

Pilot Project 2016/17

Final Evaluation Report

Authors:

Elizabeth Jeavans & Sarah Jenkins

25th October 2017

Evaluation of Shattering Stereotypes Pilot Project 2016/17

1. Introduction	3
1.1. Background to Shattering Stereotypes	3
1.2. About the Shattering Stereotypes pilot project	3
1.3. Evaluation of the pilot project.....	4
1.4. Data presentation and reporting.....	7
2. Baseline position in schools	8
2.1. Leadership views on the context and motivations for Shattering Stereotypes	8
2.2. Year 8 students’ baseline views	13
2.3. Year 12 students’ baseline views	20
2.4. Summary – baseline position	22
3. Year 8 students ‘before’ and ‘after’ comparison	23
3.1. Physics and me & physics and gender.....	23
3.2. Attitudes and intentions towards physics.....	24
3.3. Gender and subject choices	25
3.4. Comparison with before and after responses for students who did not participate in Shattering Stereotypes	25
3.5. Focus group feedback pre- and post- pilot	27
3.6. Summary – Yr8 students ‘before’ and ‘after’ comparison	29
4. Stakeholder opinions about Shattering Stereotypes	30
4.1. Student ratings and opinions of Shattering Stereotypes	30
4.2. Teacher reflections on activities, project structure and processes	33
4.3. SEPnet team reflections on activities, project structure and processes	38
4.4. Summary – stakeholder opinions about Shattering Stereotypes	41
5. Learning and recommendations for SEPnet	42
5.1. Learning points	42
5.2. Recommendations.....	43
6. Appendix A – Year 8 students ‘before’ and ‘after’ indicator questions	44
7. Appendix B – Year 8 Students’ pre- and post- pilot responses to indicator questions	45
7.1. Physics is for me	45
7.2. Physics is for girls.....	45
7.3. Physics is for boys.....	46
7.4. Physics is interesting	46
7.5. Physics is difficult.....	47
7.6. I am good at physics	47
7.7. I feel involved in physics lessons	48
7.8. I am likely to study physics after age 16.....	48
7.9. I feel I could decide to pursue any subject at school without gender being a factor	49

1. Introduction

1.1. Background to Shattering Stereotypes

The Shattering Stereotypes pilot project ran throughout the 2016/17 school year and, as stated in the evaluation brief, sought to determine *the best role Physics Outreach Officers can play in tackling and improving the Gender stereotyping problem in schools*.

The pilot was developed and run by the SEPnet outreach programme, which aims to communicate the message *'anyone can do physics'* to schools across the south east of England, with a particular focus on KS3 students. SEPnet Outreach is formed of twelve partner universities and has been operational for eight years. During a review of its outreach programme in 2015, SEPnet surveyed its Outreach Officers and held discussions with Heads of Department about its strategic direction. Both groups identified that tackling the gender imbalance in physics as a priority they wanted to address, which resulted in Shattering Stereotypes.

Context was provided in the form of Institute of Physics (IOP) research which showed that a lack of girls taking physics A-level is part of a wider problem of gender stereotyping in schools and is affected by whole school culture, not just what happens in the physics classroom. Shattering Stereotypes was informed by IOP's *Closing Doors* research report into gender and subject choice (December 2013)¹ and its *Opening Doors* guide to good practice in challenging gender stereotypes in schools (October 2015)².

Shattering Stereotypes developed interventions based on existing IOP resources that explore and address gender stereotyping, including subject choice data and activities to address unconscious bias. The programme also used resources from *People Like Me*³, a workshop about presentation of STEM careers and targeted specifically at girls, which has been developed by the SEPnet diversity lead alongside the WISE campaign for gender equality in STEM.

1.2. About the Shattering Stereotypes pilot project

1.2.1. Objectives of the pilot

The stated aims of pilot project were to:

1. Deliver a year-long programme of activities to six schools in the South East in the 2016/17 academic year. Each of three Outreach Officers (OO) will work with two schools, which will be local to each Officer's University.
2. Develop metrics to measure how gender-stereotyping culture can be measured in schools.
3. Kickstart a discussion in each of the schools on how they are gendering different subjects and therefore influencing subject choice.
4. Produce a best practice report for physics-specific Outreach Officers wishing to tackle Gender Stereotyping in Schools.

1.2.2. Delivery and structure of the pilot

A team comprising the SEPnet Director of Outreach and three Outreach Officers oversaw the planning and delivery of the pilot project and, during the first half of the 2016 autumn term, the Outreach Officers recruited a total of five schools to take part in a programme of four core activities. Not all schools participated in every activity and the numbers that were involved at each delivery point are summarised in the table overleaf.

¹ http://www.iop.org/education/teacher/support/girls_physics/closing-doors/page_62076.html

² http://www.iop.org/education/teacher/support/girls_physics/reports-and-research/opening-doors/page_66438.html

³ <https://www.wisecampaign.org.uk/people-like-me>

The core activities consisted of:

1. **Autumn term - an introductory session for Year 12 students** (originally called Physics Ambassadors) to introduce them to gender stereotyping and some of the concepts and materials that would be used in later sessions, which it was anticipated Year 12 students would help to facilitate.
2. **Autumn term – gender stereotyping workshop for Year 8 students** that was delivered in a single lesson and introduced some of the key issues and incorporated a People Like Me activity.
3. **Spring term – evening/twilight careers event for Year 8 students and their parents** to introduce the full range of opportunities for physics students. This session incorporated a People Like Me activity, a talk and a chance to meet physics role models.
4. **Summer term – communication challenge for Year 8 students** in which students took part in a day-long, off-timetable group activity to plan and design a method of engaging a particular audience group with the issue of gender stereotyping. Students selected their target audience from a list provided by SEPnet (e.g. parents, teachers, younger students).

Table 1: Schools’ participation in the Shattering Stereotypes pilot project

Activity	Yr 12 introductory session	Yr 8 gender workshop	Careers event for Yr 8 students & parents	Yr 8 communication challenge
Number of participating schools	5	5	2	3

1.3. Evaluation of the pilot project

1.3.1. Evaluation aims

In May 2017, SEPnet commissioned Elizabeth Jeavans in partnership with Sarah Jenkins and Angela Daly to undertake an evaluation of the Shattering Stereotypes pilot. The evaluation had three aims:

- To identify and establish a series of indicators to determine the impact of Shattering Stereotypes.
- To develop a set of metrics that can be used both to establish a baseline and to assess impacts during and beyond the pilot project.
- To develop a series of best practice recommendations for the delivery of the project by SEPnet and other physics Outreach Officers.

Following a review with the SEPnet Director of Outreach midway through the pilot, the emphasis of the evaluation was revised to more closely capture process learning and to identify practical recommendations for SEPnet. This was influenced mainly by schools’ varying levels of engagement, plus changes to the delivery plan and a lower than anticipated response rate to the evaluation from participating schools, despite regular contact with every school from the evaluation team and relevant Outreach Officer.

In practical terms this revision meant less emphasis on assessing student impacts and the evaluators capturing more information than originally anticipated about how the project was being run in each school and how SEPnet Outreach Officers could best support schools. To achieve this shift, more interviews than first planned were scheduled with lead teachers and Outreach Officers to capture their views about the way activities ran and the general processes used to develop and deliver the pilot. An additional midpoint report was also added to the evaluation to inform SEPnet’s planning for the summer term activity.

1.3.2. Evaluation methodology and metrics

The evaluation employed a mixture of methods to capture information from all stakeholder groups.

Head teachers

Head teachers were interviewed prior to the first activity as part of the baseline to obtain a whole school perspective on gender including use of language, initiatives to counter gender stereotyping, use of gender metrics and information around the expectations of different genders in all subject areas.

Lead teachers

Lead teachers completed a baseline e-log before and a reflective e-log after the autumn term workshop with Yr 8 students. They were interviewed in the spring term and at the end of the pilot. The spring term interviews sought to capture teachers' opinions and learning about activities completed to date in order to inform SEPnet's planning for the summer term activity. The end of pilot interviews explored teachers' feedback about overall project processes and impacts and their views about SEPnet's plans for the continuation of Shattering Stereotypes.

Year 8 students

Year 8 students who were participating in Shattering Stereotypes completed a baseline questionnaire before their first workshop. It explored their understanding of career opportunities where physics can contribute and the extent to which they agreed or disagreed with statements about their personal views on physics and its relevance to them, as well as whether or not they think gender is a factor in pursuing different subjects and opportunities. In two schools, the baseline questionnaire was also completed by a 'control group' of Year 8 students who would not be taking part in Shattering Stereotypes.

A sample group of Year 8 students in each school took part in a focus group with evaluators before the first workshop. It explored their views about gender stereotyping in schools and their thoughts and feeling about physics and other gendered subjects in greater depth.

Year 8 students completed an end of pilot questionnaire at the end of the communication challenge activity. This questionnaire repeated the questions in the baseline questionnaire with the addition of question that asked students to rate Shattering Stereotypes and explain their ratings.

In three schools, Yr 8 students who took part in baseline focus groups were interviewed and completed a mind map during the communication challenge activity to explore if and how their views had changed through Shattering Stereotypes.

Year 12 students

Year 12 students submitted a baseline e-log before their introductory session and a reflective e-log following the autumn term workshop with Yr 8 students. The former explored their motivations for taking part and anticipated impacts and the latter captured their opinions about the first workshop including its impacts for them and Year 8 students. They completed an end of project questionnaire or interview that asked them to rate Shattering Stereotypes and describe their overall reflections and impacts of the pilot.

SEPnet project team

Outreach Officers completed a reflective e-log after each first Year 8 gender workshop they delivered. Members of the SEPnet Shattering Stereotypes project team were interviewed in the spring term and the end of the pilot to capture their opinions about project processes and impacts.

All stakeholder groups

The evaluators observed a first workshop for Year 8 students, a careers event and two communication challenges.

This table summarises the metrics for each data collection point.

Table 2: Evaluation data metrics

	Method	Number n=
Baseline	Yr 12 baseline e-log	18 (2 schools)
	Yr 8 baseline questionnaire participating students	263 (5 schools)
	Yr 8 focus group	4 schools
	Yr 8 baseline questionnaire non-participating students	140 (2 schools)
	Head teacher baseline interview	4
First activity	Lead teacher reflective e-log	3 (3 schools)
	Yr 12 reflective e-log	19 (3 schools)
	Outreach Officer reflective e-log	4 (4 schools)
	Observation	1 school
Midpoint	Lead teacher midpoint interview	4
	Outreach Officer interview	2
	Observation of careers event	1 school
End of pilot	Yr 12 end of pilot questionnaire/ interview	29 (3 schools)
	Yr 8 end of pilot questionnaire participating students	181 (3 schools) 114 of these students had completed baseline questionnaires
	Yr 8 end of pilot questionnaire non-participating students	81 (2 schools)
	Yr 8 interviews	14 students (2 schools)
	Lead teacher end of pilot interview/survey	3 ⁴
	SEPnet team interview	5 ⁵
	Observation of communication challenge	2 schools

⁴ 2 x interviews + 1 x completed survey

⁵ Includes 1 SEPnet student ambassador

1.4. Data presentation and reporting

To protect individual identities and encourage honesty during feedback, all data were collected in confidence and have been anonymised in this report. Questionnaire respondents self-selected which survey questions to complete. Therefore sample sizes may differ for different questions and this report shows the number of respondents (n=) for quantitative data in each case. Percentages have been rounded and thus when totalled may be slightly greater or less than 100.

A mid-point report was submitted to SEPnet in April 2017 that outlined main areas of learning at the time and compared the baseline data for female and male Year 8 students.

This report addresses each of the evaluation aims. Section 2 presents the baseline position based on feedback from all stakeholder groups. Section 3 compares before and after indicators for Year 8 students who provided feedback at the baseline and end of pilot data collection points. Section 4 describes the opinions of all stakeholder groups about specific activities and the pilot overall. Sections 2 to 4 conclude with summaries of their main findings. Section 5 outlines key learning points from the pilot and makes some recommendations to inform SEPnet's future planning and delivery.

Relevant quotes have been used to illustrate findings and have been edited where necessary to ensure anonymity. They are shown in *blue italics* and attributed to Year 8 students, Year 12 students or teachers as appropriate.

2. Baseline position in schools

This section is in three parts. The first part focuses on leadership views about the background and motivations for their school's participation in Shattering Stereotypes. The second and third parts present the baseline information gathered from Year 8 and Year 12 students respectively.

2.1. Leadership views on the context and motivations for Shattering Stereotypes

Four head teachers were interviewed before or very soon after their Year 8 students took part in an autumn term gender workshop.

2.1.1. Motivations and expectations

For three head teachers, their main reason for taking part in Shattering Stereotypes was helping to address a gender imbalance, where fewer girls than boys take physics and other STEM subjects, including supporting existing work by schools in this area. In two of these cases, a physics teacher was going to lead the school's involvement in the pilot project, with the third being led by a careers teacher.

I just think it's a really exciting opportunity, we believe in this 100%. If you read our equality objectives, our number one is to increase... female uptake in the STEM subjects, particularly physics. And I think it's worded almost exactly like that. (Head teacher)

I think it's really to continue the work that we started with getting more girls to study physics. Also I think [the lead teacher] does work through (an IOP project), because he was saying that this project is being done lower down the school, and I think it was just an opportunity to reinforce the good practice work we were doing already. It wasn't that he was thinking, "Oh, there's a need to do this because we don't have enough girls doing physics." It was just would be even better. (Head teacher)

One head teacher described their main reason for taking part in Shattering Stereotypes as being part of a school-wide strategy or culture to address all forms of diversity and equality.

Activities to address all kinds of stereotyping are embedded in the school at many different levels and are part of its ethos. I see Shattering Stereotypes as part of this ethos and I hope it will reinforce what the school is doing and act as kind of 'health check' on how we are doing with regards to gender stereotyping. (Head teacher)

One of the head teachers who mentioned gender imbalance in physics or STEM as their main motivation for participation also cited the perceived fit of Shattering Stereotypes within a wider equality context, *we just reinforce that no subject is off limits for anybody, regardless of race, gender, ethnicity, whatever. But it all fits into our belief in equality of opportunity.*

Head teachers expressed a range of expectations around how they thought Shattering Stereotypes may work in practice and what it could deliver in their schools. Three heads cited the value of having external speakers and role models involved in activities as these often create more memorable experiences for students, which can mean that their messages have greater impact than those delivered by school staff. In the case of Shattering Stereotypes the messaging around equality of opportunity for all genders was highlighted.

External interventions are often the best remembered by students and have greater impacts, I hope the Shattering Stereotypes will be one of those and that students of both genders will become more aware that the opportunities to study physics or have physics jobs are equal for males and females. (Head teacher)

It's bringing the real world into the school. So any opportunity for that to take place we welcome with open arms. I think it's good to have, again lower down the school, some masterclasses, people coming in, and for the pupils to see a real life scientist to come in and ... that this amazing the difference that makes. Because then they can talk with authenticity about being a scientist,

working in a laboratory, doing research. It is reinforcing to the pupils lower down the school that no subject is off limits. (Head teacher).

