	-8.6%	-12.9%	+8.6%	+12.9%

Table 8. Non-mentees' responses to "How likely are you to take physics A level?" pre- and post-participation

Indeed as is shown in Figure 7, there has been a reduction in the proportions stating they would ‘definitely/probably will’ take Physics A-level, from 20% pre-participation to 11.5%.

The following figure provides a way of comparing all responses for mentees and non-mentees.

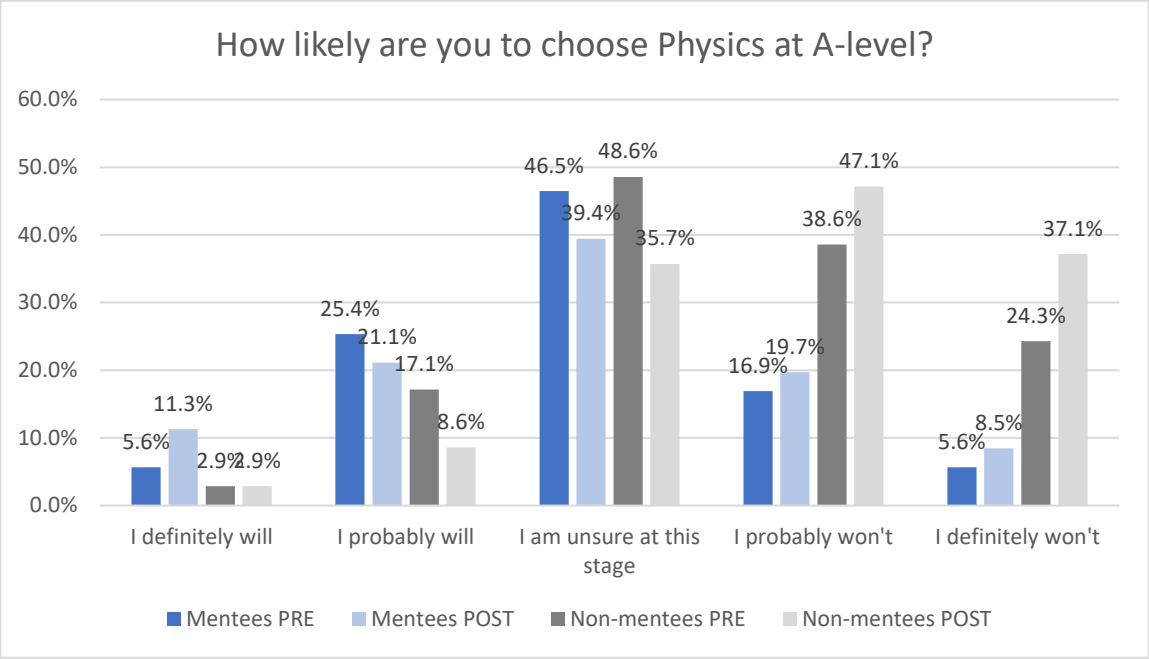

Figure 8. Comparison of pre- and post- survey responses by mentees and non-participating pupils

For mentees, there is movement from unsure towards the left hand side of Figure 8 showing more positive attitudes, whilst for non-mentees there are greater proportions moving to the right and more negative attitudes. This is consistent with findings from the previous years. Therefore based on these results, the PMP has been successful in achieving one of its key deliverables to increase the number of learners in Years 9 to 11 who are intending to take Physics A-level.

In addition to the mentoring sessions, some schools were able to attend 'Award and Recognition' days at their local university. At these events some mentees recorded 'vox pops' in response to questions about their experiences. In response to the event itself, everyone interviewed enjoyed the day:

- *"I think it's been very enjoyable. It's been an exciting experience".*
- *"I found the awards and recognition day really enjoyable so far, I think that it was a very pleasant experience."*

Highlights of the event included:

- the awards ceremony: *"I'd say that my most favourite part of the day right now would be the award ceremony at the start"*
- getting a sense of what university life was like: *"I enjoyed exploring the campus to give us an idea of what it was like at university."*
- having an opportunity to meet new people: "*it was just enjoyable seeing new people*."

With regards to broader feedback about their experiences, learners reported enjoying the mentoring project: *"At first, I wasn't quite sure what it was. But I think as soon as we actually started… I feel like it was really enjoyable".*

The majority of students interviewed said they were planning to go on to do A-levels, with some indicating they were considering science subjects:

- *"Physics might be an A-level I consider"*
- *"It'd be nice to explore physics also at A-levels or in my career".*

Only one student mentioned considering an apprenticeship as an option:
"I'd also like to either do A-levels or some kind of apprenticeship, or a degree apprenticeship. I'm kind of stuck in between and then university also".

