Equitable Curriculum Reform:

More and Diverse Women and Non-Binary Representation in The UK GCSE and A-Level Science, Technology, Engineering and Maths Curriculum.

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This White Paper was written by Callie Winch

Stemettes
35 New Broad Street
London
EC2M 1NH

stemettes.org

The views in this White Paper are those of the author and Stemettes. While these were informed by our contributors, they do not necessarily reflect the opinions of these individuals or organisations.

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Contents

Foreword

Across our society, many folks' first and most memorable meaningful engagement with the sciences and mathematics is in the classroom. Where they may have heard music at home and heard English in the street, the biggest tastes of Science, Technology, Engineering and Mathematics (STEM) happen with a teacher, textbook, lesson and the national curriculum.

I'm often told by folks that they 'hate mathematics' because of interactions they've had with a particular teacher - never has someone told me they don't listen to music because of a set of interactions with a particular music teacher.

In 11 years of running the non-profit Stemettes, as well as running activities for the general public and communities across the country, I've been honoured to engage with all manner of school environments and classrooms. As one can imagine, experiences in school vary - despite the National Curriculum being a set standard all English state schools have in common, analogous to curricula in the devolved states, the private sector and abroad. From passionate, informed and supported teachers who understand the scale of the gender problem in STEM and are playing their part in the solution-to-school spaces that deny there is even a gender STEM problem of any importance, despite the statistics in this White Paper and beyond.

STEM and STEAM will have an integral part to play in solving our problems, building the future and securing our nation. The opportunity we have now to leverage the National Curriculum to properly set up generations for life is too great. That the names of women do not appear in their rightful place in the curriculum amongst those of the men named is a dangerous tragedy.

The advantage of setting a national inclusive standard is too great, and the required change to make this happen is too small to not do so in line with National ambitions, copious existing educational resources and availability of talent of all genders to inspire. Including STEM 'Herstory' is wanted on all fronts - by those in school, those upstream from our pupils (across Industry, Academia and Entrepreneurship) - and needed by the society we're operating in.

Here's to ensuring a full set of real STEM role models for millions each year. Here's to stemming this source of mass stereotype threat and allowing folks to begin life with a truer understanding of who STEM looks like - and who has the potential to contribute to the field.

Dr Anne-Marie Imafidon
MBE, Head Stemette

Executive Summary

The adage 'if you can see it, you can be it' encapsulates the issue with the current UK STEM curriculum content. We need to broaden who can pursue a career in STEM and challenge stereotypes and dominant ideas that have long excluded girls and non-binary individuals. Over the 11 years that Stemettes have spent working with young people, we have constantly noted the lack of exposure to relatable role models.

Within this White Paper we will outline five recommendations, aimed at Government, Institutes, Industry, Educators and Parents & Carers. We have created these recommendations based on the insights generated from our research collated through a series of multi-stakeholder roundtable discussions around the UK, interviews, surveys and text-based research.

The recommendations are:

For Government: **Role models that represent the students** - We recommend that the Government must include more and diverse representation, in the form of role models, into the UK GCSE and A-Level Science, Technology, Engineering and Maths statutory subject content. This will allow for more young women and non-binary individuals to believe that STEM subjects are attainable and pursue further education or pathways into the STEM Industry.

For Institutes: **Every day models for every day people** - We recommend to equitably raise the profiles of their diverse members and to ensure the educational resources they create are accessible and actively inclusive. Stemettes, and other grassroots education organisations, need Institutes to work more cohesively for their diverse membership in order to support their work on the ground.

For Industry: **Creating impact at the grassroots level** - We recommend Industry support grassroot efforts to build their future workforce pipeline. To do so, we ask that Industry seek to support educational organisations through providing funding to grassroots initiatives, volunteering days/schemes and by raising the profile of internal role models.

For Educators: **Experience driven Curriculum reform** - We recommend Educators to support the campaign to include more and diverse representation within GCSE and A-Level UK STEM statutory curriculum content. Educators should do this by ensuring that teachers feel supported by Senior Leadership Teams and subject leaders and look towards introducing a 'whole school equity' approach.

For Parents and Carers: **Rewriting the future** - We recommend that parents and carers work to reframe how they talk about STEM with their young people. Many young people perceive STEM subjects to be exclusively for boys or are too hard/only for the highest achievers in school: we need parents and carers to help rewrite this.

Background

Jaynie, Ruben and Dinah

Stemettes is an award-winning social enterprise who have worked over the last 11 years to engage, inform and connect girls, young women and non-binary people in STEAM (Science, Technology, Engineering, Arts and Maths) Careers. We run intersectional programmes, impactful events and inspirational platforms supporting ages 5 to 25. Across our programmes, events and platforms, we are showing that STEAM is for all, in a free, fun-filled and food-filled way. Our vision is for all young women and non-binary people to make informed decisions about careers across Industry, academia and entrepreneurship in STEAM, so that they can be proportionally represented in the field. Over 65,000 young women and non-binary people have attended our events since we launched in 2013. As per our 2023-24 Annual Impact Report, 71% of young people we worked with now see the STEM field in a better light and 67% now feel better connected to peers and role models in STEM.

Since our inception, a diverse set of role models has been central to our approach and subsequent success. At this juncture for Stemettes, there is a sizeable opportunity to harness the power of our expertise and advocate for change. Reflecting this in the curriculum has been a policy change we have long hoped for and sought to support across our network of Educators, parents & guardians and influencers.

For our 10th birthday, we decided to pick up this mantle and take more direct action on diverse representation in the curriculum inspired by a 2023 letter written by Dinah Lewis, Jaynie Shah and Ruben Persey to the Secretary of State for Education (Annex 1). The letter outlined that they had realised within their GCSE and A-Level studies, the curriculum failed to mention the work and achievements of any women scientists.

"This letter came about as we finished our A-Levels last year, we noticed that most of our curriculums are not as diverse as they should be or could be. As as a result, not any women were taking up STEM subjects, leading industries to be not as gender diverse as they should be."