One head teacher was keen for their school to use Shattering Stereotypes as an opportunity to explore staff training around unconscious bias and unconscious stereotyping.

2.1.2. Addressing gender stereotyping

Only one head teacher reported that their school had not previously taken part in any particular initiatives to address forms of stereotyping. In all other cases, heads cited at least one example of activities, initiatives or curriculum opportunities where they felt Shattering Stereotypes would complement ongoing work around equality and diversity. These could be grouped into four main themes, as shown below.

Table 3: Schools' baseline activity to address stereotyping

Theme	Head teacher's example
Other equality initiatives & organisations (e.g. LGBT, racism, faith)	<p><i>We've links with Stonewall and other charities, who come in and run regular assemblies (1 per half-term) meaning everyone from Yr7 to Yr13 has an opportunity to learn about stereotyping and why it needs to be addressed.</i></p> <p><i>We've done things to tackle stereotypes for LGBT, we have a black boys' council where we've done work with challenging stereotypes for black boys. We've done work ...looking at radicalisation and stereotypes around the issues with Muslim families and stereotypes there. So we've done quite a lot of work, and we do a lot of work with outside agencies.</i></p> <p><i>Currently we're working on the equality and inclusion mark, that's like a Kite Mark for the school. There's a Stonewall diversity champion mark and we've looked at that. And there's equalities mark, ...it is very much looking about what do we do at whole school level to reinforce equality, and that's ethnicity, gender, sexuality. It looks at schemes of work, it looks at what's going on in individual departments, it looks at what do you at whole school level.</i></p>
Citizenship/PHSE curriculum	<p><i>We aim to embed anti-stereotyping in core activities, with a lot of this work being done through the Citizenship curriculum. Citizenship is a compulsory subject at KS3 and KS4 here, where as it is only compulsory at KS3 in most schools. We also offer Citizenship as an A Level, reinforcing the school's focus on developing rounded individuals. Students are taught to treat everyone the same, regardless of the characteristics that different individuals possess.</i></p> <p><i>In our school it tends to come into our citizenship programme. So we do citizenship to years 7, 8, and 9, and the year 10s do a half GCSE in citizenship. And there is a gender equality angle or aspect to that, and it would be one of the units or modules, I think, of part of that.</i></p>
Careers guidance	<p><i>Also important is the careers adviser – she's a background in gender equality related to HE entry. Initially her role was with the 6th form only, but it has broadened to cover Yrs. 7 to 11. She takes assemblies from Yr. 9 onwards which address all types of stereotyping.</i></p> <p><i>We have a full time careers adviser who does do a series of careers related (equality, role model) activities. There is a careers input into lessons and we</i></p>

	<p><i>have a Yr10 careers week where we try and encourage students to prepare for, or identify which career they would like to pursue based on their interests rather than what they ought to be doing.</i></p>
<p>Non-curricular activities (e.g. assemblies, work in local community)</p>	<p><i>Also at whole school level at assembly, we run assemblies about gender, and also we say to people who are leading assemblies not to have people in ascribed gender roles. Also a couple of years ago we did a series of assemblies about the use of language and gender as well.</i></p> <p><i>The school has four houses and each house is associated with a local charity e.g. hospital, local provider of equipment for children with special needs, which is part of our activity around acceptance and countering stereotyping. We aim to give every student an opportunity to take part in and enjoy at least one house activity per year, with charitable activities being one of those opportunities.</i></p>

Head teachers also mentioned activities that were specific to their schools and which they thought were particularly aligned to Shattering Stereotypes.

One school produces a weekly staff bulletin which highlights the school’s ‘theme for the fortnight’ and suggests activities for teachers to undertake with their tutor groups. Recent themes had included respect, where one of the suggested activities was students undertaking paired conversations about characteristics they share and are different.

Another school has an equalities group made up of a representative of each teaching department and a senior member of staff who has been assigned the role of equality and diversity manager across the whole school. This group meets termly and is exploring equality awards and schemes. The same school has a student council which the head described as providing the student voice in equality matters.

In a third case of school-specific initiatives, a head described activities focused on girls and addressing female role models in STEM subjects and leadership roles.

2.1.3. External influences

All head teachers were realistic about what a single initiative can achieve and three noted the significance of influences outside school that affect students’ attitudes to gender. Two suggested that media and parental influences are perhaps more important than what happens in school when it comes to stereotyping, and thought that schools could only try and do their best to counter stereotyping in their own environments.

There are cultural influences that you can’t control, yeah. But there are also frustrations, you can go to either extremes, you have some families that are very supportive. You have other families that when you phone up to ask them in the sixth form why they’re not in, their priority is looking after the younger children, they’ll be married in a year and they’re allowing them to study at the moment. So you’ve got two extremes and you have to work within those boundaries, I suppose. Because sometimes we can break it down at school but they need to be able to see how to take it beyond the gates. (Head teacher)

Outside school influences - particularly the media and now social media are the main factor in stereotyping and are very powerful. The way males and females are presented has much more influence than anything in school, and it’s a growing problem as phones mean everyone is being presented with stereotypes all day, every day. We have to do what we can in the school, but we’ve also got to recognise that other, bigger factors are in play. (Head teacher)

One of these head teachers described an example where popular culture has had a positive influence on stereotypical subject choices in their school.

An example of [outside school influences] is food technology, where girls have traditionally outnumbered boys hugely at GCSE and where numbers are now much more even, which I think is down to portrayal of male chefs on TV – meaning it is now cool for boys to cook. (Head teacher)

Three head teachers indicated that the ethnicity of their school population, including changes due to greater demographic diversity in their local area, also influenced students' attitudes and perceptions around all forms of stereotypes.

Generally the school has become significantly more diverse – when I first came 15 years ago here the students and staff were over 90% 'English-speaking white, protestant'. Now more than 30 languages are spoken by students, including some who come to the school speaking no English. Diversity, equality and respect have become much more significant than they were for us. (Head teacher)

When I first got here probably one of the biggest things we were working on is challenging the stereotypes of black boys, but black boys were maybe...black British and black Caribbean were a minority in the school. And the ethnic make-up has changed, ... Now we've had other stereotypes with different waves of different cultures coming through, there are different stereotypes that arise and things that you have to tackle. .. so there are different issues that arise - you have to adapt. You can't expect Shattering Stereotypes to be a magic solution because of the complex, multi-faceted nature of factors that influence perceptions around gender. (Head teacher)

The main changes really has affected the demographic and cultural changes to the centre of [school location]. So in the school a decline in the number of white British students, white British now is only 8% of our population, when I came in 2004 it was 25%. There has been a change with more children from Eastern Europe coming, for example. But predominantly the school has remained children from the Indian sub-continent, and an increase in Somalian students as well. I think in relation to the change in the cultural background of a number of student, some of the girls at home experience gender stereotyping, but when they come to school that's not the case. (Head teacher)

2.1.4. School role models for STEM

Whilst schools acknowledged the part played by visiting role models, they also highlighted the importance of having positive role models for students to encounter day-to-day. Two Head teachers reported that their A-level physics groups were predominantly male, with one school having a male: female ratio of 9:1 across all A-level physics students and another having only one female studying physics in Year 12. In one of these cases the head teacher pointed out that in recent years the school had been focused on boosting overall numbers taking A-levels in sciences and that there had been no specific emphasis on gender or physics. The same head mentioned the challenge of recruiting gender role models amongst the science teaching staff.

The school now runs A Levels in all 3 sciences every year with boys and girls in all classes, which is our marker of success. The Heads of Physics and Biology are female and the Head of Chemistry is male. This is serendipitous and not planned because the overall shortage of science teachers and struggle to recruit them means that we cannot choose gender role models, we just have to choose the best teachers. (Head teacher).

The importance of gender role models within school staff was also noted by the head of a school where the gender balance among A-level physics students was 50% female and 50% male. They cited some examples where they thought staff role models had help to influence this balance.

And we've had a number of female physics teachers, which is good for shattering stereotypes, and they've done assemblies for the whole school about science. So over time more girls have been studying science, particularly physics. And our physics technician ...is female as well, and she runs

science club. So for the school a lot of the children's experience of science will be being taught by a female and seeing females doing technician roles, our chief technician is female too. So science very much isn't seen as being a male. (Head teacher)

The same head also emphasised how their school had taken a proactive approach to recruiting more girls into physics, including work with the IOP's Capital Physics Project⁶

In the past we've done a lot of work on girls into physics with the IOP three or four years ago, had a large number of girls studying physics. But over time more girls have been studying physics, and very much when we're going through to year 9 when they do the options, triple science, we make it very clear that this is open to everybody. (Head teacher)

2.1.5. Use of gender data

The IOP's Opening Doors best practice report highlighted the importance of schools using gender disaggregated data on student achievement and progression to identify potential areas for action around gender equality. All heads said their schools collected data around the % of female and male student who choose to take different subjects. They described varying ways in which these data were used.

One head pointed out that although these data were interesting for teachers and school management, schools are limited in what they can do to address gender imbalance amongst the whole school student population.

We try to keep a gender balance, but it's by luck because if it's not part of our admissions code, so you just take in the next kid on the waiting list. All the teachers analyse their classes, they see if there's a girl-boy divide, practical subjects versus written subjects. (Head teacher)

Another head described how gender disaggregated data about subject options were collected for internal use only, as they are not required by government.

For ourselves we monitor the gender, for example, the options to make sure it's not skewed, and that really is our internal data. But we're not obliged to report, the Government doesn't ask us for gender metrics for options. But that's something which we do ourselves. (Head teacher)

In a third case, a head indicated that their school could do more in terms of analysing the data they collect already.

We don't really study the metrics they collect on gender. This is because we feel we already know it so don't do any analysis on it, although we probably should. For example, we could do analysis on which university courses girls and boys are going on to do. (Head teacher)

One head said their school reports gender data to governors and said they were also used by Ofsted.

So we record the number and % of students of both genders who take different subjects. This information is reported to governors and recorded by Ofsted. % is important because there are more boys than girls at our school. (Head teacher)

⁶ http://www.iop.org/education/teacher/support/capital_physics/page_63685.html

2.2. Year 8 students' baseline views

This part is informed by responses from 403 students Year 8 students to a baseline questionnaire and feedback from Year 8 focus group discussions, which took place before students participated in an autumn term gender workshop. The Pearson chi-square test, was applied to the data to compare categories of baseline responses for male and female students.

2.2.1. Physics and me & physics and gender

The following table and graph show the extent to which female (F) and male (M) Year 8 students agreed or disagreed with three statements about physics and them and gender prior to any Shattering Stereotypes intervention. Applying the Person chi-square test showed there was a significant relationship between gender and thinking 'physics is for me'. Based on a comparison of response in all categories males were statistically more likely⁷ than females to agree or strongly agree with this statement. However there was no significant relationship between gender and thinking 'physics is for girls' or 'physics is for boys', where females were slightly more likely than males to agree with both statements.

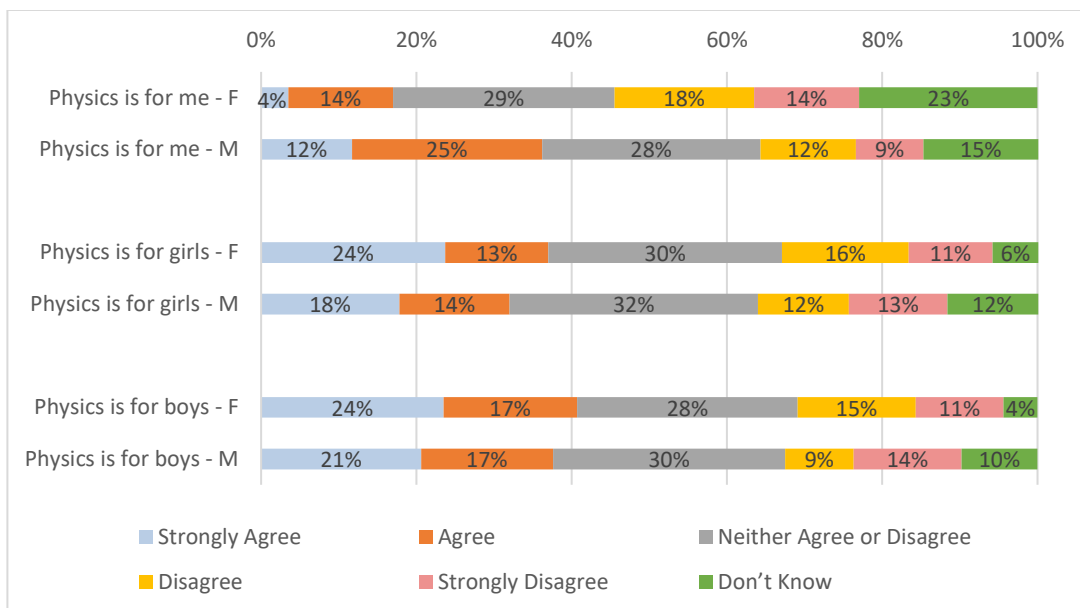
Table 4: Yr 8 students' baseline views about physics, me and gender

Statement	Gender	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree	Don't know	P value
Physics is for me n=396	F	3.5%	13.5%	28.5%	18.0%	13.5%	23.0%	0.00**
	M	11.7%	25.0%	28.1%	12.3%	8.7%	14.8%	
Physics is for girls n=400	F	23.7%	13.3%	30.1%	16.3%	10.8%	5.9%	0.51
	M	17.8%	14.2%	32.0%	11.7%	12.7%	11.7%	
Physics is for boys n=398	F	23.5%	17.2%	28.4%	15.2%	11.3%	4.4%	0.39
	M	20.6%	17.0%	29.9%	8.8%	13.9%	9.8%	

**Denotes significance at the 99% confidence interval

⁷ Comparison using Pearson chi-square test

Fig. 1: Graphical representation of Yr 8 students’ baseline views about physics, me and gender



In focus group discussions at all schools, Year 8 students expressed uncertainty about what the term ‘physics’ means or needed prompting about curriculum topics to understand what it might include. This is because most were studying ‘science’ and many were unsure of the distinction between physics, chemistry and biology. In at least one school students said different classes study one science per term in Year 8, meaning not all members of the focus group were studying physics at the time their focus group took place.

Students’ opinions about whether physics is for different genders were varied and stimulated some debate. Male and female students said physics was not gender specific and others of both genders felt it was more suited to males.

I don't think it really affects what gender you are to doing any subject, including physics, because when we pick our subjects it's more of our personality and if our gender affect something there's something wrong. (Yr8 student)

For example boys are more into practicals and they're more into chemistry and physics, while the girls are usually into biology. (Yr8 student).

No, boys do chemistry and physics and I do see more boys doing physics than girls.