The reasons behind the motivation to take A-levels included parental influence, the route required for their chosen career and the opportunity for a secure and well-paying job:

- *"I want to do A-levels because my parents say that is something good, so I'm just going to trust them".*
- *"I always knew I was going to plan to do my A-levels. I think my parents had a big thing with this".*
- *"I think I'm going to do A-levels because I would like to go into nursing or chiropracting"*
- *"The main reasons why I want to stay in school so that I can get like a good career with a good paying job".*
- *"I feel like it's good to do an A level while I can just in case and then I have that there to fall back on."*

Specifically with science A-levels, learners felt they provided a way to keep options open, *"with sciences you can access a lot of jobs with and it fits into a lot of jobs."* Those who had a clear idea of the career they wanted to access commented how early experiences were formative in their decision making, *"when I was younger I was in hospital and I think I just got like an idea from that part what I wanted to be in future".*

3.1.5 Impact of participation on mentees: Science careers

We now repeat the examination of intentions, this time in relation to a science career. We examine matched responses for mentees and non-mentees before and after taking part.

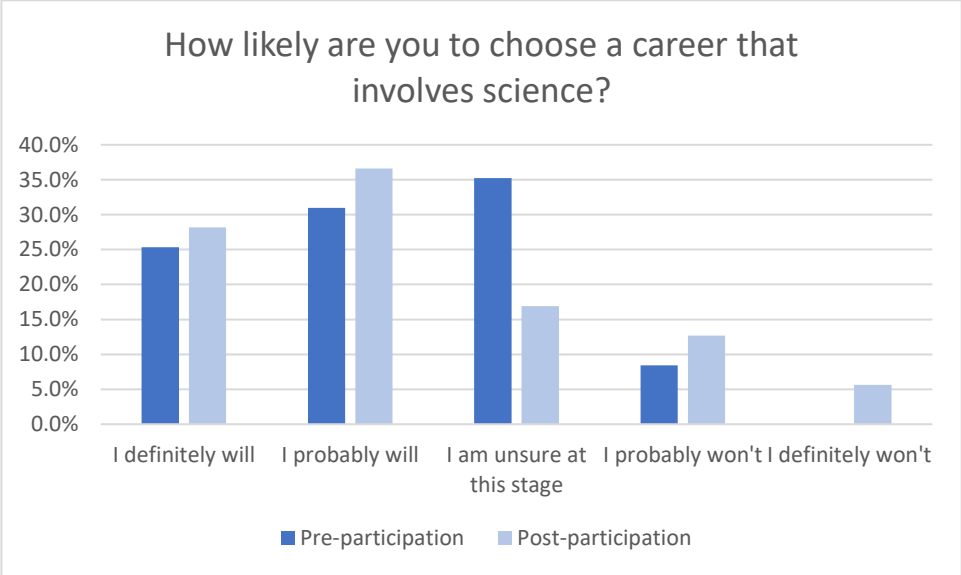

Figure 9. Pre- and post-participation responses from mentees to the question 'How likely are you to choose a career that involves science'

	I definitely will	I probably will	Unsure at this stage	I probably won't	I definitely won't
Pre-participation	25.4% (n=18)	31.0% (n=22)	35.2% (n=25)	8.5% (n=6)	0% (n=0)
Post-participation	28.2% (n=20)	36.6% (n=26)	16.9% (n=12)	12.7% (n=9)	5.6% (n=4)
Difference	+2.8%	+5.6%	-18.3%	+4.2%	+5.6%

Table 9. Mentees' responses to "How likely are you to choose a career that involves science?" pre- and post-participation

Compared with intentions in relation to Physics A-level, the proportions intending to go into a career involving science are much higher. However, there is still a shift away from being unsure into more positive attitudes. The following Figure 10 tracks the movement between categories for mentees, pre- and post- participation.