- Jaynie Shah, Letter Writer

"When studying triple Science for GCSE, I was in a fairly equal gender split classroom, but the one thing that always will stick in mind was the list of white, male scientists that was provided for us to learn."

- Dinah Lewis, Letter Writer

The letter continues, explaining that they believe that 'this stark lack of representation is contributing to the continued gender disparity in science, from the uptake of STEM subjects by girls at A-Level, to the number of women in senior positions within the STEM Industry'. The call to action was for visible and diverse women role models to be added into the STEM subject content documents.

Dinah, Jaynie and Ruben approached Stemettes with the idea for the letter to make the change. As such, we platformed their letter and gathered folks around a change we have wanted to see since inception. Dinah and Jaynie had both previously been beneficiaries of Stemettes. Dinah was a member of our Stemette Society platform and Jaynie was a Super Stemette, sat on our Stemette Futures Youth Board and had been mentored as part of a Student to Stemette mentoring cohort in 2021. The Department for Education responded to their letter stating that the current UK Curriculum is flexible enough for 'teachers to be able to plan and adapt their lessons and use their own knowledge and expertise to determine how they teach their pupils, and to make choices about what they teach'. And so, although women role models are not included in the curriculum, it is a teacher's responsibility to incorporate gender diverse examples into lessons, on top of the set content they have to teach.

"If young girls can't see examples of themselves in the curriculum, if they can't see examples of women scientists, how can we expect them to go into STEM careers? I think that summarises why this change is so important."

- Ruben Persey, Letter Writer

As a youth-led organisation, we at Stemettes knew that it was necessary to support Jaynie, Ruben and Dinah's campaign, and invest our resources into amplifying their message.

Throughout 2023 we brought together a number of stakeholders to explore why this change is required, by whom and what it could look like. Co-chaired by Jaynie, Ruben and Dinah, we hosted three roundtable discussions. One in London at the US Embassy, one in Newcastle at the Newcastle Civic Centre and one in Birmingham at Make UK. We were joined by a range of Industry representatives and community stakeholders across the STEM sector and beyond wanting to maximise commitments to ensure that women in STEM are proportionately - and rightfully - represented in education. The discussions that occurred at the roundtables, form the basis for this White Paper.

As we evolve into an increasingly digital world, a diverse workforce is critically needed. In working to ensure there are more and diverse women and non-binary role models in the UK GCSE and A-Level Curriculum, we are platforming our passionate youth-voice and acting as a mouthpiece for marginalised women and gender diverse people across the UK. By ensuring that the formal education young people receive in the UK is actively more diverse, it enables informal grassroots education organisations, like Stemettes, to have more of an impact on the future of STEM, STEAM, leadership across the field and in wider society.