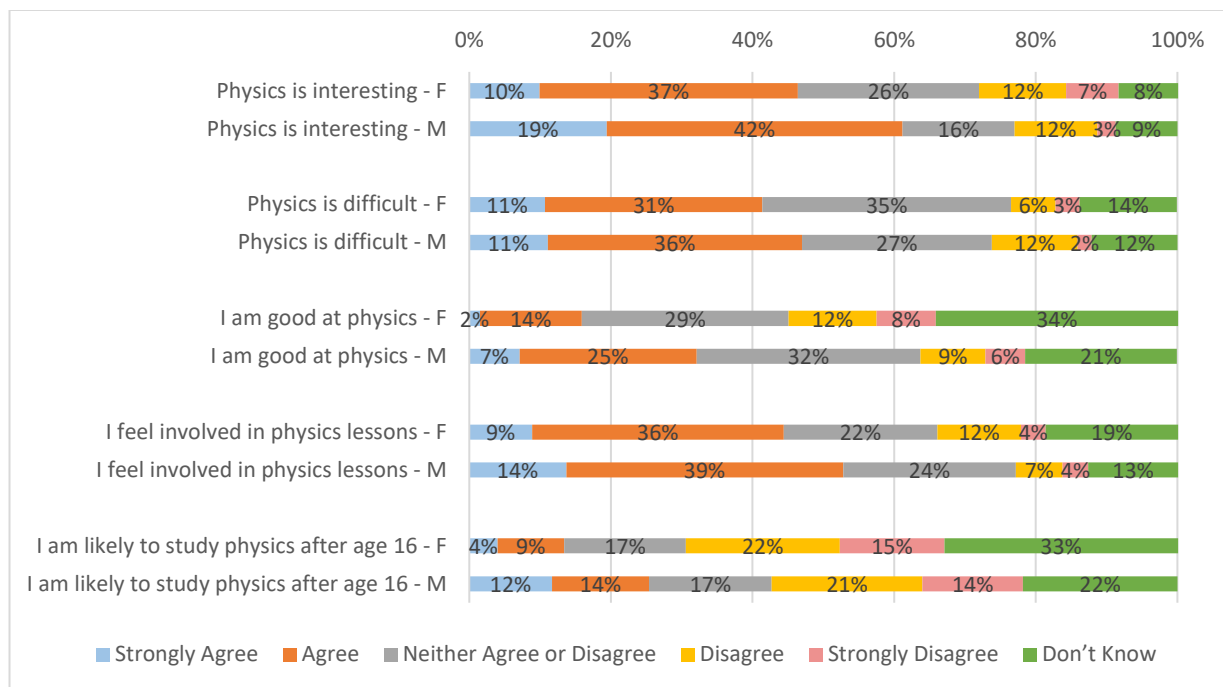
2.2.2. Attitudes and intentions towards physics

Applying the Pearson chi-square test to data presented in the next table and graph shows that there was a significant relationship between gender and thinking 'physics interesting' or 'I am good at physics'. Males were statistically more likely to agree with these statements than females. However using the same statistical test there was no significant relationship between gender and thinking 'physics is difficult', feeling 'involved in physics lessons' or being likely 'to study physics after age 16'. Although not statistically significant, more males (47%) than females (41.4%) agreed or strongly agreed that 'physics is difficult', more males (52.8%) than females (44.4%) agreed or strongly agreed that 'I feel involved in physics lessons', and more males (25.4%) than females (13.1%) agreed or strongly agreed that 'I am likely to study physics after age 16'.

Table 5: Yr 8 students' baseline attitudes and intentions towards physics

Statement	Gender	Strongly agree	Agree	Neither	Disagree	Strongly Disagree	Don't know	P value
Physics is interesting n=399	F	9.9%	36.5%	25.6%	12.3%	7.4%	8.4%	0.00**
	M	19.4%	41.8%	15.8%	11.7%	2.6%	8.7%	
Physics is difficult n=403	F	10.7%	30.7%	35.1%	6.3%	3.4%	13.7%	0.12
	M	11.1%	35.9%	26.8%	12.1%	2.0%	12.1%	
I am good at physics n=398	F	1.5%	14.4%	29.2%	12.4%	8.4%	34.2%	0.009**
	M	7.1%	25.0%	31.6%	9.2%	5.6%	21.4%	
I feel involved in physics lessons n=400	F	8.9%	35.5%	21.7%	11.8%	3.5%	18.7%	0.26
	M	13.7%	39.1%	24.4%	6.6%	3.6%	12.7%	
I am likely to study physics after age 16 n=400	F	4.0%	9.4%	17.2%	21.7%	14.8%	33.0%	0.10
	M	11.7%	13.7%	17.3%	21.3%	14.2%	21.8%	

**Denotes significance at the 99% confidence interval

Fig 2: Graphical representation of Yr 8 students' baseline attitudes and intentions towards physics

No focus group participants named physics as their overall favourite subject and fewer than half said it was their favourite science subject. Female and male representation among the latter group was roughly equal. Some other students mentioned specific topics or characteristics of physics lessons that they enjoyed.

I don't really like it but the only part I enjoy about it is learning about space and the planets. (Yr8 student)

I like doing some of the physics equations because it includes maths. (Yr8 student)

I enjoy it when you're not just listening, you're doing experiments and practicals and things like that. (Yr 8 student)

Students who indicated that they disliked physics found some physics topics or scientific language difficult to understand or disliked lessons where they were mostly listening to a teacher.

Some of the topics are quite easy and some of them are hard. Like in Year 7 when I had to do this homework for revision I didn't get it. I read my sister's text book and it made it slightly easier. (Yr8 student)

To be honest it's kind of boring but it's also if you understand it, because some of the words they're words I don't understand and sometimes the teachers they don't really explain it so that you understand it. (Yr 8 student)

It's just really boring because we just do lots of listening and labelling and we don't do tasks which I prefer doing like in Spanish. (Yr8 student)

When discussing whether or not they felt involved in physics, students cited enjoyment and being able to understand topics as reasons for feeling involved.

I'm involved in physics because I answer questions and focus on the work very well. I enjoy it more. (Yr8 student)

When explaining why they didn't feel involved some students compared physics to other subjects where they said they felt more involved because they understood those subjects better, including examples where, unlike physics, they had studied those subjects throughout primary school.

I don't feel involved because I don't understand it. (Yr8 student)

I feel more involved in English because it is the language we speak and we've learned it since we were younger. (Yr 8 student)

Some focus group participants commented on how they found science and physics to be more engaging and enjoyable outside school, because they felt under less pressure to show interest.

Because when you're in a class you have to learn it but when you're outside you get to learn what you want. In class it's more intense, like you have to get this knowledge to pass the tests. But if you're outside you don't need to have that knowledge. You can have the knowledge if you want and it's if you want to do it. (Yr8 student)

Because outside of school like I don't get forced to do it, but when my friends are talking about space I kind of want to know what they're talking about and like when they're doing their homework and stuff I like helping them. But then as soon as I come into school I just can't be bothered anymore. (Yr8 student)

Other students did not think that exploring science or physics outside the classroom was something they did or were likely to do.

Yeah well I'm not really into doing it outside, I don't really like to study outside of school or outside of education. (Yr8 student)

2.2.3. Jobs with Physics

Year 8 students were asked to list jobs where they thought they would use physics or would be able to do with physics. The six most common job types based on their answers are ranked here along with the proportion of students who selected each type.

Table 6: Types of job where Yr 8 students think physics would be useful

Rank	Job type	Proportion of Yr 8 students
1	Scientist (not specifically a physicist)	65%
2	Engineer	54%
3	Astronaut/work for NASA	35%
4	STEM teacher (inc. physics teacher)	33%
5	Healthcare professional (e.g. doctor, nurse, paramedic)	26%
6	Physicist	24%

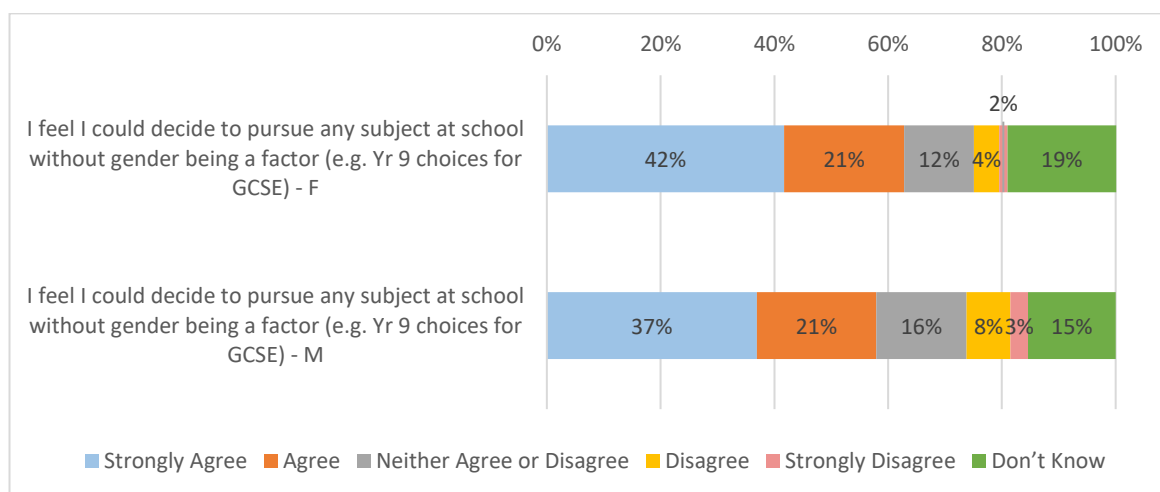
2.2.4. Gender and subject choices

The table and graph overleaf show there was no significant relationship between a subject's gender and students feeling they could pursue any subject at school without gender being a factor. Although not statistically significant when compared using the Pearson chi-square test, slightly more females (62.8%) than males (57.9%) agreed or strongly agreed that 'I feel I could decide to pursue any subject at school without gender being a factor (e.g. GCSE choices)'.

Table 7: Yr 8 students’ baseline feelings about freedom to choose subjects

Statement	Gender	Strongly agree	Agree	Neither	Disagree	Strongly Disagree	Don't know	P value
I feel I could decide to pursue any subject at school without gender being a factor (e.g. Yr 9 choices for GCSE) n=399	F	41.7%	21.1%	12.3%	4.4%	1.5%	19.1%	0.37
	M	36.9%	21.0%	15.9%	7.7%	3.1%	15.4%	

Fig. 3: Graphical representation of Yr 8 students’ baseline feelings about freedom to choose subjects



Most focus group participants felt that they could pursue any subject regardless of gender, with fewer disagreeing. When students did disagree this often led to some fervent debate

I very much disagree with [name of student] because I think that girls can do things as much as boys can, if not girls can do better. It's a bit sexist to be honest if you think that girls can't be as athletic as boys or cannot be as smart as boys because they're girls. (Yr8 student)

I disagree with her because people who are doing like an experiment in a science class and something was going to explode, girls are more likely to move to the back and the boys are more likely to come forward to see. But when it comes to book work the boys might not want to do it but the girls are going to be a bit more like – yeah they're going to want to do it and the boys aint because they like to be active. So when it comes to PE I think we all can do the same thing because we've all got legs and we've all got arms. (Yr 8 student)

Well but as much as we all have legs and arms we also have brains, because it doesn't matter because not all boys – for example there's a lot of boys in my class that like English as much as girls and there's a lot of girls in my class that like science as much as boys so it's kind of not a thing. (Yr8 student)

2.2.5. Experiences of gender stereotyping

Year 8 focus group participants discussed experiences where they had been put off from doing something because of their gender. A common response was linked to PE or different sports, with girls most likely to complain that they did not have opportunities to take part in the same sports as boys.

I've been put off by a lot of things like if a group of boys are like playing football and then I come into the cage to play with them, they'll be like "Girls can't play football." And because they said that to me and they're a group of boys, they think that because I'm a girl I can't play and then it ended up that I could play and then it just shut them up, yeah. (Yr8 student)

I know that at school when we do sports day, some of the races, one of the races the girls aren't allowed to, because it's 300 metres and only the boys do it. Boys and girls do like 100 metres and 800 metres and other competitions. I'll ask "why can't girls do the 300 metres?" and no one can give me like a good answer. (Yr 8 students)

Some girls and boys said they did not want to do sports or physical activity that they can't do because they are seen as traditionally male or female.

Yeah I feel like that as well because if like a boy's going to dive in mud if they're playing roughly, I honestly would not go and dive in the mud. I wouldn't do rugby even if I could. (Yr8 student)

Netball, yeah only girls do netball. I play basketball. No I wouldn't do netball, I've done it but I won't do it because I can't bounce the ball in it. (Yr8 student)

Another aspect of school where students were most likely to report that they encountered gender stereotyping was being told-off for bad behaviour. Male and female students noted how male and female teachers tended to address bad behaviour differently for boys and girls.

Then in class sometimes the boys get let off more than the girls do, because when the girls get into trouble they get told off way more than the boys do. That's male and female teachers that tell the girls off more. And I don't think that's just about behaviour so because the boys, they're worse, their behaviour's worse but we will do something small, like really small, not as bad as the boys and we'll get told off way more than they do. (Yr8 student)

Like in the dinner queue you really notice that teachers shout at the boys way more than us. Like we can be doing the same things – pushing in. And the boys when they do it they get told off like so everyone knows they're being told off. (Yr8 student)

Female and male students also mentioned parts of their lives outside school where their gender had been a factor in what they'd been allowed to do or felt comfortable doing. For example, a female student said:

When I was a bit younger I used to go to like a lot of these clubs, and then my friends didn't know about them and then some of them was mostly boys, because I used to do sports and stuff and then one of my friends found out and they were just like "Ha, ha, you play with boys," and everything. And then like they kind of matured as they got older but like sometimes it still didn't go away. (Yr8 student)

A male student commented on an example of stereotyping by their sibling:

When I first came to London or England, my sister came before me, like a month before me so she was already going to school and when I started going to school it was next to my sister's school so I had to go with her, but she always used to go with her friends but she never like let me speak with anyone, she always used to push me apart from her friends because they were all girls and so I just kind of got used to it. (Yr8 student)

A female student also described an example of sibling gender stereotyping:

But I asked them again and they said no you can't go because it's all boys but it's not really fair because they're my family even if they are all boys. And even all like the girls in my family, the never ever like – if they go out, there's like no boy from my family there and if my brothers ask them to come it's like "No it's all girls so you can't come." But it's not fair because it doesn't matter

about your gender, especially if you're family because you're meant to hang out with your family and they separate each other from everything that they do. (Yr8 student)

2.3. Year 12 students' baseline views

Seven female and eleven male Year 12 students from two schools completed a baseline e-log after or before their introductory session to Shattering Stereotypes. All were studying at least one science subject and 72.2% (13) were studying physics A-level, which is not surprising since the Year 12 role in Shattering Stereotypes was introduced as 'Physics Ambassador'. As a consequence of the 'Physics Ambassador' tag, one of the schools represented in this feedback recruited only from students who were studying physics. In the other school, half the students, all of which were male, were studying physics. None of the Year 12 students reported that they had been involved in any gender equality activities or initiatives prior to Shattering Stereotypes.