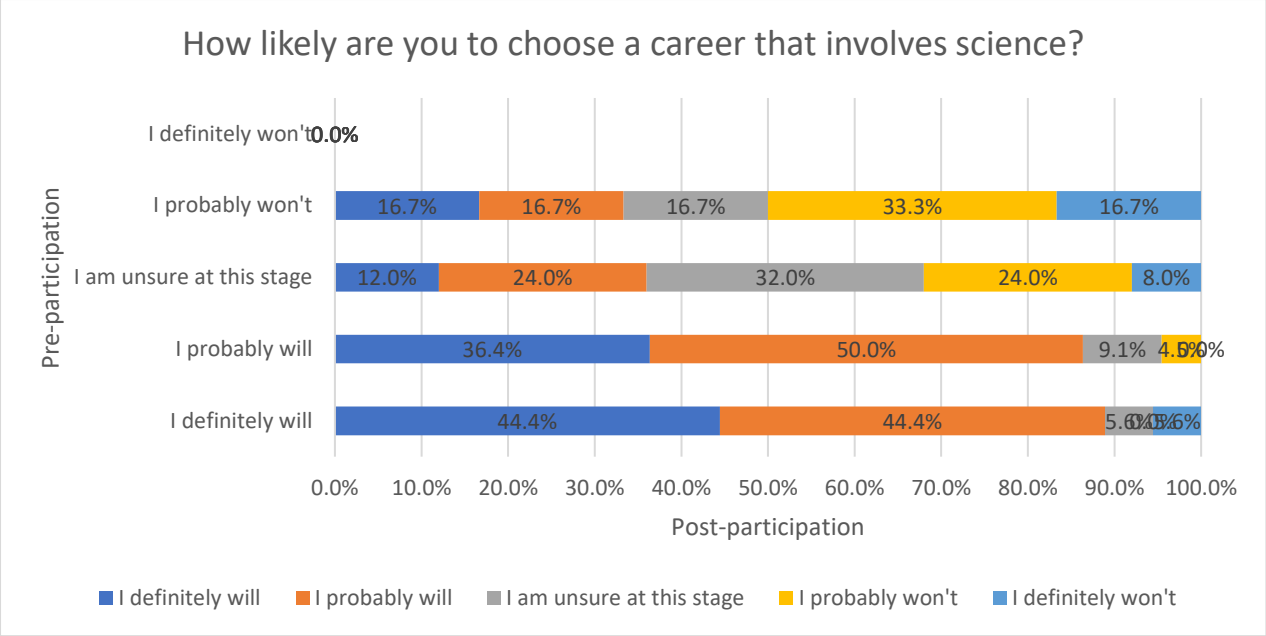

Figure 10. Movement between pre- and post-participation responses from mentees to the question 'How likely are you to choose a career that involves science?'

Figure 10, shows significant positive movement up the categories, with some slippage between ‘definitely will’ and ‘probably will’. However, there is very little movement down the categories, with the smallest proportions shifting into ‘definitely won’t’.

Once again, in order to provide a comparison, we examine the same data for non-mentored learners. In the following Figure and Table we can see there are much smaller proportions of non-mentored learners indicating an interest in a science career.

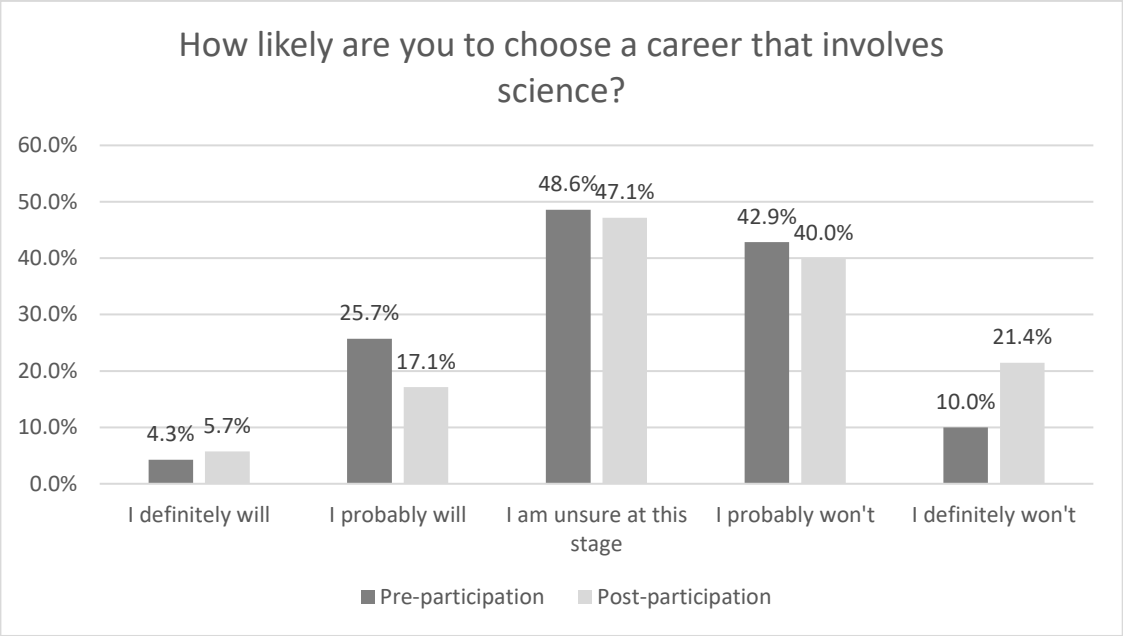

Figure 11. Pre- and post-participation responses from non-mentees to the question 'How likely are you to choose a career that involves science'

	I definitely will	I probably will	Unsure at this stage	I probably won't	I definitely won't
Pre-participation	4.3% (n=3)	25.7% (n=18)	48.6% (n=34)	42.9% (n=30)	10% (n=7)
Post-participation	5.7% (n=4)	17.1% (n=12)	47.1% (n=33)	40.0% (n=28)	21.4% (n=15)
Difference	+1.4%	-8.6%	-1.4%	-2.9%	+11.4%

Table 10. Pre- and post-participation responses from non-mentees to the question 'How likely are you to choose a career that involves science'