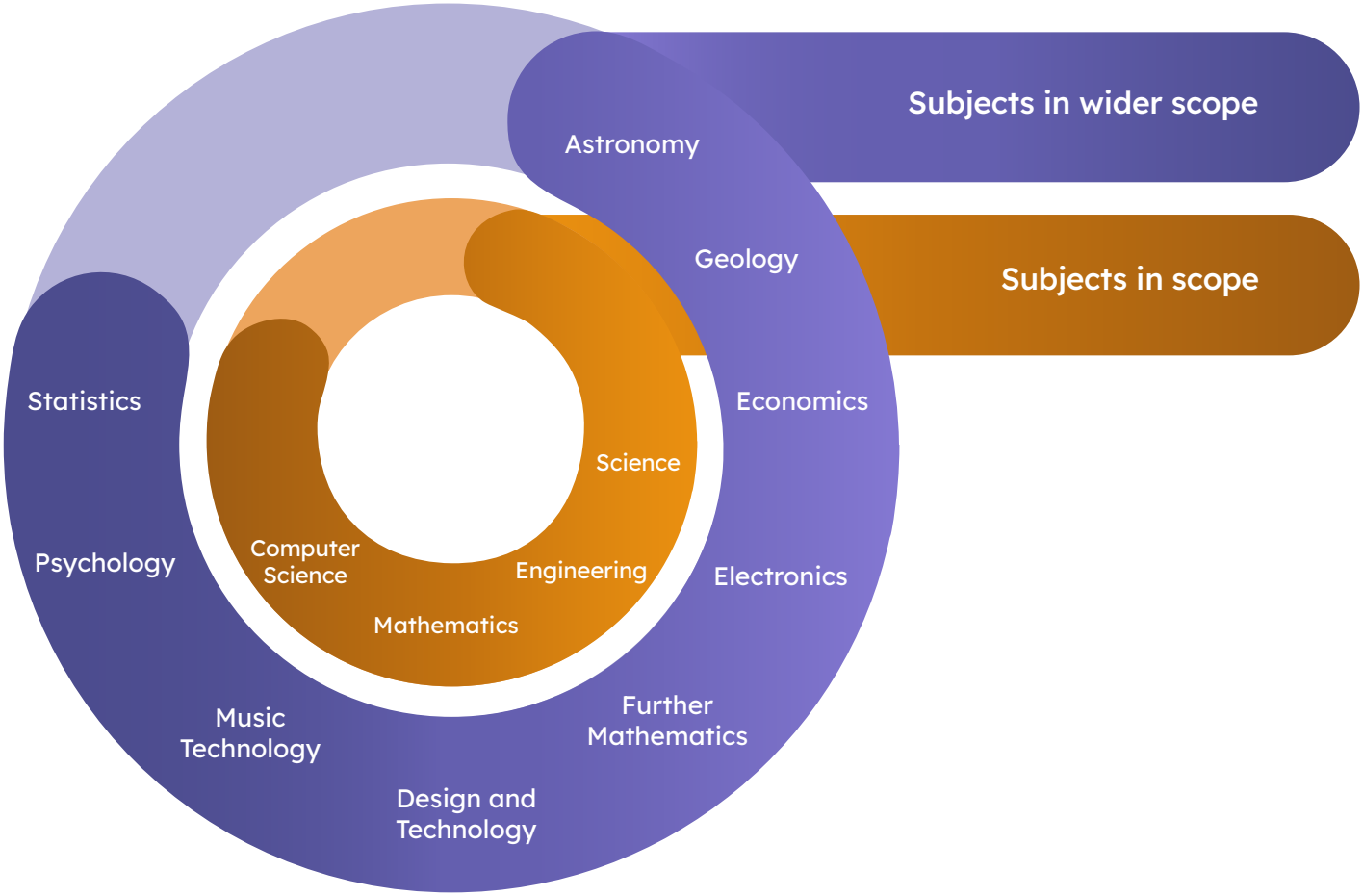
Current State

Women and gender diverse people are currently underrepresented at all levels within the STEM sector. Around the world, approximately 1/3 of scientific researchers are women and only 12% of the members of the National academies of Science are women (UNESCO, 2024:2). The current government workforce data statistics show a decreasing trend in the percentage of women within the STEM workforce. In 2019, women made up 46% of science professionals in the UK yet in 2023, this dropped to women making up only 43.7% of science professionals in the UK (WISE, 2023). With the rate of women and gender diverse individuals within STEM falling, we must look at the STEM pipeline and address the points at which people are leaving, as well as the options to enter and re-enter.

The gender gap within the STEM Industry is not a result of innate gender differences, nor is it related to the level of economic development within a country. These differences actually arise due to a range of 'societal factors and systemic barriers' that deter women and gender diverse individuals from pursuing STEM education or careers. The barriers include "a lack of visible role models, underrepresentation in leadership roles, unsupportive learning environments and inadequate professional structures and work cultures" (UNESCO, 2024:4).

Flaws in the UK STEM Curriculum: Hindrance to Diversity

The current UK GCSE and A-Level Science, Technology, Engineering and Mathematics curriculum is a collection of guidelines and content that is not conducive to producing a diverse pipeline of inspired young people into the STEM fields. Upon analysing the current specifications and statutory guidance on programmes of study, we have found a lack of representation in all STEM curriculum specifications. A truly fit-for-purpose subject content curriculum would outline the names and achievements of a diverse group of STEM professionals in this field who have contributed to its development. This list should contain a diversity of protected characteristics including but not limited to gender, ethnicity, ability and sexuality.



In the statutory guidance on National Curriculum for Science Programmes of Study (2004) for Key stage 3 (KS3), there are six named male roles, yet only 1 named woman role model - Rosalind Franklin. At Key Stage 4, there are no role models mentioned at all. Prior to GCSE level, role models are only listed in the non-statutory notes and guidance which schools are not required by law to teach.

In the GCSE science specifications of the leading examination boards, only 2 women were named in comparison to 40 male scientists who were named or had concepts named after them.

In the KS3 and KS4 National Curriculum for Mathematics Programmes of Study (2013), 100% of all named theorists are Male. This current STEM national curriculum is not representative of the dynamic, ever-changing UK population and, so, is not fit for the future of education or employment.

Subjects	No. of Women/Non-Binary Individuals Referenced In Statutory Curriculum Content - KS3-5	No. of Males Referenced in Statutory Curriculum Content - KS3-5
Science	**1**	**14**
Mathematics	**0**	**3**
Engineering	**0**	**2**
Computer Science	**0**	**1**

Students and teachers alike are not feeling empowered by the STEM curriculum content within schools. In a survey conducted by Stemettes and the British Science Association (2023), it was found that one in three students between the ages of 14-19 could not remember being taught about a women or gender diverse scientist in the last two years of study.

70%

of the young people surveyed also said they thought it was important for schools to include information about women and non-binary STEM role models in their lessons.

71% and **65%**

Boys (71%) are even more likely to agree with this statement as girls are (65%), lack of representation affects those of all genders. Educational institutions are required to abide by the Equality Act (2010), yet the content of the current UK GCSE and A-Level STEM curriculum proves to be inequitable and unfit for the future of work and education.

A Call for Contemporary & Diverse Role Models

Speaking to our beneficiaries, the few young people that have been taught about a STEM role model that is a woman or non-binary person, have noted that they are often historical figures and, hence, are unrelatable.

"'STEM textbooks often feel like dusty relics, failing to ignite the spark and bridge the gap between theory and real-world innovation. We need real, relatable heroes – the young creators, makers, and doers shaping the future of STEM with their passion, and ingenuity, those who look like us and have fun while doing it!".

- Lella Violet Halloum FRSA, MBCS, Stemette
Beneficiary and Global Student Outreach Lead at IBM

This lack of relatability undermines the importance of placing role models within the curriculum content, as they should act as individuals that young people can see themselves, their peers or their family within. Robin Walker, MP for Worcester and previous Minister of State for School Standards, stated "When I go into schools, I see lots of displays and information about people like Marie Curie and Ada Lovelace, so there is very good teaching going on in our schools about women role models in the sciences and computing" (House of Commons Science and Technology Committee, 2023:16). By not requiring the role models taught within STEM subjects to be wholly intersectional, the women and gender diverse individuals that are repeatedly platformed are restricted to the likes of Ada Lovelace and Marie Curie. We are championing the bare minimum of support that the education system should be offering our marginalised youth. Despite the fantastic achievements of these women within the field, many young people will struggle to relate to them and they are so often used as examples.

"When choosing my A-Levels, I found myself in a class of males who gave the message that science is a man's world. I went on to do my A-Levels and I was the only women student in the class and it made me question whether I belonged in this space and how I fitted in."

- Dinah Lewis, Letter Writer

Nearly half of the girls and non-binary individuals that took part in the Stemettes x BSA survey disagreed or strongly disagreed that they felt represented within the classroom. To change this, we need to be championing contemporary and diverse women and non-binary STEM contributors.