2.3.1. Personal expectations

Around three-quarters of Year 12 students expected Shattering Stereotypes to have some form of impact on them, with the others not anticipating any personal impacts. These expected impacts could be grouped into three main themes, as shown in the table below. Around one-quarter of students described impacts in each of these themes.

Table 8: Yr 12 students' expected personal impacts

Theme	Yr 12 student's example
Develop skills/ enhance CV	<i>I hope I am of use to other people and I can develop my own skills whilst helping others.</i> <i>Good mark on my CV.</i>
Learn about gender equality	<i>Enlighten myself on the importance of gender equality in science etc.</i> <i>Informing me more on possible gender inequality. I will be able to understand stereotypes better.</i>
Promote equality in STEM or STEM generally	<i>Motivate and teach others that anyone can take part in STEM subjects no matter your gender, there should be no boundaries for anyone because of gender stereotypes etc.</i> <i>Open up my interest to other students and try to influence them to choose science career.</i>

2.3.2. Expected impacts for others

Year 12 students were also asked about expected impacts on Year 8 students and at a whole school level. Around three-quarters thought that the main impact for Year 8 students would be on their interest and motivation to study STEM subjects or pursue STEM opportunities.

I understand the influence the older students have on the minds of the students in the younger years. I hope I can make them understand that science is a field everyone can enter. (Yr12 student)

Explore more science options. Influence them to choose science career. (Yr12 student)

That more students regardless [of] their gender will take physics as their GCSE and A-Level choice. (Yr12 student)

Other anticipated impacts for Year 8 students were learning about gender equality and discovering the full range of opportunities that are available to them.

Most Year 12 students also described impacts that they expected Shattering Stereotypes to have at a whole school level. The overwhelming response here was to increase the numbers of students taking STEM subjects, particularly physics or participating in STEM activities. In some cases female students were specifically mentioned.

More females will do STEM subjects especially Physics, as not many girls study the subject. (Yr12 student)

I hope to increase the number of participants who voluntarily take part in clubs and organisations related to science. (Yr12 student)

More students will study physics in general. (Yr12 student)

2.3.3. Opinions about the Year 12 introductory session

Most Year 12 students who had attended an introductory session reported that they found these sessions interesting and helpful. However there were some suggested improvements around being more specific about the activities that would form the pilot project; the content looking at male and female stereotyping equally; and the format being more interactive or involving the students more.

I thought it was a really good session, it really gave an insight into the focuses of Shattering Stereotypes and I liked the taster activities we did like the quiz to help us explore other career paths. It wasn't really clear what exactly we were going to do though, in terms of specific activities which we would help to carry out in the year as part of this scheme. (Yr12 student)

Overall it was good. It made us aware of the stereotypes in physics. It could have been improved by looking at both sides of stereotypes so looking at statistics to see why there are those stereotypes. (Yr12 student)

It was good, only the thing that might be improved is the number of activities that are included in introduction session. Try to become more involved with the students not just present but more interaction. (Yr12 student)

2.4. Summary – baseline position

- Most schools were taking part in Shattering Stereotypes to help address a gender imbalance in STEM subjects, particularly physics. Some also wanted to participate in a project that they felt would support their wider equality work or ambitions.
- The external nature of Shattering Stereotypes was thought to potentially strengthen the likelihood of it having any impact.
- Opportunities were identified to link Shattering Stereotypes to other areas where equality is addressed, specifically:
 - Equality work around LGBT, racism, faith etc.
 - Citizenship/PHSE curricula
 - Careers guidance
 - Non-curricular activities such as assemblies, community work etc.
- Parental opinions and portrayal of genders in the media and popular culture were thought to have a significant influence on school students' views around stereotypes and are outside a school's influence.
- Having good STEM role models within schools were deemed important as students encounter these every day.
- There is scope for schools to do more around their analysis and use of gender disaggregated data about subject choices and progression.
- Male Yr 8 students were statistically more likely than females to think 'physics is for me. There was no significant relationship between gender and thinking 'physics is for girls' or 'physics is for boys', where in both cases females were slightly more likely than males to agree.
- Not all Yr 8 students were familiar with the term 'physics' or knew what topics in science are physics. Those who liked physics or felt involved in physics were most likely to understand lessons.
- Male Yr 8 students were statistically more likely than females to think 'physics is interesting' or 'I am good at physics'. There was no significant relationship between gender and thinking 'physics is difficult', feeling 'involved in physics lessons' or being likely 'to study physics after age 16'.
- Yr 8 students think that the jobs where physics is useful or that require physics are scientist, engineer and astronaut/work for NASA.
- Although not statistically significant, slightly more females than males agreed or strongly agreed that 'I feel I could decide to pursue any subject at school without gender being a factor (e.g. GCSE choices)'.
- Yr8 students could identify gender stereotyping within and outside school and displayed a good level of baseline understanding of the concept.
- Most Yr12 students were taking part in Shattering Stereotypes to develop their skills or CVs, to learn about gender equality or to promote STEM subjects to younger students of all genders.
- Most Yr12 students expected Yr8 students would become more interested or motivated through Shattering Stereotypes to study STEM subjects, which would impact at the whole school level on numbers of students taking these subjects.
- Yr12 students found the introductory session interesting and informative, but felt it should provide more information about exactly what they would be delivering throughout the pilot, be more balanced in terms of content and more interactive in terms of format.

3. Year 8 students ‘before’ and ‘after’ comparison

Year 8 students were the primary target audience for Shattering Stereotypes. This section compares responses to a set of nine indicator questions (see Appendix A) that were captured before the first workshop and at the end of the pilot from 114 Year 8 students who took part in Shattering Stereotypes activities. All these students participated in the first gender workshop and the communication challenge. A careers event was held at one school attended by eight of this cohort of students, although it is not known if any of them went to the careers session.

The participating students’ before and after responses to every indicator question are documented in full in Appendix B, and the tables below present the percentages of respondents who strongly agreed or agreed with each indicator statement. Before and after data were compared for the whole participating cohort and for participating male and female students. There is also an analysis of personal views about physics from students who participated in focus groups in two schools at the start and end of the pilot.

It is important to note that any shifts cannot be attributed directly or solely to Shattering Stereotypes but may reflect students’ general experiences during Year 8.

81 students who did not take part in Shattering Stereotypes also completed before and after questionnaires and section 3.4 presents the data for this non-participating cohort of students alongside the equivalent data for the participating cohort.

3.1. Physics and me & physics and gender

Across the cohort of Year 8 students who participated in Shattering Stereotypes the percentage that agreed or strongly agreed ‘Physics is for me’ increased by 3.4% between the start and end of the pilot, but remained at under one-quarter. The increase for male students was 9.8% and for females the number fell by 1.7%.

The percentage of all students who agreed or strongly agreed that ‘Physics is for girls’ increased by 6.1%, but remained at less than one-half overall. The increase for females (+7.4%) was slightly higher than that for males (+5.9%).

The percentage of all students who agreed or strongly agreed that ‘Physics is for boys’ stayed the same at 46.5%, with the percentage of females falling by 1.6% and the percentage of males increasing by 2.0%. None of these before vs after changes or gender variations were statistically significant when compared using the Pearson chi-square test.

Table 9: % of Participating Yr 8 students agreeing with statements about physics and gender before and after Shattering Stereotypes

Agreed or strongly agreed with statement	All participating students (n=114)		Participating female students (n=63)		Participating male students (n=51)	
	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>
Physics is for me	21.1%	24.5%	19.1%	17.4%	23.5%	33.3%
		+3.4%		-1.7%		+9.8%
Physics is for girls	37.8%	43.9%	43.4%	50.8%	29.4%	35.3%
		+6.1%		+7.4%		+5.9%
Physics is for boys	46.5%	46.5%	52.4%	50.8%	39.2%	41.2%
		same		-1.6%		+2.0%

3.2. Attitudes and intentions towards physics

Applying the Pearson chi-square test showed that for all students and female respondents only, the percentages who agreed or strongly agreed 'Physics is difficult' increased at the end of the pilot by amounts that were statistically significant⁸. For all students the percentage increased by 21.1%, rising from one-third to over one-half. The percentage for females increased by 26.9% from just over one-quarter to over one-half. The increase for males was 13.7%, which was not statistically significant.

Other than the above exceptions, applying the Pearson chi-square test showed that none of the before and after changes in percentages or gender variations were statistically significant for this group of indicator statements.

For all other statements in this group, the increases or decreases across the whole participating cohort were less than 5%. However, there were some interesting gender contrasts. The percentage who indicated that they thought 'Physics is interesting' fell by 7.9% for females and increased by the same percentage for males. Similar shifts occurred for 'I am good at physics' and 'I feel involved in physics lessons', where the respective figures for females were decreases of 4.7% and 9.5% and for males were increases of 4.0% and 7.8%.

The percentage for females increased only in one case: up 4.7% for 'I am likely to study physics after age 16'.

Table 10: % of participating Yr 8 students agreeing with statements about feelings towards physics before and after Shattering Stereotypes

Agreed or strongly agreed with statement	All participating students (n=114)		Participating female students (n=63)		Participating male students (n=51)	
	Before	After	Before	After	Before	After
Physics is interesting	47.3%	46.5% -0.8%	44.4%	36.5% -7.9%	50.9%	58.8% +7.9%
Physics is difficult	33.3%	54.4% +21.1%**	27.0%	53.9% +26.9%**	41.2%	54.9% +13.7%
I am good at physics	27.2%	22.8% +4.4%	23.8%	19.1% -4.7%	31.4%	27.4% +4.0%
I feel involved in physics lessons	43.9%	42.1% -1.8%	44.4%	34.9% -9.5%	43.2%	51.0% +7.8%
I am likely to study physics after age 16	21.1%	23.7% +2.6%	17.5%	22.2% +4.7%	25.5%	25.4% -0.1%

** denotes significant at the 99% confidence level

⁸ Comparison of before and after data using Pearson chi-square test

3.3. Gender and subject choices

Before Shattering Stereotypes 'I feel I could decide to pursue any subject at school without gender being a factor (e.g. Yr 9 choices for GCSE)' was the only statement where the percentage of students who agreed or strongly agreed was in excess of 50%. The baseline figure of 61.4% increased by 7.9% for all students after the pilot, with the increase for females (+11.1%) being higher than that for males (+3.9%).

None of these before vs. after changes or gender variations were statistically significant when the Pearson chi-square test was applied.

Table 11: % of participating Yr 8 students agreeing with a statement about gender not affecting subject choice before and after Shattering Stereotypes

Agreed or strongly agreed with statement	All participating students (n=114)		Participating female students (n=63)		Participating male students (n=51)	
	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>
I feel I could decide to pursue any subject at school without gender being a factor (e.g. Yr 9 choices for GCSE)	61.4%	69.3% +7.9%	63.5%	74.6% +11.1%	58.8%	62.7% +3.9%

3.4. Comparison with before and after responses for students who did not participate in Shattering Stereotypes

This section presents data for all the non-participating cohort of students who completed both the before and after questionnaires alongside the equivalent data for the participating cohort of students.

Physics & me and gender

Although not statistically significant when applying the Pearson chi-square test, there was an increase of non-participating students who agreed or strongly agreed with the statements about physics and gender before and after Shattering Stereotypes, with the greatest increase of 9.9% agreeing or strongly agreeing with the statement 'physics is for me'.

Table 9: % of participating and non-participating Yr 8 students agreeing with statements about physics and gender before and after Shattering Stereotypes

Agreed or strongly agreed with statement	Participating (n=114)		Non-participating (n=81)	
	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>
Physics is for me	21.1%	24.5% +3.4%	22.2%	32.1% +9.9%

Physics is for girls	37.8%	43.9% +6.1%	32.1%	39.6% +4.8%
Physics is for boys	46.5%	46.5% same	38.3%	40.7% +2.4%

Feelings and attitudes towards physics

The percentage of non-participating students agreeing with statements about feelings towards physics before and after Shattering Stereotypes shows both positive and negative shifts.

The most notable of these changes is in response to the statement 'physics is difficult'. This was statistically significant at an increase of 21.1% for the participating students, however, the same statement saw a decrease of 13.6% for non-participating students. One third of participating students and almost two thirds of non-participating students agreed or strongly agreed with this statement before Shattering Stereotypes. The relative increase and decrease after Shattering Stereotypes resulted in around half of both participating and non-participating students agreeing or strongly agreeing with this statement.

Table 10: % of participating and non-participating Yr 8 students agreeing with statements about feelings towards physics before and after Shattering Stereotypes

Agreed or strongly agreed with statement	All participating students (n=114)		All non-participating students (n=81)	
	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>
Physics is interesting	47.3%	46.5% -0.8%	44.5%	58.0% 13.5%
Physics is difficult	33.3%	54.4% +21.1%**	61.7%	48.1% -13.6%
I am good at physics	27.2%	22.8% +4.4%	19.7%	19.7% same
I feel involved in physics lessons	43.9%	42.1% -1.8%	38.3%	44.4% +6.1%
I am likely to study physics after age 16	21.1%	23.7% +2.6%	19.8%	32.1% +12.3%

Gender and subject choices

As shown overleaf, the percentage of students feeling that they could decide to pursue any subject at school without gender being a factor increased for both participating and non-participating students after Shattering Stereotypes. Although not statistically significant using the Pearson chi-square test, there was greater increase within the non-participating cohort. However, when comparing the percentages of participating and non-participating students agreeing with the statement after Shattering Stereotypes, they are similar at 69.3% and 66.6% respectively.

Table 11: % of participating and non-participating Yr 8 students agreeing with a statement about gender not affecting subject choice before and after Shattering Stereotypes

Agreed or strongly agreed with statement	All participating students (n=114)		All Non-participating students (n=81)	
	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>
I feel I could decide to pursue any subject at school without gender being a factor (e.g. Yr 9 choices for GCSE)	61.4%%	69.3% +7.9%	49.3%	66.6% +17.3%

Although it is difficult to make direct comparisons between the participating and non-participating as the number of students for each cohort is different, the data suggests that multiple factors influence students' perceptions of physics during Yr 8.

3.5. Focus group feedback pre- and post- pilot

A sample of students in two schools provided focus group feedback before and at the end of the pilot project. They completed personal meaning maps, in which they were asked to write the phrase 'Physics and me' on the centre of a piece of paper and write down everything they could think of that they associated with this phrase.

A category analysis of students' maps showed that before and after the pilot, almost half of all comments from male and female students described positive feelings about physics. Before and after around one-fifth of comments described negative feelings or opinions. Around one-quarter of comments on maps completed before Shattering Stereotypes were simply physics terms or topics, such as forces, soundwaves or planets and just under one-fifth of comments at the end of the pilot fell into this category.