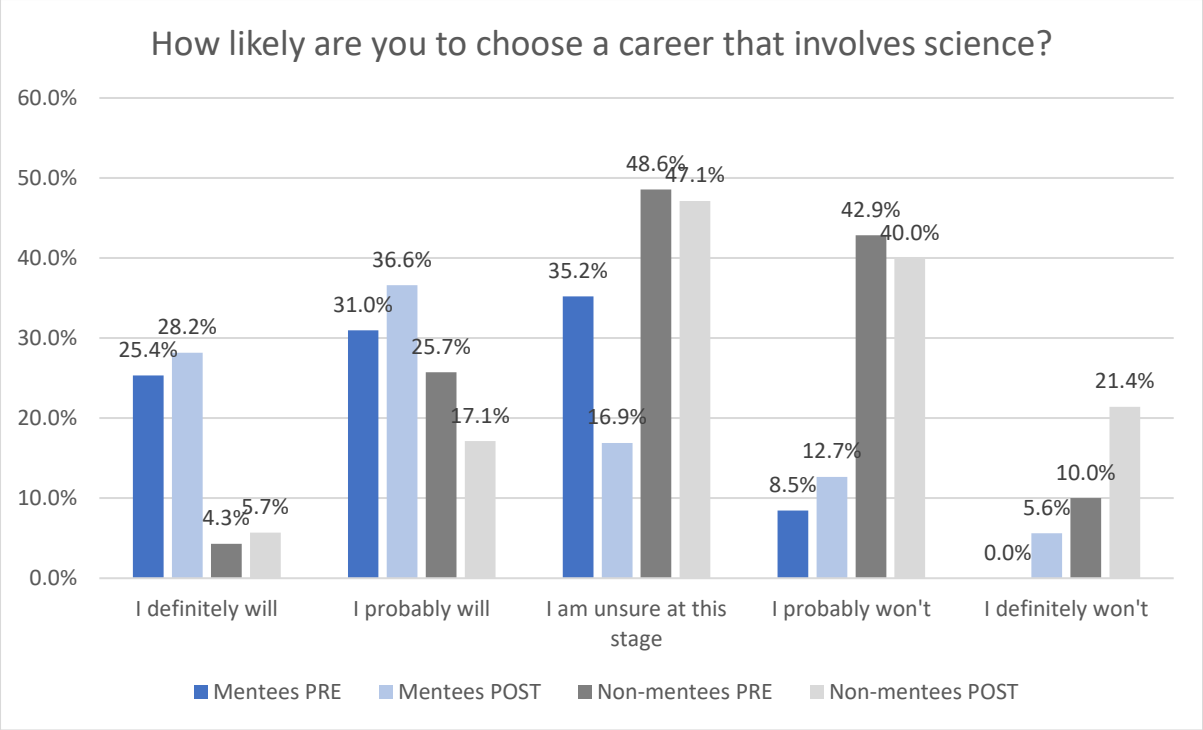

Figure 12. Comparison of pre- and post- survey responses by mentees and non-participating pupils

Figure 12 makes clear the difference in intentions and attitudes between mentees and non-mentored learners. In particular, we can see there is not much change in attitude of those non-mentees who are unsure, whilst with the mentored learners there is a shift towards more positive attitudes.

As before, Figure 12 gives a comparison across all groups and indicates that participation in the PMP has positively impacted on mentees' intentions to go into a career involving science.

3.1.6 Teachers' assessment of impact

As part of the teacher survey they were asked to assess the impact of participation for their own learners. Over one third (n=4) of teachers responding to the survey felt that participating in the project had encouraged learners to take, or at the very least seriously consider, Physics A-level.

Additional impacts included broadening learner awareness of STEM pathways and contributing to a growth in learner science capital, as well as building enthusiasm, with one teacher reporting *"one [pupil] in particular absolutely loved it and was very enthusiastic following the sessions"* (Teacher survey). Schools have reported instances where learners have grown in terms of self-confidence, another key deliverable for the PMP.

Whilst many students were highly engaged to consider further study through participating, the project was also able to help one student crystalise their interest in following another path: *"For a small minority it was a very useful experience that has made them realise that physics may not be for them. Either way the students have gained a lot from the experience"* (Teacher survey).

The small age gap between mentor and mentee was felt to be a very positive and contributory factor in encouraging learners to see pursuing physics as something 'they could do' with one teacher commenting, *"Students' delivering the outreach activities being so near our own students' ages makes our pupils think that could be me. So as role models they are very welcome in school and I am sure will have made a big difference to raising some of our pupils' 'horizons'"* (Teacher survey).

3.1.7 Increased engagement with science

Mentees were encouraged to carry out a weekly reflection following a session in order to record their thoughts on the content, including anything they particularly enjoyed or would like to change. This information was used by mentors to help shape the following sessions and was reviewed by the evaluation team in order to gain insight into the sessions from the perspective of the mentees. In particular, this has helped to provide evidence for one of the key project deliverables, namely increased confidence/sense of belonging/engagement related to STEM in mentored students.