Problem Statement

Young women and non-binary individuals are not feeling connected to the current STEM curriculum content, and so, alongside other systemic issues, are not pursuing a future in STEM. Thus, there should be fair and diverse women and non-binary STEM contributors included in the UK GCSE and A-Level Curriculum. Our definition of curriculum content includes the statutory curriculum content which should be regulated for equity by Ofqual and be put into practice by the Department for Education. Analysis of the current UK curriculum shows that there is poor representation of women and non-binary role models featured within the teaching content. Representation within the curriculum is important to create a sense of belonging for staff and students alike, to reduce instances of bullying and mental health problems and to reduce barriers to achievement (Pearson, 2020).

As demonstrated in the visual below, there is a much lower number of girls and non-binary individuals going on to study STEM subjects at A-Level around the UK. This rate drops off at a sharp rate as the number of STEM subjects being studied increases. Swathes of the population are dropping off of the pipeline into the STEM sector due to feeling disconnected from the Industry and curriculum change is an important step to remedy this. If the UK is to create a workforce of the future that is able to tackle the complex world problems facing us, and embrace the opportunities of emerging technologies, we as a nation must invest in inspiring a diverse mix of young people into STEM through all parts of their compulsory education.

Recommendations

For Government

Our key recommendation is that the Government must include more and diverse representation, in the form of role models, into the UK GCSE and A-Level Science, Technology, Engineering and Maths statutory subject content.

The current greatest challenge to closing the economic development gender gap is women's underrepresentation in emerging roles, particularly in STEM industries (UNICEF, 2020:5). Therefore we urge that the Government reform the current UK STEM curriculum for GCSE and A-Level to ensure equitable representation for marginalised young people. This will allow for more young women and non-binary individuals to believe that STEM subjects are attainable and pursue further education or pathways into the STEM Industry. You can be what you can see. We ask the UK Government to call upon the devolved governments of Scotland, Wales and Northern Ireland to work collaboratively on this change.

We agree with the findings of the UK House of Commons Science and Technology Committee in their Fifth Report of Session 2022-23:

"In our view, it is important that all children are able to see themselves in what they learn from an early age. A diverse national curriculum - that contains women scientists for example - is one low-cost way of ensuring this. Similarly, the careers advice and support pupils receive from the earliest years should promote diverse and inclusive role models. Children should see themselves in who they aspire to emulate."

- (UK House of Commons Science and Technology Committee, 2023:3)

The research undertaken for this inquiry demonstrates that this recommendation is supported by stakeholders, Industry, academia, young people and parents. The content that our young people are being taught is not preparing them for the future of the STEM Industry.
As seen in the table overleaf, the gender uptake of science subjects post-16 is disproportionate, marginalised young people are not seeing STEM as a viable career path for themselves.

94%

of parents we surveyed said that the current UK STEM curriculum that is being taught to their children in schools is not representative and diverse.

"No women featured. Diversity only really covered during Black History Month. Gives the impression that STEM is not for everyone."

- Parent, Uxbridge

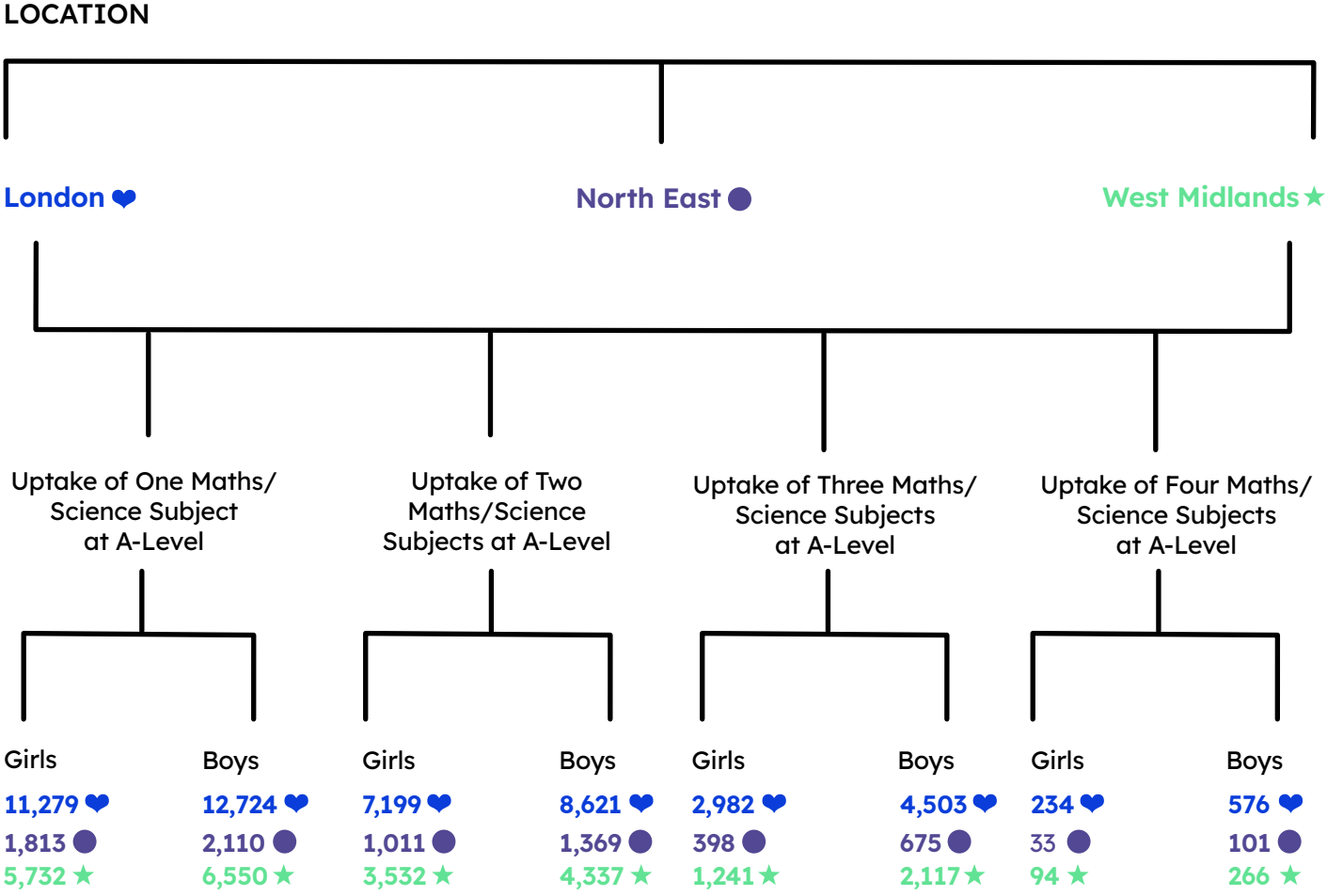
"LGBTQIA+, ethnic minority groups and women are all missing unless teachers broaden the curriculum to include these kinds of role models as enrichment not as basic information."