References to gender and physics were found in just under one-tenth of comments before Shattering Stereotypes and around one-sixth at the end. Before, most comments from female and male students indicated that they thought physics is equally for both genders.

It's for everyone, any gender (Yr 8 student before)

Explosions are not just for boys to like. Girls can like explosions as well equally. Both genders can like physics. (Yr8 student before)

I think it's for everybody (Yr 8 student after).

Comments from males and females at the end of the pilot were more likely to indicate that some students felt physics was more for males than females.

Seems more like for boys. (Yr 8 student before)

Not a lot of girls want to do physics. (Yr 8 student after)

The stigma that 'it's only for boys, not girls' needs to be broken. (Yr 8 student after)

Examples of negative and positive comments about 'physics and me' are given in table 12. Most of the positive comments highlighted the practical nature of physics, enjoyment of particular topics or generally enjoying physics lessons. There were also some references to the usefulness of physics. Most of the comments categorised as negative expressed the view that physics as a whole or particular physics topics were thought to be difficult or uninteresting.

Table 12: Yr 8 students positive and negative comments about ‘physics and me’ before and after Shattering Stereotypes

	‘Before’ examples	‘After’ examples
Positive views about physics & me	<p><i>You do very different activities to other lessons, which I enjoy and I always get involved.</i></p> <p><i>It is interesting I always get involved in physics lessons.</i></p> <p><i>I like physics – particularly love space.</i></p> <p><i>I like doing the physics equations because it includes maths.</i></p> <p><i>I love experiments and practicals.</i></p>	<p><i>I enjoy the study of forces in physics.</i></p> <p><i>Physics is a really fun subject because you learn new things and you also do practicals that are fun as well.</i></p> <p><i>I think we should learn a bit more physics because I think it is quite interesting.</i></p> <p><i>It is what helps us to have everyday life.</i></p> <p><i>I like learning how forces are used in everyday life.</i></p>
Negative views about physics & me	<p><i>I think it is all quite boring.</i></p> <p><i>I don’t find it that interesting.</i></p> <p><i>I am not a big fan of it, it’s tricky and boring.</i></p>	<p><i>I find each physics subject tricky at first. It is definitely not my favourite subject.</i></p> <p><i>I personally find physics quite difficult, it’s hard to understand.</i></p> <p><i>I enjoy biology but I find physics boring.</i></p>

Students whose maps showed changes to their views about physics after Shattering Stereotypes were prompted to explain those changes. The main explanation for becoming more positive was a better understanding of physics or finding it easier.

I think I’m more able to do physics now, because I understand more about physics, more than I did before. (Yr8 student after)

It hasn’t been because of [Shattering Stereotypes]. I like it more now because I understand it and I didn’t before because we hadn’t really done much physics before. (Yr8 student after)

A few students thought physics had become harder throughout the year, but were not sure why, other than finding topics more difficult than the physics they’d studied in Year 7 or at primary school.

I loved it all at primary school but now some topics are cool and some topics are boring. (Yr8 student after)

We are focusing more on different physics now and I need more support as a lot of it is quite hard. (Yr8 student after)

3.6. Summary – Yr8 students ‘before’ and ‘after’ comparison

- Any shifts cannot be attributed directly or solely to Shattering Stereotypes but may reflect students’ general experiences during Year 8.
- There was an increase between the start and the end of the pilot from 21.1% to 24.5% in students thinking ‘Physics is for me’. The figure for female students fell by 1.7% and for male students increased by 9.8%
- Changes in indicators for all students were not statistically significant with the exception of thinking ‘Physics is difficult’ where there was an increase from 33.3% to 54.4% across both genders. The increase for female students was also statistically significant at 26.9%, whereas the increase for male students of 13.75 was not significant.
- Before Shattering Stereotypes 61.4% of students (63.5% of females and 58.8% of males) agreed with the statement ‘I feel I could decide to pursue any subject at school without gender being a factor’. The overall figure increased by 7.9% after the pilot, with the increase for females being 11.1% to 74.6% and for males being 3.9% to 62.7%. None of these changes or gender variations were statistically significant.
- Almost half of feelings expressed about ‘Physics and me’ before and after Shattering Stereotypes were positive and highlighted the practical nature of physics, engaging topics or generally enjoying physics lessons. Negative feelings were attributed to physics as a whole or particular topics being difficult or uninteresting.
- There were mixed views among male and female students about whether physics is gender neutral or appeals more to boys than girls.

4. Stakeholder opinions about Shattering Stereotypes

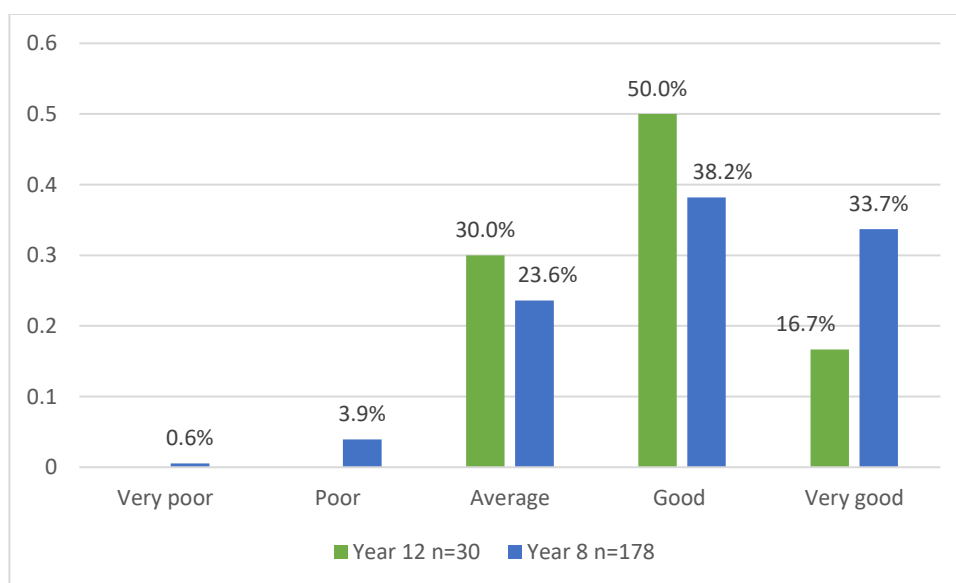
This section features stakeholder opinions about Shattering Stereotypes activities and the project as a whole. The first part is based on feedback from Year 8 and Year 12 students. The second and third parts present the views of teachers and the SEPnet project team.

4.1. Student ratings and opinions of Shattering Stereotypes

4.1.1. Delivery of Shattering Stereotypes

Overall, most students rated Shattering Stereotypes positively in their responses to an end of pilot questionnaire, with 66.7% (20) of Year 12 students and 71.9% (128) of Year 8 students rating it above average.

Fig. 4 Yr 8 and Yr 12 students' ratings of Shattering Stereotypes



It should be noted that many Year 8 students' explanations for their ratings suggest that they were basing their opinions on the communication challenge activity. This is unsurprising as the time lapse between the first workshop and the end of pilot feedback was at least six months and most of these students were attending schools where the spring term careers event did not take place.

The most common explanation for Year 8 students' positive ratings was the significance of the subject matter, including the relevance of gender stereotyping to them and others.

Because it tells us how not to judge girls and boys with what they are 'expected' to do. (Yr8 student)

I think shattering stereotypes is a good thing. It is not equal and is unfair to tell someone what they should do, like and wear depending on their gender. (Yr8 student)

I think it's a good idea because boys and girls should be able to do what they want without stereotypes holding them down. (Yr8 student)

It made me realise that a lot of women don't pursue a job in the field of physics. It also made me realise that I can do whatever I want and the stereotypes shouldn't take hold of my future. (Yr8 student)

The main explanation given for lower ratings were features of the communication challenge, such as the session being too long, a lack of clarity in instructions, lack of variety in tasks and some problems with team dynamics.

It was quite boring but the role plays were okay. I think it should have been 1 lesson instead of the whole day. (Yr8 student)

It started off well but lost its momentum and was too long. They should show us/do stuff with us that the school can't by itself. (Yr8 student)

I thought it was an interesting experience but we had quite a few sheets handed out that were confusing and if we were put in our own chosen groups of people would have worked better. (Yr8 student)

It was interesting however it could've been more fun and in depth. You could have had more different activities. Also you made the students judges and some weren't fair. (Yr8 student)

Year 12 students who participated in focus groups described similar views, with the subject matter being highlighted as the main success factor and aspects of the format being suggested as areas for improvement.

Addressing the topic of gender stereotyping among younger students before they make GCSE subject choices was the most-commonly described success factor.

Conveying the importance and effects of stereotypes and an early age. (Yr12 student)

Being able to explain stereotypes surrounding subjects because it will allow these students to pick any GCSE option without thinking it has to be 'right' for their gender. (Yr12 student)

It's a good time to do it because hopefully when they realise how important it is not to stereotype people they will feel freer to choose whatever subjects they want to for GCSE. (Yr12 student)

Year 12 students' suggestions to improve Shattering Stereotypes were to expand the content to outside school life in all activities and, in terms of the format, to reduce the duration of the communications challenge, include more role models and incorporate a greater variety of activities.

It was too long -you only need half a day as no-one can concentrate for longer. Also don't let children judge others works as this give them an opportunity to be personal and friendship groups may imbalance the outcome. (Yr12 student)

Maybe have some role model speakers that talk to children and give them real examples of the consequences of stereotyping. The instructors could talk more about their experiences and field of interest not just give instructions about the tasks. (Yr12 student)

More different organised activities – children in Year 8 get rowdy and bored, give them different things to do or make it shorter it doesn't need a whole day. (Yr12 student)

4.1.2. Outcomes from Shattering Stereotypes

Year 8 students expressed in focus group discussions and interviews their views about any outcomes that Shattering Stereotypes had for them. They ranged from nothing to being more enlightened about opportunities not being constrained by stereotypical perceptions of gender.

Before I started this I had the idea that I wanted to do engineering and I'm still on that, but just this project it hasn't changed my mind but it has made me realise that women aren't restricted to nurses or – not like engineering or physics or anything. (Yr8 student)

I think it's changed my mind about doing physics as a GCSE, because my brother and my sister they didn't like it and it kind of put me off doing physics but as soon as I went on this – it's encouraged me to take it more. (Yr8 student)

I think I now know that boys might like girl things and girls might like boy things and you should just choose like whatever subjects or other stuff you like doing because you like it. (Yr8 student)

A further outcome was that some focus group students had already talked to their families or friends about gender stereotyping, or intended to speak to others about it.

I think it's somehow encouraged my family, because I've told them about this project and then my grandpa's are more like "Yeah everyone's equal here." And he's just telling the whole family everyone's equal. It's because they're like very traditional and I mean he has been doing more of what they call man work but he lets me do these things now. (Yr8 student)

I've talked to my friends about it, because they really want to come here. I'm the one that got chosen as one of the people in my class, so I've talked to them about it and I've talked to my mum about it. She thinks it's cool. (Yr8 student)

Well before, I didn't really think about it that much, I wouldn't have talked to my parents about it, but since today I think I've got more interactive with it and I would discuss it with more people. Because the more people know about it, the more it spreads around and we can stop the judging and we can stop the people from continuing to stereotype. (Yr8 student)

Year 12 students reflected on outcomes for them, for Year 8 students and at a wider school level. In terms of personal outcomes most students highlighted the opportunity to develop their transferable skills, particularly leadership or communication, or enhanced understanding of gender stereotyping.

My team work and leadership skills have grown. (Yr12 student)

I learned about organising groups and feel more confident in presenting points. (Yr12 student)

Made me more aware of the stereotypes surrounding us. (Yr12 student)

Made me able to get a more in depth perception of stereotypes and how they affect the workplace. (Yr12 student)

A small number said the project enabled them to help Year 8 students or had not delivered any personal impacts.

When describing outcomes for Year 8 students, Year 12 students emphasised learning about gender stereotyping in general and opening up options for subject or career choices.

These activities allowed the Year 8s to understand gender stereotyping. Before the activity they did not know what gender stereotyping was. (Yr12 student)

Showed them that anyone regardless of gender can do anything. Opened up options for them. (Yr12 student)

Taught them what gender stereotyping is. Can largely help them [Year 8 students] in choosing their future subjects. (Yr12 student)

Around half of Year 12 students felt that Shattering Stereotypes had not had any outcomes at a whole-school level, with some commenting that this was because it only focused on Year 8. Others suggested it had introduced the possibility to address stereotyping on a school-wide basis and a small number thought it had impacted on teachers' awareness of stereotyping and its implications.

It showed we need to improve everyone's understanding of the term stereotypes and what to do about it. (Yr12 student)

It showed teachers that they might be stereotyping without realising. (Yr12 student)

4.2. Teacher reflections on activities, project structure and processes

4.2.1. Project aims

Lead teachers echoed the views of head teachers and were supportive of a project to address gender stereotyping in schools. Year 8 was felt to be the right time to work with students on this issue as any later and they will have already formed opinions about gender and made subject option choices.

There was some confusion about whether primary purpose of Shattering Stereotypes was to address/reduce gender stereotyping or to equalise the gender balance in physics through greater understanding of physics career opportunities. It was also felt that the aim may have changed or shifted over the course of the pilot.

'I am just not sure that you can do both aims within the same project, as it dilutes what you are doing and can be confusing to students and us, particularly when you sometimes link it to physics and at other times don't'. (Teacher)

This dual aim created mixed messaging, which led to difficulties with promotion and engagement. One teacher suggested that numbers for the careers evening would probably have been greater if the event was called 'People Like Me' and pitched as a careers/subject options event.

This dual aim wasn't always seen negatively, however teachers generally felt that a clear distinction needed to be made as to whether the gender stereotyping was a leading aim with physics careers being a secondary objective.

'To make a point for physics I'd aim that to the year 12s, as opposed to the kids. You could touch on it, but if you're looking at gender and stereotypes, then add in physics careers, that could be a good selling point for that.' (Teacher)

All teachers highlighted their large workloads and busy environments and calendars in schools. These factors mean they need clear and simple aims and a comprehensive plan when being approached about any new initiative. A plan should include details of all activities, school input required and dates so that teachers are aware of exactly what is happening when and can allocate the resources needed in advance. Dates for autumn term activities should be booked in the summer term in the preceding school year, and dates for spring and summer should be booked before Christmas.

'you need a plan that includes achievement milestones as well as a list of activities, so you can see how each element relates to the aims' (Teacher)

4.2.2. Project structure

Having activities take place over a whole year was generally welcomed by teachers, however, the individual pilot activities were considered to be too far apart which meant the Year 8s may not have connected them together and lessened the likelihood of '*built learning and progression*' taking place.

'(The activities were) too far apart for there to be any reinforcement of messages and the whole structure was too discrete. It needed more cohesion across the activities' (Teacher)

Holding the first events closer together was suggested to help '*build momentum and create a platform for later stuff*', although as one teacher commented this could still happen on a termly basis, just at the end and start of sequential terms rather than being more spread out throughout the year.