- Overall, the sessions for cycle 6 seem to have been uniformly well received by students: *"Thank you for holding these sessions! I have really enjoyed them".*
- There were opportunities to make connections between the content and own lives: *"I enjoyed watching the videos and thinking about how much physics is used in our daily lives".*
- Learners enjoyed taking part in practical activities where included *("I enjoyed the quiz and darts game as it was interactive")* and where not included, indicated they would've liked more *("More hands-on activities", "It could be improved by more hands-on activities").*
- Learners were regularly able to identify key learning points from sessions *("Sea water is corrosive so it's hard to build stuff on it", "How cyclists use aerodynamics for better performance")* but sometimes seem to have misunderstood some of the more complicated physics concepts.
- Learners could identify several transferable skills needed in physics-related jobs *("I have learned that collaboration and communication are very important", "How to think like a physicist")* as well as the importance of teamwork (*"Teamwork for everything"*).
- The sessions successfully challenged some perceptions around what being a physicist means, *"You don't have to be the brightest in physics now to include it in your future plans",* and learner comments demonstrated the sessions had broadened their perception of physics, *"That I use physics everyday loads*", and their awareness of careers that involve physics *"Different jobs to do with physics".*
- The mentor reflections showed mentors actively reflecting on student feedback *("I will take into account the suggestions of types of activities and look into their curriculum")* to shape future sessions structure *("It would be useful if the mentor teaches us stuff about topics like the topics we learn in school")* and content *("Perhaps we could be taught about the structure of bridges before creating our own")*.

In the vox pops, learners mentioned that the project had broadened their awareness of what physics is, helped them develop new skills or raised awareness of how it linked to other subjects: "*I've got to see where physics fits into other subjects and how I could possibly use it in my life or in a career that I choose"*. Importantly, they felt the experience challenged stereotypes: *"It gave us a sense of idea that physics isn't just like, one set subject, for old men, it's for like every gender and every person"*.

In the focus group with learners, some of the discussions centred around how they felt about being chosen for the project. Some expressed their surprise at being chosen by their teacher because physics wasn't something they saw themselves doing, *however "it [the mentoring] changed my perspective on it [physics]"* (Mentee, focus group). This change in perspective arose because the mentor was able to help the mentee make a link between their career interest and physics. In this case the mentee was interested in stage acting and the mentor was able to discuss the topics of sound and light, including how sound would echo around the stage. This was a powerful connection for this mentee and flipped a negative perception around into a positive one, with an ongoing interest. A strong theme throughout the focus group discussions was that of a changed mindset or perception in relation to physics, in many cases an interest in physics was *"always there but never really thought about it*" and how it connected to other areas of their lives and interests and in general, *"After doing the sessions, it just made me have a whole different perspective on the work we do about physics"* and *"I think I'm more appreciative of the opportunity I've been given because I'm able to see physics in everyday life, whereas other people who haven't spoken to people in the field might not be able to."* This change in perception has continued beyond the mentoring sessions:

- *"My everyday view on things has changed, for example in the back of my mind, I'm wondering, what's that got to do with physics? And how was that created?"*
- *"[Before taking part] I would want to know how it's [physics] going to benefit me in the future. Because if it's not going to benefit me, what's the point? […] but now I tend to listen more, because I connect it to things I might use in the future and when we're learning, I just try to connect it to something that might be useful for me."*

The mentoring project also provided ways in which familiar content was presented in new ways, including some practical activities learners would not normally get to do in class. However, there were limitations for some schools due to sessions being online and these therefore tended to be more discussion-based.

In addition to having an impact on their attitudes and intentions in relation to physics, mentees in the focus group also discussed how they used the opportunity to *“learn more about university and further education”,* something they were experiencing further at the Award and Recognition ceremony, which was where one of the focus groups took place.

3.2 Mentors

The project's deliverables in relation to the mentors for the year 2021-2022 were to:

- Increase confidence of student mentors attributed to mentoring experience.
- Develop employability skills in student mentors attributed to mentoring experience.
- Provide a positive experience of mentoring and to encourage mentors to consider a teaching career.

3.2.1 Feedback from teachers and mentees

Overwhelmingly, teachers praised mentors on the project with the language used to describe the mentors being positive, including descriptions such as *'enthusiastic'*, *'very good'*, and *'approachable'*. There was strong evidence for the impact of the high quality of the training, with teachers describing the mentors as being *"well trained"*, *"relatable"* and *"good with learners"*. One teacher commented that they felt the mentors were *'brave'* in engaging with learners. Suggesting an awareness of how potentially challenging it could be to teach for the first time, but which most mentors managed well. Only one comment suggested a mentor *'struggled to engage pupils'*.

One teacher made a particular reference to having a female role model available to their learners. There was further feedback from the mentee focus group on the importance of having female role models, *"I was quite negative because it's like a male dominated subject, but ours was run by a female"* and this helped to change their perception. Having positive female role models is an important aspect of the project as there are issues in schools where even if female learners are interested in physics at Year 9, *"there's a bit of a sort of a hesitancy to break the mould"* (Teacher, focus group).