- Parent, West Sussex

"It is not inclusive or diverse, it simply reinforces stereotypes of middle-aged, white men in lab coats."

- Parent, Worcestershire

Gender Comparison of Uptake of Maths/Science Subjects at A-Level - 2022/23



Data: A Level & Other 16 to 18 Results, Academic Year 2022/23, National Statistics, Office for Statistics Regulation

What Should Curriculum Change Look Like?

The Government needs to introduce a curriculum fit to ensure that every young person has an equitable opportunity in entering the STEM Industry. We are asking for a curriculum that considers the interdisciplinary of all the subjects, one that is equitable in how nature it represents different groups and a curriculum that is future thinking.

A varied range of role models must be included in all years in which a student would be working towards GCSE and A-Level examinations.

"People who are choosing A-Level Physics are the ones who are already aware they want to do it. What about those who don't know if they can do it? Or those who do not have the confidence because they haven't seen role models that are doing technology or physics or engineering?"

- Jaynie Shah, Letter Writer

The inclusion of role models can deliver this ambition but they must be intersectionally representative of the diversity within the UK population. We therefore call for the representation that should be included within the UK GCSE and A-Level STEM curriculum to encompass differences of gender, ethnicity, class, ability, age, educational attainment, sexuality, religion, nationality and neurodiversity. The examples used need to have contemporary relevance to them, they should not all be historical figures or dead. We stress that it is also important to include representation of those who have had 'squiggly careers' - those whose career paths have not been traditionally straightforward, i.e. individuals who may not have traditionally been high achievers at school, those who have moved between disciplines or entered the STEM Industry at a later age.

Examples that should be included are Kathleen Lonsdale, Nettie Stevens and Lise Meitner, as outlined in Jaynie, Dinah and Ruben's initial letter to the Government. Examples can also be pulled from resources such as the Stemettes' 'Stemillions' programme - an extracurricular activity designed to engage young people in STEM. The Stemillions programme provides teachers with activities based on different women in STEM to widen their understanding of representation within the sector. These women include a range of actual women and non-binary in Industry who explain their career path and the current role they are in. All of the activities are linked to the national curriculum and so, the teacher notes and lessons can be reused during set lesson times. Grassroots resources should be being enforced and referenced from the top in order to provide young people with the most equitable learning. Young people should be able to relate to the figures that are placed within the subject content, they should look like themselves, their friends, their families, their teachers. STEM statutory content should be able to provide inspiration to all those following the curriculum, even those outside of formal education settings such as homeschooling. Hence, this relatability looks different for nearly every young person within the UK.

"It needs to look like them, it needs to look like who they see around them. And it needs to be somebody that they can access. So if it's a middle-aged white man, that doesn't necessarily emulate what they consider to be someone that they are related to or can become."

- Amy Brewer, Science Subject Advisor at OCR and Ex-Teacher

"I've never really been taught about many scientists in general, apart from a timeline about the history of the atom, but even learning about the individuals and the role models, wasn't a priority...I think it's very important especially if you're aspiring to a role in that kind of field to see who else has gone before you and them being like you, to motivate you."

- Rachel, Stemette Futures Youth Board Member

"We have to make sure that there is representation beyond tokenism. It's got to be blended, not binary. It's not just all of a sudden, here's a lesson on women scientists, it's got to be represented as a golden thread as we work with looking at people of colour, LGBTQ individuals, etc. There needs to be a greater exposure so that children see the mirror and the window, because if children don't see themselves in the curriculum, they won't feel represented."

- Alex Fairlamb, Teacher, Kings Priory School

We recommend that the representation we have outlined, within the curriculum, must be incorporated in an authentic and consistent manner. For the representation to truly inspire marginalised young people to become more engaged with STEM, this cannot be included as a tokenistic gesture during Black History Month or International Women's Day. These role models have to be consistently shown to young people throughout their educational careers. This should be provided within the statutory subject content in a way that is easily applicable to the wider lesson and fits in with the wider discourse that the students are learning. It cannot be added as an additional, optional component within the non-statutory notes. Teachers are already struggling with time management regarding the statutory content and so are less likely to have the capacity to add in additional learning that is only optional. We are asking for this change to be implemented from Key Stage 4 to Key Stage 5, but, in the most equitable scenario, this representation would be introduced from Key Stage 1.

In the Department of Education's response to the letter sent by Jaynie, Dinah and Ruben, they stated that teachers have the flexibility to teach supplementary content about STEM. By talking to teachers and exam boards within our research we have found this not to be true.

"Teachers tell OCR that they find it challenging to cover the whole specification in their timetabled lessons, and the provision of this in schools varies widely. Thus, additional content to cover the contributions of women in STEM and highlight the many varied career opportunities available would also be challenging to deliver, understandably. So teachers are making a compromise about the content of the curriculums and the number of hours teachers commonly have to deliver it in."