'I think it could be closer together. Because obviously there's a lot going on in school and they (the Yr 8s) tend to forget, and sometimes they just don't want to do it any more because of whatever's happening. Whereas if it's, I don't know, if it's one every half term or at the end of the term but closer, so say it's end of (one term), beginning of (another term), quite close together, then it's still fresh in their minds. (Teacher)

Including activities and resource materials that teachers or Year 12s could pick up and deliver without SEPnet input, such as lesson starts or assemblies, was suggested as a strategy to improve continuity and to maintain momentum and reinforce messaging.

4.2.3. Delivery of Shattering Stereotypes activities

Teachers identified strengths and areas for development for each of the three main elements of Shattering Stereotypes, as summarised in table 13.

Table 13: Strengths and areas of development for each element of Shattering Stereotypes

	Strengths	Areas for development
Year 8 Gender Workshop	<p><i>People Like Me.</i> Both students and teachers were reported to be engaged with the People Like Me activity as it was personal. <i>'And then the People Like Me grid thing (...), I think the students were quite...it opened their eyes, "Okay, I can describe myself in different and I can do these types of careers." So that was quite interesting to look at that.'</i> (Teacher)</p> <p><i>Small group discussions.</i> Group work and discussions were seen as particular strengths with teachers reporting positively on the Year 8 students' involvement.</p>	<p><i>Clear Year 12 briefing.</i> Teachers highlighted the need for the Year 12 students to know exactly how to support Year 8 students otherwise <i>'they just wander around'</i>.</p> <p><i>Classroom management.</i> It was noted that the Year 8 students could, at times, become unsettled and that an Outreach Officer could be required to manage the room. It was felt that this could be alleviated by ensuring the presence of lead teachers, or other teachers, who understood the project and the structure of the workshop.</p>
Careers Event	<p><i>Activities.</i> It was observed that both Year 8 students and parents appeared to enjoy the activities, particularly People Like Me. The word cloud and unconscious bias messages were particularly memorable for one teacher.</p> <p><i>Presentation style.</i> One teacher commented positively on the inclusive presentation style used in this event.</p> <p><i>Meeting the scientists.</i> When meeting scientists, students wanted to know what different jobs entailed, e.g. asking scientists what do you actually do? This was in contrast to parents who were more interested in finding out about the qualifications needed for particular jobs/roles. One parent emailed a teacher saying they</p>	<p><i>Reaching 'less-engaged' parents.</i> Teachers reported that the careers evening engaged those parents who come to everything anyway and there was a feeling that the project needs to focus on reaching 'less-engaged' parents. <i>'even if it had gone ahead it wouldn't have got to the ones who need to hear about this'</i>.</p> <p><i>Addressing both girls and boys.</i> Although it was recognised to address both boys and girls in the session, one teachers observed that the boys may feel slightly uncomfortable when the presentation referred to girls in physics.</p> <p><i>Resourcing for after-school activities.</i> Teachers need to put in a large amount of work to deliver an activity out of school hours and it was felt that the numbers reached was not</p>

	<p>enjoyed the evening and had subsequently discussed the career opportunities it presented with their child.</p>	<p>reflective of this effort; <i>'So it's a lot to handle, it's a lot to ask for people as well because they've got their classes and then they have to come after school and... So I wouldn't recommend any after school stuff.'</i> (Teacher)</p>
<p>Communications Challenge</p>	<p>Providing messages about Stereotyping. Teachers felt the messaging about stereotyping was particularly strong in this activity, with one teacher suggesting that it could be the introduction session rather than the gender workshop. <i>'I think it's well organised and it's got a powerful message.'</i> (Teacher)</p> <p>Year 12s and Year 8s working together. In one school the relationship between the Year 12s and Year 8s was thought to be particularly successful. <i>'But I like the way it's planned though, because you have the sixth formers who are there for the younger years, and the younger years just work together.'</i> (Teacher)</p>	<p>Reduce activity length. The activity was considered too long and could be improved by reducing it to half a day maximum.</p> <p>Reduce the number of students. The activity may have more impact if it was run as a class activity with 30 students in groups of 5 or 6.</p> <p>More pace and structure. Potentially breaking down the session into a series of 20 minute tasks would maintain interest of Year 8s. <i>'Today was quite nice, but very quiet, if understand what I mean by quiet, so maybe if there were more discussions in between.'</i> (Teacher)</p> <p>Highlight physics roles. Providing a clear introduction about who is in the room from SEPnet and how their roles/experience relate to the project, e.g. introducing female physicists, would help support messaging.</p>

4.2.4. Outcomes for teachers and wider school

Teachers

Teachers reported that their own awareness of unconscious bias increased through their participation in Shattering Stereotypes.

'I am now more careful to use gender-neutral examples and carefully consider grouping of students for teamwork/group activities.' (Teacher)

The impact of Shattering Stereotypes also reached wider than lead teachers. Three teachers who came to one of the careers events were newly qualified and identified two personal impacts for themselves; the 'People like me' activity gave them ideas about their own potential strengths and weaknesses and potential career directions; and meeting scientists gave them information about career opportunities that they can share with students, specifically around opportunities within chemistry and physics that studying physics can provide.

One lead teacher mentioned how the pilot project raised awareness of gender stereotyping across their entire school.

'A lot of staff have heard about the project & I have had many interesting conversations. It has certainly raised awareness school-wide.' (Teacher)

Careers

One school reported an increase in enquiries about STEM related careers from the Year 8 girls in the school which they partly attributed to a previous event where they brought female role models working in STEM to the school, but also to Shattering Stereotypes.

'(The careers lead gets) more question on things like engineering. I've heard aeronautical, all that stuff, so that's quite popular at the moment..... I need to do research so I can answer their questions, but they're there, they're very positive, which I think this programme has helped them get...' (Teacher)

Year 12 students

Schools used different strategies to recruit Year 12 students. As previously mentioned in section 2.3 the term 'Physics Ambassadors' meant one school only recruited from their cohort of physics students, whereas another school cast the net wider to including science A-Level. One school successfully recruited Year 12 students from STEM subjects to support the communications challenge by highlighting the opportunity for them to develop skills through their participation.

'So the ones that wanted...because the way I marketed it, the way put it up on the board was leadership skills, just the types of skills that you may need in order to go on to university. And I think that worked well with them because they want to improve, because some of them are quite shy, and to work with the younger years and to, because they're a lot older as well, to put your opinion on that.' (Teacher)

In one school the interest from the Year 12 students fell away as the project progressed. It was suggested that this reduced interest and motivation may have occurred because these students were not clear at the outset about the purpose and details of what they were part of.

However, teachers observed a number of positive impacts for the Year 12 students who were involved in the activities; the main being managing a team and the development of facilitation skills in the communications challenge.

'And I told them that from the get-go, "You are in charge, so whatever happens if you want to shut it down you shut it down." And it was nice to see some of them do it. Obviously I'm teacher, I'm an adult, I'd be like, "Okay, stop, that's enough," and they'd understand. But the way the sixth formers did it was quite subtle, but the year 8s still got it. So it was nice to see them practise that.' (Teacher)

One teacher observed that a Year 12 student who came to a careers event found it particularly helpful to meet the 2nd year undergraduate student role models. They gave him an idea about different opportunities and stimulated him to think about what specific university courses and options he might take. He found this more directly relevant than discussions about jobs as studying at university is closer to the stage he is at now, and the undergraduate students are closer to him in age than most 'working' scientists. Having seen this positive reaction of this Year 12 to the undergraduate students, it was suggested that undergraduate students could be used during the Year 12 briefing.

This would help give the whole thing a context that is directly relevant to Year 12s in terms of relevant role models and content for university applications e.g. I met X from University Y and they inspired me to..... etc. (Teacher)

The value of this link to university and further studies was echoed by another teacher who suggested that in order to get Year 12 students involved and fully on-board they would need to see what they are getting out of a programme from the outset and understand how it can contribute to things that they deem important such as their UCAS application. At this school, Year 12 students are involved in

scheme delivered by the Engineering Development Trust⁹ where they work with a local industry on a project over the course of 6 months with key visits to school from engineers and off-site industry visits. The Year 12 students are committed to the project from the outset as they can see a clear programme of activities and exactly what skills they can gain from participation.

Involvement with SEPnet

Teachers were asked about any strengths a relationship with SEPnet brings to their school. Comments were mainly around the positive impact of visiting external speakers/scientists from universities and the provision of related resources for students.

'I think having people from the university come and speak to them, because me they see every day, (...) to an extent. But having someone come in and they actually pay serious attention.' (Teacher)

The significance of relevant resources and weight of external organisations was thought to also extend to parents.

'And having handouts, I think that's important as well because it's not from the school, it's from a university, so they actually pay attention and read it. And they can take it home as well and their parents can actually know what's going on, because some of these kids are like, "My mum wants me to do this, can I join this?" I'm just like, "How do you know about it?" "So and so gave me this leaflet." So I think that's important, having information given to me from [the university's] resources.' (Teacher)

It was noted that teachers and parents responded positively to the physicists who spoke at the careers events, although it was felt the visiting physicists who took in the communications challenge could have been made more visible and been more involved in proceedings as physicists and role models.

4.2.5. Opportunities for wider school involvement

Teachers saw potential in involving the wider school and could see advantages of embedding the message of gender stereotyping and unconscious bias across a school. One felt that if students were exposed to the main messages throughout the school year, then the activities with external speakers would have more of an impact.

'Because I think it would be a good idea if they (the students) had a background knowledge of it, and then this (activity) would just reinforce their knowledge. Whereas here they're learning on the spot and it's not enough sessions for them to actually have a lightbulb moment. Whereas if they had a background knowledge they'd be like, "Yes, Miss, I know," and then it would be more work getting done.' (Teacher)

Another teacher suggested that the project should focus on teachers and not students to have a greater impact across a school.

'it would be better to have staff and not students as the focus, as this could mean gender was integrated in all lessons and across everything the school does, rather than just focusing on a particular set of students, which is likely to reduce the potential for having impact across the whole school.' (Teacher)

Unconscious bias training for all staff would be one way to embed the main messages of the project across the school.

Some teachers welcomed plans for inclusion of Shattering Stereotypes within PHSE/Citizenship lessons (some schools deliver PHSE and others deliver the Citizenship curriculum). It was felt that such an approach would have the advantage of reaching more students as gender stereotyping is relevant for all subjects, not just physics.

⁹ <http://www.etrust.org.uk/ees/about-ees>

'you wouldn't be pigeon holing gender as something that is only important for STEM and girls. It is equally relevant to some arts subjects and boys, as well as things outside the curriculum.' (Teacher)

However, one teacher highlighted that working with PHSE in their school could be problematic as it is often delivered by cover staff which could mean the project would not have the relevant strong and permanent lead that is needed.

'So PSHE can be a good point, but it just depends on the day, the kids' mood, and the teacher. So that could be difficult, because I thought that was a good point to put it through there. But then again, a teacher may not understand what they're teaching, because different teachers, different subjects, that's another thing.' (Teacher)

4.3. SEPnet team reflections on activities, project structure and processes

Three SEPnet Outreach Officers and the Director of Outreach involved in the project were asked to reflect on the successes, challenges and impacts of Shattering Stereotypes for all stakeholders in this pilot year. This section also includes reflections from a SEPnet student ambassador who was involved in delivering the communications challenge in all three schools that took part in this activity.

As each Outreach Officer sits within their own host university they were asked to describe the impact on both themselves and their host institution. The main student, teacher and wider school outcomes identified by Outreach Officers mirrored those identified by teachers and reported in section 4.2.

4.3.1. Delivery of Shattering Stereotype activities

Outreach Officers identified differences between the schools in terms of their culture and how they operate. One notable example was at a school where it became exceptionally difficult to arrange activities as the lead teacher was in a senior position and so had little time to dedicate to the project.

The schools involved teachers who were not the lead teacher to help supervise all activities. This was particularly the case for the careers event and communications challenge due to staffing an out-of-hours event in the case of the former, and the large number of students involved in the latter. It was noted that, at times, these supporting teachers appeared to be unaware of the full aims and purpose of Shattering Stereotypes and so were not actively reinforcing the project messages.

The SEPnet project team identified very similar strengths and areas for development across each of the three activities as previously summarised for teachers in table 13.

In addition, Outreach Officers regarded active involvement of Year 8 students to be a particular strength of the communications challenge

'But I really think that it is a very, very good idea to have the students do a communications challenge, both for learning reasons, both for them and us, and also because this is something that gives them the chance to get more active in the project and take ownership of it.' (Outreach Officer)

Outreach Officers, like teachers, suggested that more could be done to highlight them as physics role models and make more of their own experience, both throughout the whole project and specifically within the communications challenge.

'I think one of the things we bring to it is that we can talk about, we understand some of the issues because we're quite close to it. Especially when you come on to talking about the lack of women going into STEM, we've been through that, so it's often much easier for people to explain about things when they've been in that situation.' (Outreach Officer)

'In the third activity physics was only mentioned in the end and for less than five minutes.' (Outreach Officer)

Members of the SEPnet project team commented on the length of time it took to deliver Shattering Stereotypes, particularly with regard to working with busy schools and recruiting graduate physics ambassadors for the careers event. It was felt that the effort needed to deliver the programme was not always proportionate to the impact on students and schools.

'Because I spent so much time chasing two of the schools, phoning them, emailing them, phoning them again, phoning them again, just trying to get them to pin down some dates.' (Outreach Officer)

As highlighted by the teachers, Outreach Officers noted that having a clear plan with agreed dates from the outset could help in quickly establishing the full programme of activities within schools.

It was felt that the existing resources from IOP and People Like Me needed contextualising for them to be relevant for Year 8 students and Shattering Stereotypes as a whole. Outreach Officers suggested that a move towards a more cohesive programme of activities may help to address this in the future.

4.3.2. Outcomes for Outreach Officers

The SEPnet project team described a number of main outcomes from working on the project which can be grouped into three main themes as summarised below.

Table 14: Outcomes for Outreach Officers from Shattering Stereotypes

Outcome	Example
Working as a team	<i>'it's been exciting to be part of something bigger and work with the others. It's the first time that they've sat down together and seen a plan emerging from a whiteboard. Experiencing this has influenced how I do things at (my host organisation). I've got a small team together to work in the same way as we did.'</i> (Outreach Officer)
Reviewing existing activities in terms of gender balance	<i>'Do you know, first of all I think that I'm reviewing what types of workshops I am delivering and trying to make them more gender balanced without, I think, putting Marie Curie in all of them.'</i> (Outreach Officer)
Embedding messages of Shattering Stereotypes into other activities	<i>'I did make a small session that I named it Follow your Heart, and it was not about physics but it was about understanding why we want to do what we want and why we should do it if that's the good thing for us, like stereotyping.'</i> (Outreach Officer)

4.3.3. Outcomes for SEPnet

One Outreach Officer described how their host physics department was concerned about the uptake of physics by girls and women and that Shattering Stereotypes was of particular interest as it has the potential to help address this issue.