In the vox pops, mentees mentioned they noticed when mentors were enjoying the experience too: *"the mentors, it felt like they enjoyed teaching us, I enjoyed them teaching as well."*

3.2.2 Impact of participation on mentors

This section examines the weekly reflections completed by the mentors and summarises the different impacts occurring.

Increased confidence of mentors

Due to the fluid situation many schools were operating under across the different cycles of the project, it is unsurprising that some mentoring session had varying numbers of mentees attending, with some working with smaller than normal group sizes, sometimes three learners

instead of six. However, this enabled mentors to work with smaller groups in a more focused way: *"So last session clearly gained some attention in the school. Everyone seemed VERY engaged with the problem and were asking questions and probing the rules and structures as they should even in the time constraints. Good session :)"* (Mentor reflection).

Mentors who had participated in multiple cycles of the project were able to demonstrate increased confidence in working with mentees due to familiarity with the material, with one commenting: *"[this] was another decent session…Was confident with the material as had planned it in detail for Level 4 [mentor qualification]"* (Mentor reflection).

Overall, taking part had a strong positive influence on many, with one summarising the positive experience had in their final session: *"I am still thrilled with how it went, and thought it was a fitting end to the sessions"* (Mentor reflection).

Developing mentors' employability skills

Many mentors demonstrated a strong level of self-awareness and reflection in their own work. This included:

- focusing on levels of engagement: *"the session didn't go as plan as engagement was low… it wasn't engaging enough and in the future I will try and make a more fun activity for the mentees to take part in"* (Mentor reflection).
- ensuring those with less confidence also participated: *"I made sure everyone had a say and shared their ideas"* (Mentor reflection).
- being flexible with their session plans to accommodate late arrivals: *"Only five mentees joined at the start….most people joined on slide three or four. I paused and went over what I just covered quickly so I hope everyone was on the same page"* (Mentor reflection).

Some mentors also demonstrated an awareness of assessing mentee learning retention, *"They also seemed to remember well what we had covered each week"*, (Mentor reflection), and selecting activities that promoted different types of learning, even if mentee enjoyment and engagement wasn't always initially clear:
"As much as some pupils are happier to give answers, it's still work [for the mentor to get them to engage], I'd have doubts that they want to interact at all if it weren't for the most common praise in the mentee forms being that they like having the discussions and giving their own opinion" (Mentor reflection).

Mentors also demonstrated skills in personalising sessions based on what they had learned about mentees and mentee interests:
"I used the information about the mentees from the first session and discussed the careers that they had mentioned to us" (Mentor reflection).
"space was a topic many of the mentees wanted to do, so we decided to extend the session and adapt the following session plan" (Mentor reflection).

One mentor was also able to make connections with current research and local activity:
"LIGO is incredible and so is CERN I couldn't not tell them. And Cardiff is a big player in the LIGO collaboration which localises the session!" (Mentor reflection).

Many mentors either became aware of the importance of preparation through their experiences with the session, *"I only saw the slides the morning of, proved very difficult to deliver in time available"* (Mentor reflection), with some having to think on their feet, *"Over half of the students were fairly engaged, but only giving short answers so took a bit of imagination to keep talking some of the time"* (Mentor reflection).
This led to a re-focusing for many, and additional preparation of additional 'just in case' activities, *"Next time, we will need to make sure teams is working properly. We managed to run with what we had, but potentially having backup activities for future sessions would be a real help"* (Mentor reflection) or proactively engaging with the school to ensure issues didn't happen again, *"A meeting was arranged with the school lead to try and resolve these issues before the next session"* (Mentor reflection).

Positive experience of mentoring

Many mentors clearly enjoyed their time working with the mentees (*"Love it in general"*, Mentor reflection), with some commenting they were *"a bit sad that we didn't have 2 of our sessions and that this was the final one"* (Mentor reflection). Mentors were able to positively reflect on the knowledge sharing part of their role: *"The mentees seemed to have learnt a lot, especially about how physics ties in to everything/lots of unexpected jobs"* (Mentor reflection) and many were aware that being involved with the PMP may have a long-term impact on mentees in the future: *"It was really nice to talk to the mentees and get positive feedback from the last 5 sessions and hear what the mentees had learnt/changed their opinions on….and it was exciting to hear that they were hoping for careers in physics"* (Mentor reflection).

3.2.3 Longer term impact on mentors

In early 2022 the project gathered feedback from previous mentors on their experiences, this included comments on the motivation for being involved in the project and the impact it has had on them since. Nine responses were received from mentors who worked across the lifetime of the project, with eight having been undergraduates at the time of their experience and one postgraduate. Two thirds of the responses came from females, 22.2% were males and 11.1% non-binary. In terms of their current status, for those in employment most were working in industry with around one third in education or science communication-related roles.