- Amy Brewer, Science Subject Advisor at OCR & Ex-Teacher

Not all teachers will have the capacity to teach non-statutory notes or use their personal time to research around their subject in order to provide the supplementary content needed to inspire marginalised young people. Therefore not all young girls and non-binary people will learn about a role model in STEM that they can relate to. This experience should not be a privilege and only reserved for some. Teachers are time-poor, and so are teacher Educators, as they are trying to get through a lot of content in a strict time frame. Representation needs to be packaged in bite-sized ways through the curriculum content as well as ways that can be easily embedded into the teacher training curriculum. As part of this recommendation, we suggest taking influence from best-practice Institutes and grassroots organisations that are already looking at platforming marginalised voices within the STEM sector. Some particularly influential and accessible work is being done by Mathematics in Education Innovation (MEI) and OCR who create a range of inclusive enrichment resources across all age groups. OCR have been passionate about making the curriculum to be more representative and have been liaising with teachers to understand what they want to see in their resources.

"We've been producing blogs and people galleries and updating those and we've got some resources, hopefully coming out in the near future to help teachers integrate more representation."

- Amy Brewer, Science Subject Advisor at OCR & Ex-Teacher

Enrichment material should, ultimately, not be needed when there is a curriculum that is suitable for all young people studying it. Although this additional material is being created with the needs of both teachers and young people in mind, it creates a disparity between the young people who have been taught it and those who have not. We need a curriculum that is future thinking, looking at sustainable development and future skills, one that is setting our young people up for success in an uncertain future.

Why Should The Curriculum Change?

Research has shown that by providing young people with regular exposure to role models that they can see themselves, their peers and their family in, increases their sense of belonging and confidence in the subject. Girls and gender diverse young people tend to have a different learning style in comparison to boys in the classroom. Girls have shown to prefer lessons that are 'clear, relevant to their lives, and provide opportunity for collaboration', as well as 'lessons that provide out-of-class experiences' (Andrus, Cox, Jacobs and Kuriloff, 2014). Furthermore, a lesson's relevance to girls' lives encourages and deepens their formal education engagement. Lessons that are about topics that are applicable to their wider world or easily relatable to current events, interests girls and non-binary individuals more in the classroom. If we add STEM role models that girls and non-binary individuals can relate to and see themselves in, we can assume that their interest in the subject will increase. By being able to see themselves mirrored in the representation that is taught within the lesson content would allow for practical application and an increased sense of self-confidence.

"A lot of research shows that girls really respond to sciences and STEM that is in context and relevant and has a real world application...We want to put the role models in the curriculum but we also want to show them their purpose and their agency."

- Maria Rossini, Head of Education at British Science Association

"QA have found that by including examples of women coders in the curriculum helps as that keeps more women on the programme and means less drop outs."

- Mary Sansom - Chief of Staff at QA

The Possible Selves Theory helps to explain why providing role models frequently in the curriculum is an effective way of engaging marginalised students with STEM. The Possible Selves Theory explains the relationship between 'self-concept, imagined future selves, motivation and behaviour' (Markus & Nurius, 1986). This concept looks at the idea that young people can imagine their possible future selves. These can be positive future selves which would motivate young people to achieve their goals or negative future selves which we might not want to become.

the future selves of young people can be shaped by social and cultural context, personal experiences and experiences with people who we may look up to or give us advice. Providing frequent, accessible and relatable STEM role models to young people allows them to create a positive future self and improve their self-confidence in pursuing a career in the STEM field. Without providing these role models, marginalised young people, especially those in a low socioeconomic position or those who have caring responsibilities, will turn to a career pathway with guaranteed return for them and disregard a career in STEM.

Economic Growth and an Innovative Industry

An altered curriculum not only inspires and changes opinions for many young people about the subjects they are studying, it also allows for economic growth and increased innovation within the wider STEM Industry. It is a cost-effective means of changing the terrain of the sector for the benefit of future generations to come. Diversity really matters for STEM, Industry stakeholders in our research all agreed that it is an economic imperative to ensure that the talent we have coming into the Industry is varied. We have the capacity to build a future workforce of young individuals that are passionate about their careers, excited to pursue growth and shape the sector for their successors.

"I think it's quite hard to say that we should leave the national curriculum as it is being the way forward for this in terms of representation. We need positive action, we need intentional role models to show people that this is a career path for them."

- Leo Nicholas, Equity, Diversity and Inclusion Lead at Ørsted

The skills developed and experiences individuals have in STEM education and Industry are extremely important and, currently, underrepresented girls and non-binary people are missing out. They run the risk of losing out in the future and not being able to access the opportunities that are there for the taking. Statistics show that an inclusive team within an organisation allows for more innovation, with organisations being able to make better business decisions up to 87% of the time and twice as fast as non-diverse teams (Cloverpop, 2017).

By ensuring that young people are inspired, we are setting the Industry up to be as diverse as possible by creating an engaged pipeline of future talent. Diversity really matters within the STEM Industry and should not be seen as simply a 'tick box exercise'. There has been low economic growth within the UK for the last 13 years and so ensuring measures to have a growing, successful economy that delivers long, sustainable jobs is critical. Innovation is part of this, without diversity and inclusion in workplaces, innovation is stifled. Excluding invaluable talent and skills from the workforce is bad for the economy, is bad for global competitiveness and is not fair on our young people.

"Often when we see projects that have failed, or they've missed something that was key to the success of that delivery, it's because they haven't had that rounded view of the approach...We're seeing pockets of the Industry where women are taking up those senior roles and, hence, their projects are becoming more well balance and we are seeing a difference."

- Karen Blake, Co-CEO at Tech Talent Charter

Inaction regarding representation in STEM will exact a toll. At the current rate of inequality within the workforce around the world, it will take '99.5 years to achieve gender parity world-wide' (World Economic Forum, 2020). Increasing gender diverse participation in STEM careers has the potential to 'close the gender pay gap and boost women's cumulative earnings by $299 billion' over the next 10 years (Council on Foreign Relations, 2017). Including representation within the UK GCSE and A-Level STEM curriculum boosts the confidence of marginalised young people, fixes the pipeline into the Industry and acts as a catalyst for economic growth.