'Yeah, when I started and a few times since he's (the Head of Department) said that that's one of the things that he's most interested in and with the outreach projects he's trying to promote girls into physics.' (Outreach Officer)

Shattering Stereotypes also allowed for a longer-term interaction with schools that is unlike other SEPnet activities delivered by Outreach Officers in schools, which tend to be one-off in nature. This longitudinal interaction has enabled the Outreach Officer to develop more in-depth relationships with both teachers and students than is usually the case.

'I think the good aspects have been is at some of the schools you build up a nice relationship... I feel like I went in there quite a few times because I did some things for the teachers as well, I felt like I really got a relationship and knew the teachers well and we both knew how to work with each other, that kind of thing. And some of the students remembered me from coming in before, which I thought was quite nice, and it's nice to come back to ideas that we'd introduced before and discuss them in more detail.' (Outreach Officer)

Although the discussion of gender stereotyping with Year 8 students was seen as one of the main strengths of the project, there was a question about whether SEPnet were in the best position to be leading those discussions or if other organisations that are focused on equality may be more appropriate.

SEPnet were planning to disseminate the findings of Shattering Stereotypes with a wider audience through the INTERACT¹⁰ conference in September 2017. It was felt that one of the strengths for Shattering Stereotypes is that it puts SEPnet in the leading role of actively developing a project and sharing the learning with the wider physics outreach community.

10

<https://www.iopconferences.org/iop/frontend/reg/thome.csp?pageID=641956&eventID=1102&traceRedir=2&eventID=1102>

4.4. Summary – stakeholder opinions about Shattering Stereotypes

Experiences

- Most Yr8s rated their experience of the project positively, with a focus on the communications challenge. They based their positive ratings on the significance of the subject matter, including the relevance of gender stereotyping to them and others.
- Outreach Officers welcome the opportunity provided by the project to work as part of a team and to be involved in building up a relationship with schools, as opposed to one-off activities. They appreciate the chance afforded by Shattering Stereotypes to share best practice and ideas with one another.
- Teachers valued external visits and having access to resources from universities.
- The active involvement of the Year 8s was deemed a particular strength of the communications challenge.

Outcomes

- Some Yr8 students reported that, following their involvement in Shattering Stereotypes, they now view future opportunities as not being constrained by stereotypical perceptions of gender
- Year 8 was felt to be the right time to work with students on this topic as any later and they will have already formed opinions about gender and made subject choice options.
- Year 12 students developed transferable leadership and communication skills through their participation in the communications challenge.
- Year 12 students need to be presented with a clear project plan from the outset so that they understand what to expect and what they can gain from their participation.

Opportunities for development

- There is potential for the Year 12 students to learn about studying physics and physics opportunities from University undergraduate ambassadors.
- Teachers need a clear project plan from the outset with a defined main aim plus clear information on individual activities, resourcing and key milestones and dates.
- Dates for activities need to be agreed with the school one to two terms in advance and in the preceding year for autumn term delivery.
- Activities need to be cohesive and presented as a year-long programme. This should include additional activities that the school can deliver themselves outside of external visits to maintain interest and momentum.
- Clear messaging and language for all stakeholder groups needs to be used throughout the project.
- All activities have strengths and areas for development and these should be reviewed to enhance individual activities and to develop a cohesive programme.
- There is potential to work with teachers to embed the messages of gender stereotyping and unconscious bias across a school.
- When working with a wider team of teachers, those teachers need to be fully on board with the project to ensure reinforcement of project aims and messages.

5. Learning and recommendations for SEPnet

This section draws out the main learning from the evaluation and suggests a number of recommendations for SEPnet to consider for the future development of Shattering Stereotypes.

5.1. Learning points

5.1.1. Project structure and planning

Shattering Stereotypes had relatively limited human resources. In order to make most effective and efficient use of those resources, the main aim of the project and its distinguishing features, e.g. delivery by physics-specific Outreach Officers and connection to universities, should inform all aspects of planning and delivery and when defining expected outcomes.

Yr8 is an appropriate time to introduce messages about gender stereotyping as it is before students make their GCSE subject choices. The Yr8 timetable can also offer the flexibility to accommodate activities delivered by external providers. However, it should be noted that at this stage the students are taught 'science' and may not necessarily know what is meant by the term 'physics', which needs to be recognised in the language used throughout delivery.

Teachers and Yr12 students would benefit from clear information at the outset, i.e. the start of the year, about everything that the Shattering Stereotypes pilot will entail and how they are expected to be involved. This will allow them to plan well in advance for activities and their own involvement.

Teachers think contact with undergraduate scientists is useful and particularly relevant for Yr12 students. Consideration could be given to deploying undergraduate scientists as role models, both within Shattering Stereotypes and other SEPnet schemes and offerings.

Interactions between Yr12 and Yr8 students can be very successful, but they require well-defined facilitation and for Yr12 students to be clearly briefed on their specific role and overall session aims.

One year is thought to be a sensible time frame for such a project with termly activities delivered by external visitors creating key points or scaffolding to provide structure for a programme of linked activities.

Activities need to be reviewed so that they provide a cohesive year-long programme of activity. Providing resources for teachers to use between Outreach Officer-led activities would help create continuity and enhance the impact on students involved.

Physics teachers are a natural entry-point for a gender stereotyping project as physics is a subject where post-16 choices are known to have a significant gender bias. They are also a natural match for physics-specific Outreach Officers. However, the project aims could be further embedded into the wider school by involving other relevant teachers e.g. PHSE/ Citizenship, careers, form heads.

When involving other teachers from across a school, they need to be fully aware and on-board with the project aims and purpose to help reinforce the key messages. Providing unconscious bias training was identified as a way of engaging other members of staff.

5.1.2. Delivery of activities

All activities delivered through the pilot have strengths and areas for development. Although it is recognised as a pilot, the time taken to arrange some activities is not proportionate to the outcomes for students and teachers involved. Therefore the delivery of activities should be streamlined, ensuring identified strengths are incorporated into new activities or events.

The active discussion by Yr8s in the communications challenge was seen to be a particular strength and provides a model that could be developed further.

Yr12 involvement should not be restricted to physics students. With this in mind, the use of the term 'Physics Ambassadors' should be reviewed and the transferable skills that can be gained from participation highlighted for all Yr12 students.

Whilst parents are an important audience, their engagement is difficult to secure and any Shattering Stereotypes activities may only connect with the most-engaged parents, or those who are already aware of gender stereotyping issues. It may be more realistic and easier for Shattering Stereotypes to focus within schools, i.e. other teachers, students and support staff, in order to widen the message.

5.2. Recommendations

Findings from this evaluation have highlighted a number of recommendations relating to the content, communication and future development of Shattering Stereotypes which are presented here as suggestions for consideration by the project team.

Content

R1: Review the Opening Doors report to identify those principles that are most closely aligned to Shattering Stereotype's objectives and SEPnet's strengths. Develop content that is consistent with those principles, which is likely to include Initiatives, Careers guidance & Student Ownership.

R2: Ensure key features of SEPnet are present throughout all activities, e.g. use of undergraduate ambassadors to promote messages about studying physics, capitalising on the experience of Outreach Officers and other physics graduates to explain career routes and progression opportunities.

R3: Develop a suite of activities (lesson starts or assemblies) that can be delivered by teachers and Yr12s throughout the year to support and reinforce a core programme of SEPnet-led activities. Teacher and Yr12 activities will require content materials and guidance for use.

R4: Review content of the separate elements of the programme, including where these link or overlap, to maintain focus and ensure a cohesive approach.

Communication

R5: Develop a clear schematic overview for all stakeholders, with accompanying more-detailed information for each stakeholder group (Yr12s, teachers) explaining their expected involvement and commitment throughout the project.

R6: Provide clear, simple messages and template documents to help wider engagement with the project i.e. Information for all school staff and parents/carers.

R7: Consider how to incorporate increased lead-time into the planning and communication process to optimise school commitment and engagement.

Future development

R8: Use academic year 2017/18 to revise and develop the programme and recruit schools for further test delivery in 2018/19.

R9: Consider working with a panel of teachers to ensure the programme is informed by their needs and experiences.

R10: Use strengths and areas of development identified in this evaluation to create meaningful, engaging activities that deliver impacts for all stakeholders.

R11: Ensure the key features of SEPnet are present across the programme, e.g. use of Undergraduate Ambassadors, using the experience of Outreach Officers and Physics Graduates.

R12: If the programme is to focus on gender stereotyping in general rather than gender and physics, review evaluation indicators to ensure they are more consistent with this aim.

6. Appendix A – Year 8 students ‘before’ and ‘after’ indicator questions

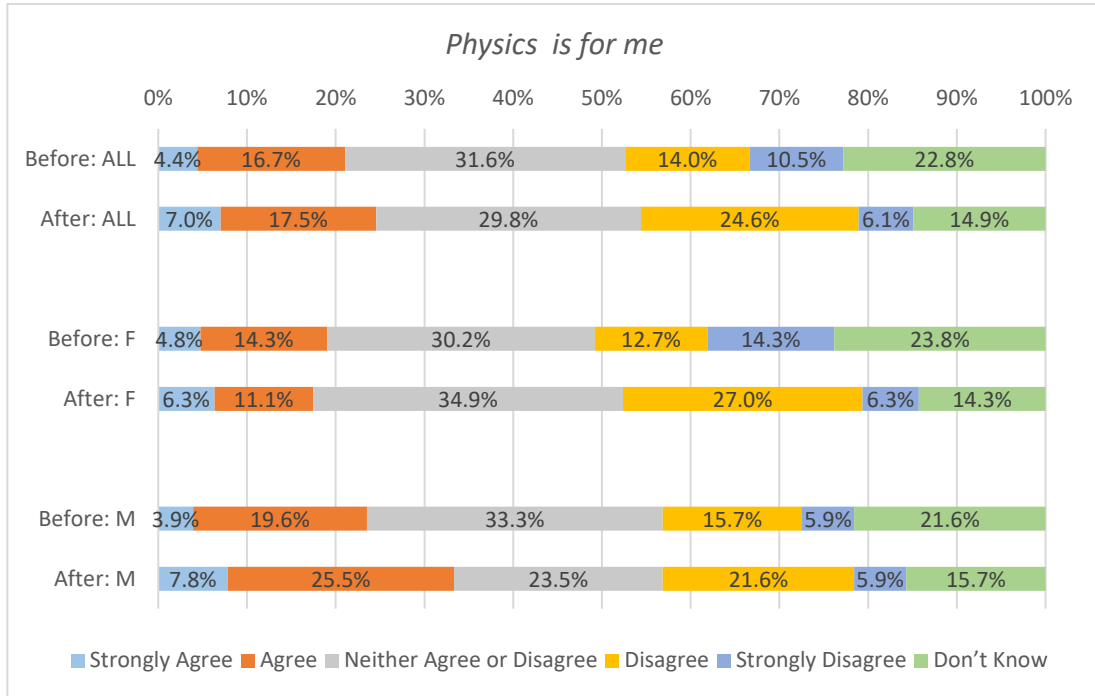
How much do you agree or disagree with the following statements?

	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree	Don't Know
Physics is for me						
Physics is for girls						
Physics is for boys						
Physics is interesting						
Physics is difficult						
I am good at physics						
I feel involved in physics lessons						
I am likely to study physics after age 16						
I feel I could decide to pursue any subject at school without gender being a factor (e.g. Yr 9 choices for GCSE)						

7. Appendix B – Year 8 Students’ pre- and post- pilot responses to indicator questions

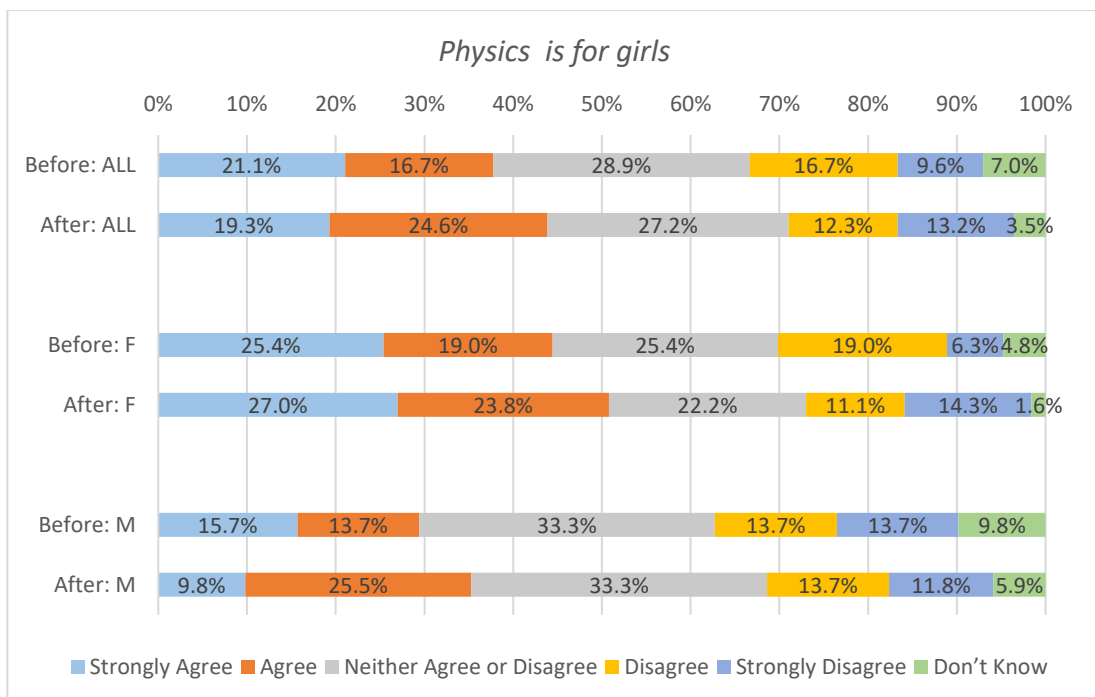
7.1. Physics is for me

Fig. 5: % of participating Yr8 students who agree or disagree that ‘Physics for me’