In terms of the motivations for involvement, common themes were “giving back”, sharing their “passion” for physics and encouraging more females and underrepresented groups into physics. Mentors were pragmatic in realising not everyone would necessarily go on to choose physics but they were keen to be able to highlight “how it [physics] affects the real world”.

Options	Percentage (n)
Increased confidence working with young people	88.9% (n=8)
Improved physics knowledge and skills	66.7% (n=6)
Improved personal skills such as team working and communication	88.9% (n=8)
Increased awareness of equality, diversity and inclusion issues	88.9% (n=8)
Improved employability	88.9% (n=8)
Increased understanding of Science Capital and how it applies in schools	88.9% (n=8)
Increased interest in participating in science outreach or public engagement activities	100% (n=9)
Increased interest in teaching as a career	33.3% (n=3)
Increased interest in a science outreach or public engagement career	66.7% (n=6)

Table 11. Responses to the question "We are interested in understanding more about the different impacts of mentoring on you. Please select all of the items in the list below that are relevant to you."

The mentor alumni were then asked to consider what had the most impact on them and why. Science capital and awareness of equality, diversity and inclusion issues were the aspects most commonly reported as having a longer term impact. This is significant, given the Science Capital Teaching Approach is the underlying theoretical approach for the project and signifies that it isn’t only there benefitting the mentees, but the mentors also. Below are the descriptions from the mentor alums of why this impacted on them.

- *“The biggest impact for me was an increased awareness of equality, diversity and inclusion issues. I was aware of an imbalance but this project really emphasised the issues and made me realised how much work there still is to do. This has had a continued effect on me and as such I went on to tutor multiple female GCSE pupils in physics throughout the pandemic in the hope of changing the stigma around this*

subject, and also attend CUWIP 2021, the 'Conference for Women in Physics', which also explored these issues and was truly inspiring."

- *"Science Capital was not something I'd heard before, and I found it really resonated with my own beliefs around education and how learning should be achieved. I also began to consider a career in outreach and public engagement."* This mentor alumni now works in this field.
- *"The Science Capital Teaching Approach. This was something which I didn't appreciate fully until I went into a school and interacted with students who weren't particularly thrilled by physics... when I was in high school, I loved the science, and being taught from a textbook about theory suited me quite well. Some of the students I interacted with didn't have that learning style. It completely changed how I think about getting a point across, both in my job and other volunteering activities elsewhere, and how to relate something to a student to help them understand it."*

Other comments from the mentor alumni reflect how the experience had a positive impact on their employability skills:

- *"Being given autonomy to have a go with my ideas (with support if I asked and a structure given to me to reflect so that I would never completely fail) and build confidence that way; feeling in control and that all that I achieved I directly drove made me feel much more accomplished and put a lot more effort into helping the mentees achieve as much as possible".*
- *"Personal skills listed above [team working and communication] are very interpersonal but I also found I had better organisational skills and felt more confident presenting and more able to understand what would and would not work (judgement?). I also got a community which meant I was better at sharing ideas and being collaborative with them as well as feeling more supported even after leaving the project."*
- *"I have learned to time presentations independently so that they do not rely on engagement of the audience - pupils can be very shy at first! I have definitely learned that "plan B" comes in handy if you mis-time or finish early."*
- *"It was well presented over teams and other resources used. Educational just to see the organisation of the scheme alone. Also although we used teams a lot for learning over covid, I hadn't had much practice of actually content so it was good to have chance to get fully comfortable before needing to present uni work at the end of the year."*

In some cases, the positive experience of the mentor alumni resulted in them wanting to continue taking part in youth volunteering, which is especially important with graduates going into industry. If they are able to carry this positive mentoring experience with them they are likely to continue to be a role model for other young people, thus continuing to encourage participation in science-related careers. The impact of the training sessions were also very positively reported. This was especially the case when the content was preparing the mentors for going in to work with young people.

With regards to teaching careers, there was some increased interest amongst those responding to this survey but it was also the case where mentor alumni realised “teaching wasn’t for me”. This is a very important point to consider, as there are many people who progress into a teaching qualification without significant experience or understanding of what the career entails. Just as with the PMP project in general, not everyone is going to carry on into physics but if they are able to better understand their own interests as part of the process then that is a positive outcome.

When asked for any other final thoughts, the mentor alumni were very positive about their experience, specifically mentioning the support and passion of the project team. One mentor alum summed their experience up as a *“Generally a really enriching and eye-opening experience”*, whereas another commented, *“I am truly grateful to have been able to contribute and be part of this project, and the benefits I have gained from it are significant, including improved employability.”* This final comments sums up the benefits for mentors: *“I would absolutely recommend this Project; it's a fantastic opportunity! You learn invaluable skills, get a qualification out of it, the mentoring itself is so rewarding and fun, and you get paid as well. I am genuinely glad I signed up, as it was a brilliant experience.”*

3.3 Teachers and Schools

In order to provide some context on the situation in schools, the following summary is drawn from responses to the teacher survey.