Key stakeholders in the sector have long been calling for the Government to implement an equitable STEM curriculum for our young people. We recommend that curriculum representation be varied, accessible, attainable, authentic and consistent. This reform should be instated with consultation from Institutes and grassroot organisations already looking at improving gender equity within Science, Technology, Engineering and Maths.

For Institutes

Our recommendation for Institutes is for them to equitably raise the profiles of their diverse members and to ensure the educational resources they create are accessible and actively inclusive.

Institutes exist for the development of their members, and respective fields, and foster a range of different individuals in their membership pools. We recognise that there is impactful work being done by STEM Institutes, but, to ensure that marginalised individuals are engaging with STEM, Institutes need to be systemically nurturing and platforming a plethora of individuals representative of the diverse UK population. Institutes should also, where possible, assist the government in naming and selecting role models for inclusion in the curriculum, ideally from the diverse internal pool within their membership bodies. Stemettes, and other grassroots education organisations, need Institutes to work inclusively for their diverse membership in order to support their work on the ground.

As stated in the House of Commons Science and Technology Committee's Fifth Report of Session, we urge that any organisation that has the capacity to raise the profile of inclusive role models has the duty to do so:

"It is more about role models within your immediate community...There is a structural challenge there because we cannot replace who is in someone's family or community. Having some of those visible, high-level role models is important".

- Kemi Badenoch MP, House of Commons Science and Technology Committee, 2023

Professional STEM Institutes should be conscious in the work that they are doing, ensuring that they are including all intersectional areas of diversity in their outreach efforts. STEM Institutes should be actively aware of the Industry influence they have and aim to be internationally representative, without being tokenistic. As mentioned above, the ability for young girls and non-binary individuals to see role models that are reflective of their identity is an extremely important action in increasing interest in STEM education and careers.

Young girls and non-binary people need to be able to mirror the actions of authentic individuals who are succeeding in the STEM sector despite holding a marginalised identity. The young people that Institutes are able to influence have the capacity to, ultimately, pursue a STEM career, become Institute members or fellows, and act in turn as a role model in the future. This cycle has the capacity to inspire and increase the number of marginalised individuals within the sector in tandem with curriculum representation reform.

STEM Institutes have wide reach, some on a global basis, and should be using this responsibly to inspire through the uplifting of their membership base. Some STEM Institutes are raising the profile of a selection of their members, which we implore them to continue doing, but these members need to be more diverse, highlighting differences in ethnicity, sexuality, ability, class, gender performance etc. This representation need not be tokenistic and should be supportive of the wider Diversity, Equity and Inclusion work of Institutes.

"Girls need to feel three things to be engaged with a subject. They need to feel that the subject is relevant, that they can actually succeed in it and that they will belong in that kind of space."

- Olivia Wolfheart, Membership Engagement Manager at BCS, The Chartered Institute for IT and Ex-Teacher

In line with this work towards platforming representative role models, equitable education tools and resources should be created by Institutes to showcase relatable, contemporary representation within the Institute. Institutes often channel the expertise of their members to produce educational documents, but we recommend that they should aim to be more conscious with the representation they are including within them.

They should use the same technique in platforming their membership base as role models to include an intersectional range of representation within these tools. The role models platformed by Institutes should be put forward to government as easily accessible examples to include within the statutory STEM subject content. Institutes should aim for the resources to be easily integrated into current curriculum content and to refrain from being perfunctory.

Supplementary Resources created by Institutes are currently being used in the place of inclusive representation in the statutory subject content which should not be seen as a suitable alternative for curriculum change but rather a filler until all young people are provided with diverse representation in their STEM curriculum. In the production of these resources, Institutes should also recognise the current teacher recruitment crisis, meaning that non-STEM specialists need to be provided with resources that are accessible to those without prior technical knowledge.

"I think one of the key things that we have to recognise is that there are increasing numbers of non-specialists. At present, my friend who's a history teacher is teaching year seven maths, he has not done that since being 16 years old...If there's lower teacher quality because they don't know how to extend beyond the curriculum that they're given, I think that's something we can work on."

- Alex Fairlamb, Kings Priory School

"It's one of the things that's really important to me is that while we are planning these resources, we are keeping EDI at kind of the forefront of our mind and making sure that where things can be brought in to make the curriculum more inclusive and representative, it is done."

- Sarah Denison, Equality, Diversity and Inclusion Lead at Mathematics in Education Innovation (MEI) and Ex-Teacher

Finally, we recommend that Institutes are ensuring that they work together to reduce duplicative efforts and ensure maximum effectiveness of inspiration. For long-term systematic difference, Institutes need to be coordinating to develop a wider political message. When Institutes are able to work as a collective, influential voice, the most impactful change is able to happen. Where Institutes are already in curriculum reform talks, they should prioritise asking for a diverse STEM curriculum. To further amplify this change, Institutes should seek to work with grassroot educational organisations, like Stemettes, on advocacy and campaigning work to provide support and expertise. Institutional bodies need to ensure that they are platforming role models within their diverse membership pool and creating accessible, inclusive education resources. By doing so, it will increase the impact of representation within the UK GCSE and A-Level STEM curriculum to young girls and non-binary people and boost their increase in STEM education and careers.

For Industry

We recommend for Industry to nurture environments where despite a chronic lack of awareness of 'Herstory', this is celebrated and allows a diversity of current talent to become leaders and role models for future generations.

In order for the wider Science, Technology, Engineering and Mathematics Industry to support the dismantling of gender disparity within the sector we recommend that they support grassroot efforts to build their future workforce pipeline. To do so, we ask that Industry seek to support educational organisations through volunteering days/schemes, by raising the profile of internal role models, and by providing funding to grassroots initiatives. These actions, by proxy, demonstrate that organisations are committed to ensuring that marginalised individuals are entering the STEM workforce and are challenging toxic, exclusionary cultures within the sector. We are able to inspire girls and non-binary individuals to pursue STEM career paths but have to ensure that the destination is fit-for-purpose once they land there.

"It's about seeing those individuals that are already a part of the sector not pulling the ladder up behind them but taking others with them, those that are younger than them or those that are new to the profession."