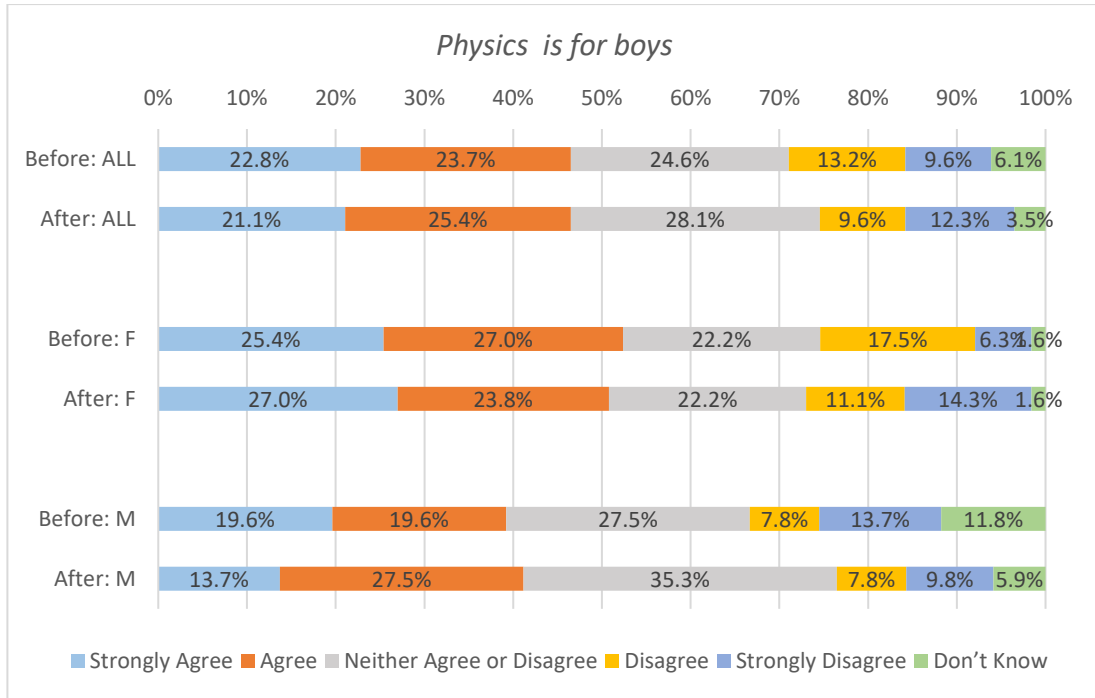
7.2. Physics is for girls

Fig. 6: % of participating Yr8 students who agree or disagree that ‘Physics for girls’



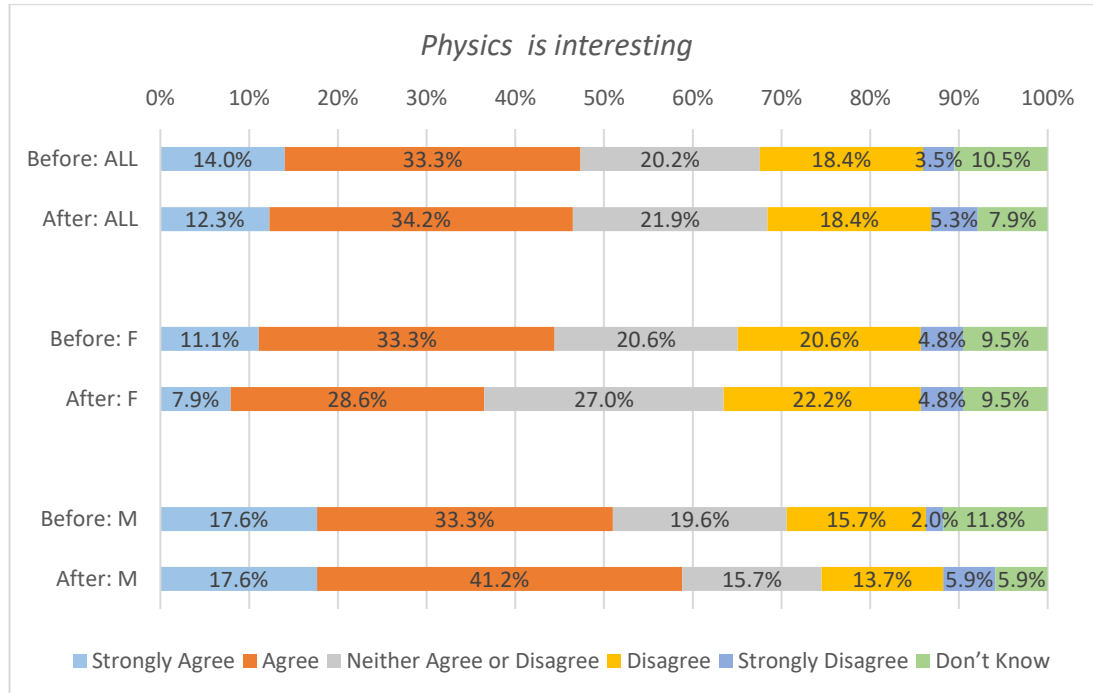
7.3. Physics is for boys

Fig. 7: % of participating Yr8 students who agree or disagree that ‘Physics for boys’



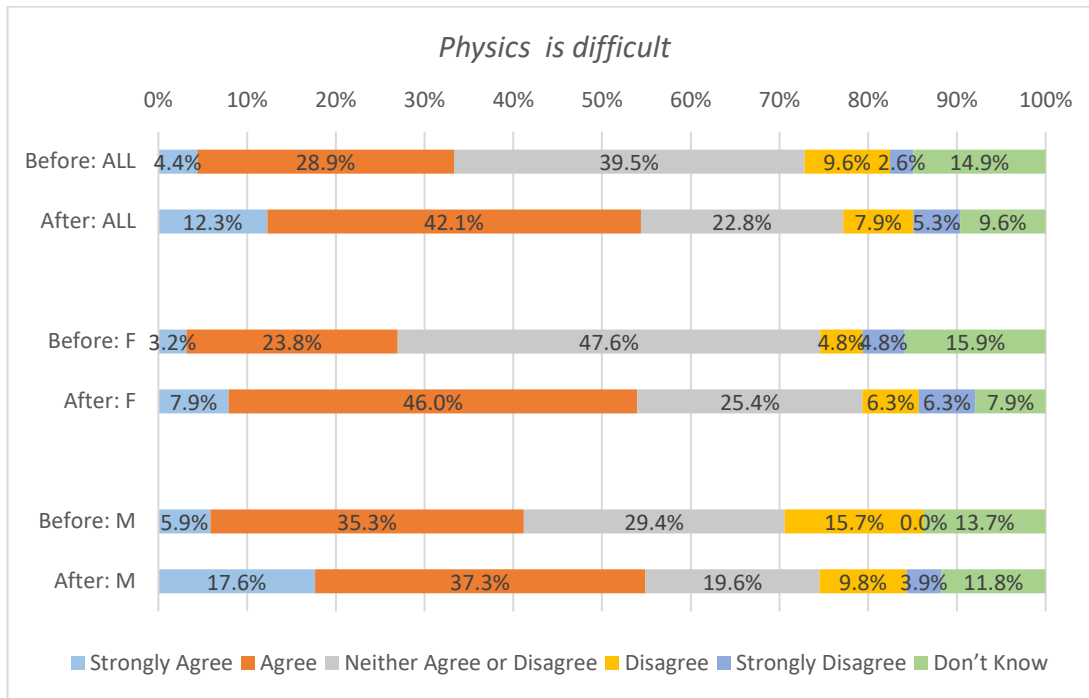
7.4. Physics is interesting

Fig. 8: % of participating Yr8 students who agree or disagree that ‘Physics is interesting’



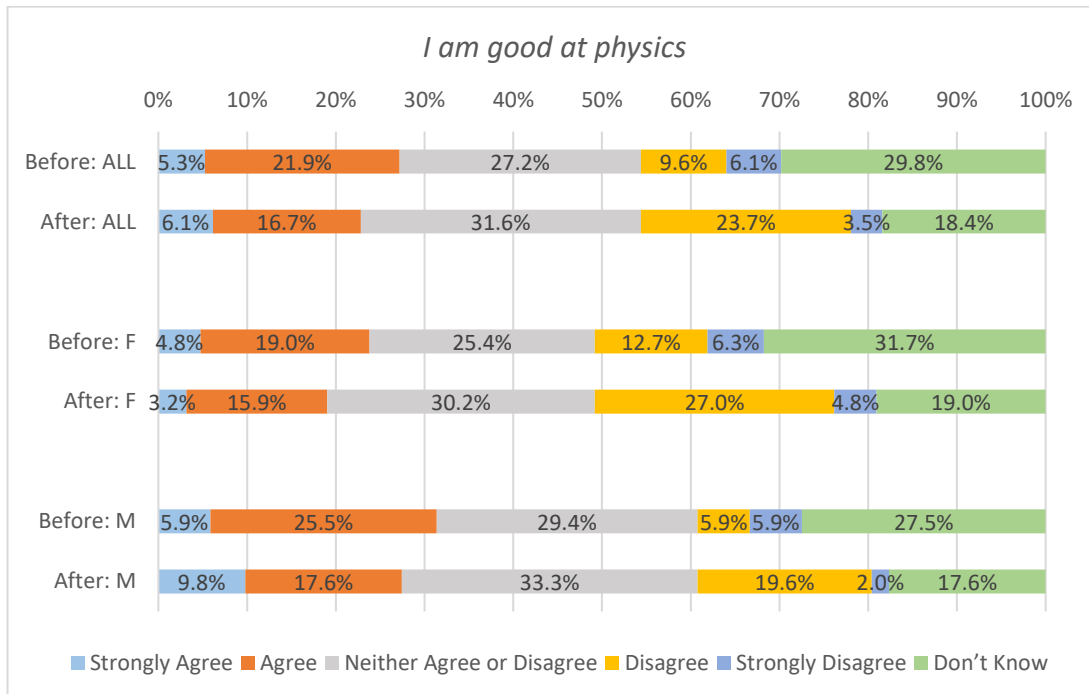
7.5. Physics is difficult

Fig. 9: % of participating Yr8 students who agree or disagree that ‘Physics is difficult’



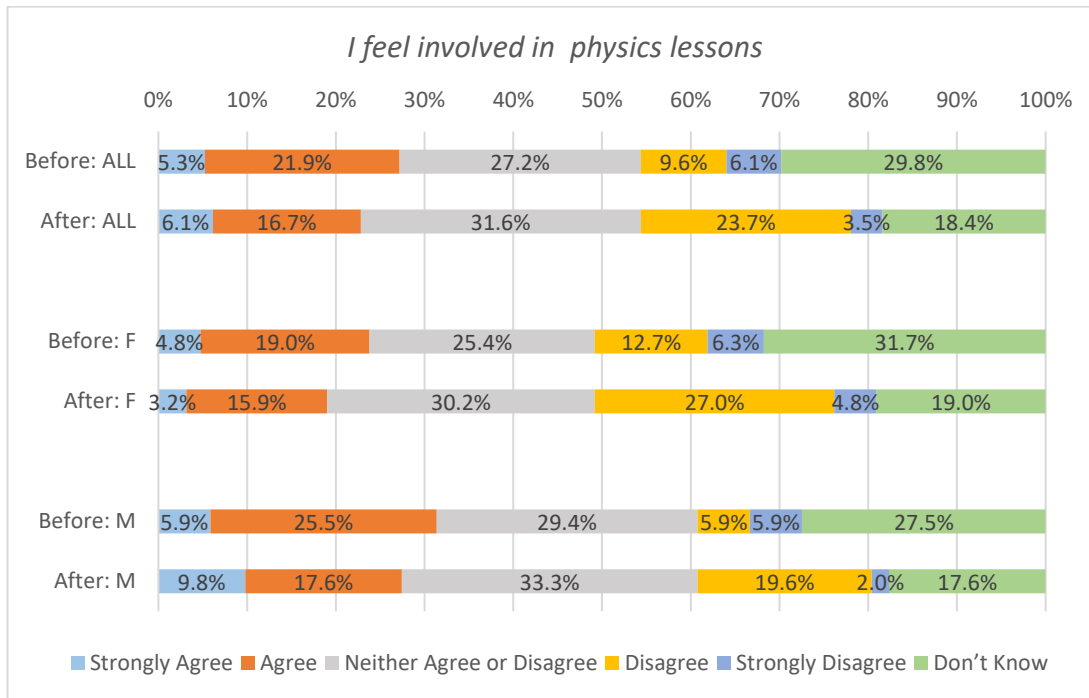
7.6. I am good at physics

Fig. 10 % of participating Yr8 students who agree or disagree that ‘I am good at Physics’



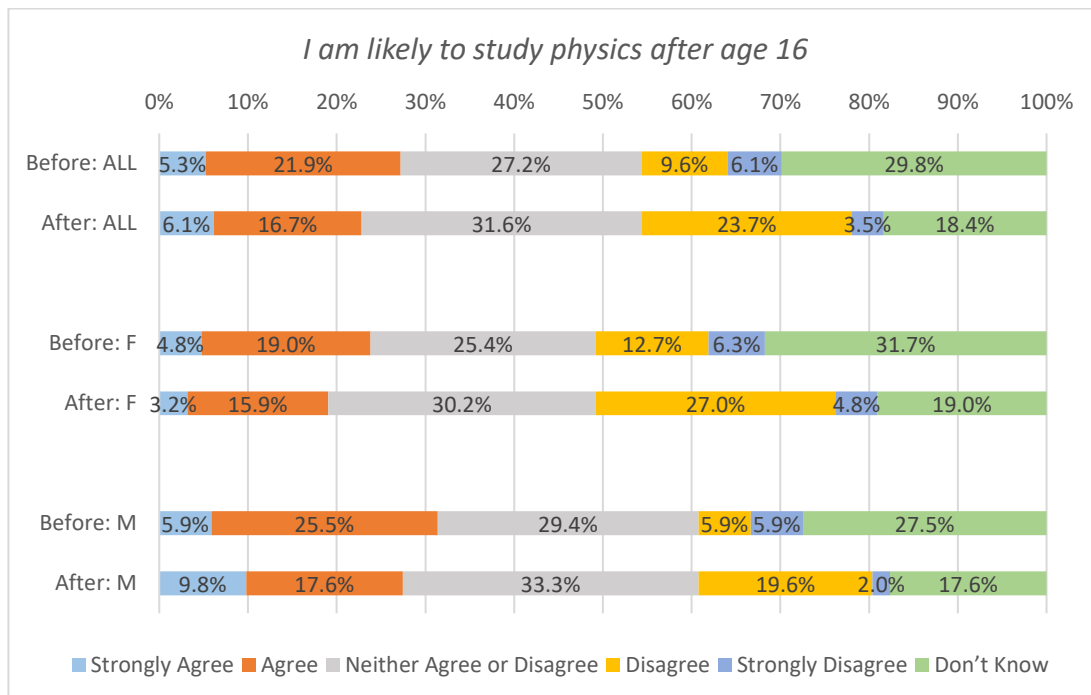
7.7. I feel involved in physics lessons

Fig. 11 % of participating Yr8 students who agree or disagree that 'I feel involved in Physics lessons'



7.8. I am likely to study physics after age 16

Fig. 12 % of participating Yr8 students who agree or disagree that 'I am likely to study Physics after age 16'



7.9. I feel I could decide to pursue any subject at school without gender being a factor

Fig. 13 % of participating Yr8 students who agree or disagree that 'I feel I could decide to pursue any subject at school without gender being a factor'