Nine of the eleven respondents were taking part in the project for the first time. The majority of those liaising with the project were Physics or Science teachers (42%), followed by Head of faculty/science or Assistant Head of function (33%) and Curriculum or subject lead (25%). In terms of the levels of staffing across the schools:

- Five of the schools responding had one Physics teacher in their department (45%).
- Four schools had two teachers (36%) and one school had three (9%).
- One school reported having no Physics specialist teachers.

Two thirds of schools engaging with the project offered Physics A-level. In some cases this means there isn't a sixth form in the school. There was then a range of feedback as to the circumstances allowing an A-level to run.

- Two schools would run Physics A-level for one learner.
- Four schools would run it for six learners or less.
- One school commented it would depend on funding/timetabling.

3.3.1 How teachers engaged with the project

For schools new to Physics Mentoring (nine of the eleven respondents), two engaged as a result of contact from one of the PMP team. Schools reported becoming involved with the project as it was a way in which to provide opportunities to broaden students' awareness of opportunities beyond compulsory education and as a way of bringing in external experts. Word of mouth played an important role in encouraging schools to participate as several reported hearing about the project from colleagues in other schools.

Many teachers (n=5) commented that a key benefit of engaging with Physics Mentoring was the introduction and development of relationships with local universities. One teacher also appreciated the validation of mentors promoting the same messages they taught in lessons: *"It was encouraging and heart-warming to see mentors, not that much older than the students, share the same messages that I am in class" (teacher survey)* commenting *"Students often take our word with a pinch of salt but I think hearing it from people who are "closer" to them, gives what we're saying a bit more weight"* (teacher survey). Of those surveyed, 20% (n=4) hoped the project would increase current or future learner uptake of GSCE or A Level physics,

and 10% (n=2) felt the project broadened student awareness of pathways beyond what they currently knew. One teacher felt participation would specifically encourage more girls to take Physics A Level (n=1), and 2 teachers commented that they felt the project offered them professional development (n=1) or opportunities to discover new teaching resources or activities (n=1).

3.3.2 Wider school impact

Many schools who responded to the teacher survey were engaging with the project for the first time and therefore were either unable to identify wider school impact (n=2, 15%) or felt it was too soon to measure (n=3, 23%). However for those that were able to comment, wider school impact of participating in the project included raising the profile of physics within the school, students seeing new opportunities with the subject or having increased *"passion"* for the subject. Two schools reported participation in the project had enabled them to offer additional qualification options for students with one commenting *"there is a potential to run GCSE Astronomy next year as a result of the interest of students"* (teacher survey) and another stating *"our potential uptake of students into year 12 has already improved compared to the past three years"* (teacher survey).

One of the current challenges in schools continues to be the fact that *"recruiting to science [teaching posts] has been very, very difficult"* (Teacher, focus group). This has consequences for uptake of science GCSE and A-level, as it means science is being taught by non-specialist teachers in Years 7 and 8 and where schools have learners who do not value science, this can make it particularly challenging to encourage young people to take physics. There are further knock-on effects in that schools may not be able to offer Physics A-level. In some instances schools have partnership or collaboration agreements in which learners can move between schools in order to take Physics A-level, but learners "don't want to go to another school to do it" (Teacher, focus group).

4. Conclusion

The project has been able to increase the numbers intending to take physics. The proportion of mentees indicating they would choose Physics A-level have increased following participation, compared with a drop in the level of interest from non-mentored learners. Unfortunately there is limited data available, therefore we are unable to make a quantitative assessment of impact on the intentions of mentees by gender. However, there were several observations from teachers and comments directly from mentees about the importance of female role models both as mentors and within the session content itself. In addition to the increase in positive intentions in relation to Physics A-level, there was also an increase in the proportion of mentees interested in science-related careers. There were many examples where mentees developed their self-confidence in relation to physics and there is clear evidence of an impact on perception of physics well beyond the sessions themselves.

Both current mentors and alumni reported increased confidence as a result of their participation in the project. There was also a clear development of employability skills, ranging across teamworking, organisation and communication. Importantly, there was also an increased awareness of equality, diversity and inclusion issues, with the impact of this continuing beyond the mentors' experiences with schools. There is evidence that the project has positively impacted on mentors' career interests in relation to both teaching and roles in outreach and science communication.

About the authors

Ondata Research collaborates with clients to help them understand project impact, whilst also providing mentoring and support through the phases of project development and delivery.

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Clare has worked in science engagement for national and local museums in London and across Scotland for the past 10 years. Working in both delivery and development, her museum-based projects have ranged from tinkering workshops for secondary students to science events for over 4,000 people. Most recently as Science Engagement Manager at National Museums Scotland, her work has focused on science engagement strategy development alongside evaluation of a wide range of funded STEM projects for funders such as Scottish Power Foundation, the Scottish Government and Children in Need. As a freelancer she has worked with regional museums such as Andrew Carnegie Birthplace museum on ASN and digital science engagement, and previously worked directly with primary schools for outreach, after school STEM clubs and teacher consultations.

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