- Miranda Lowe CBE, Principal Curator at The Natural History Museum

Based on multi-stakeholder research, we suggest that implementing volunteering schemes within individual organisations is an impactful way to support the inspiration of girls and non-binary individuals into the sector. Programs such as STEM Ambassadors show how powerful having Industry professionals in the classroom can be, senior leaders have the choice to support programs like this by supporting employees to volunteer their time. By exposing marginalised young people to relatable volunteers working in Industry, they are increasing the reliability of role model representation within the curriculum. As mentioned by Professor Dame Athene Donald in the House of Commons Science and Technology Committee, we need representative and authentic individuals from Industry to engage in outreach volunteering opportunities with marginalised young people:

"We need diverse people going in. People from Industry can really do good things by going in and talking about their day job. An academic might not be the right person at all. We should think about who gets involved with those programmes and try to make it easier to do that. That also applies to work experience."

- Professor Dame Athene Donald, 2023:18

By engaging in volunteering opportunities, we can aim to demystify careers in the STEM Industry, with organisations being able to interact with girls and non-binary individuals and show the inner workings of their businesses. Volunteers are able to give talks, sit on panels, but most importantly, bring the role model representation within the curriculum to life. We cannot rely solely on teachers to provide supplementary diversity education prior to curriculum reform though, Industry should also be empowering their futuremakers.

"It's up to organisations, like ours, that are in the STEM Industry, whether that's maths, engineering, science, technology, to come in and look at how we support our futuremakers."

- Hind Naciri, Head of Impact and Engagement in Europe at Standard Chartered

Not only does Industry volunteering provide a positive impact on girls and non-binary individuals' pathways into the STEM sector, The Turing Trust also outlines that it can improve employee engagement, team building and corporate reputation (2023). By encouraging a diverse network of volunteers to come together outside of their typical work environment and back a mutual cause, organisations within the STEM Industry are facilitating collaboration and strengthening internal team dynamics. Furthermore, volunteering as a member within the STEM Industry can act as a powerful tool to bolster brand image and demonstrate authentic commitment to social issues without being tokenistic.

Best practice can be seen within the STEM Industry at organisations such as Make UK, the Manufacturers' Organisation, in which their apprentices participate in a range of extra activities outside of their job roles. This includes supporting events as role models on behalf of the organisation to promote job opportunities to the next generation.

We recommend that individuals within the STEM Industry aid in raising the profile of internal role models in order to supplement the representation within the formal education sector. By encouraging diverse, authentic individuals within the Industry to stand up as role models, we are increasing the likelihood of relatability to representation for marginalised young people.

"Industry needs to come to schools and actually talk about the real world experience, because one of the biggest challenges we're facing is making sure these young people are job ready when they come out of schools and universities."

- Sam Bramwell, CEO at Marra

As part of the research behind this White Paper, Stemettes have worked with Tech Talent Charter to create a document outlining supporting a culture of mentorship and role models within business. Tech Talent Charter is an open playbook for inclusive practices across the sector, with Stemettes being a founder member of the signatories. Role models are essential for women's success in business. Research shows that women role models have a magnified impact on women relative to male role models for men. This is because role models within Industry can help women see what is possible, expand their horizons and develop the confidence to pursue their goals. Tech Talent Charter (2024) have outlined a number of ways to help identity role models within the STEM Industry, these include individuals who are:

- Consistently meeting/exceeding expectations
- Demonstrating the organisation's values
- Helping others to succeed
- Willing to share their knowledge & experience

Once role models have been identified with the Industry, it is important that managers are able to cultivate them to be as impactful as possible for young people. We recommend that organisations prepare prospective role models by:

- Providing them with opportunities to share their knowledge and experience. This can be done through formal mentorships programs, informal lunch and learns, or even just by encouraging them to share their advice with colleagues.
- Giving them feedback on their performance. This feedback should be constructive and focused on helping them to grow and develop.
- Providing them with access to resources and training. This can help them to continue to grow and develop in their careers.
- Setting clear expectations for them. This includes communicating the values and behaviours that you expect them to demonstrate.
- Being a role model yourself. Leaders play an important role in setting the tone for the organisation. When leaders demonstrate the values and behaviours they want to see in their employees, it sends a powerful message.

"Industry needs to build that whole, human-centric, empathetic culture that understands why bringing in wide spread diversity into their workplace makes a difference, makes strong products and makes great business sense."

- Karen Blake, Co-CEO at Tech Talent Charter

We recommend that Industry should proactively invest in the future STEM workforce by supporting and contributing financially to grassroots organisations working on disparity in the field. By supporting grassroots organisations working to educate marginalised girls and non-binary individuals into STEM, Industry is, by proxy, investing into a more innovative and diverse future for their organisation. Industry needs to encourage employees to extend their knowledge through volunteering opportunities and raise the profile of role models in their organisations. By doing so, Industry is committing to provide an entryway for marginalised individuals interested in STEM who may have previously not seen someone with their own likeness in the Industry.

For Educators

Our key recommendation for Educators, schools, trust leaders, SLT members and councils is to support and rally behind the campaign to include more and diverse representation within GCSE and A-Level UK STEM statutory curriculum content. Educators should do this by ensuring that teachers feel supported by SLTs and subject leaders and look towards introducing a 'whole school equity' approach.

Through speaking to current and ex-teachers, governors and educational stakeholders, we recommend Educators to move towards a whole school equity approach to augment inclusive curriculum reform. The introduction of a whole school equity approach ensures that representation is continued outside of the classroom and that curriculum reform is supported by the policies and practices of the educational body in which it is taught. Whole school equity ensures that schools can guarantee that their teaching and communications are inclusive, that young people have a voice in how the school is run and that no young person is discouraged from pursuing a path that best fits their talents. Educators are recommended to use resources such as the 'Limit Less' Campaign from IOP, the Equity Compass from Louise Archer's YESTEM (Youth Equity + STEM) project and Stemettes' 'Stemillions resources'.

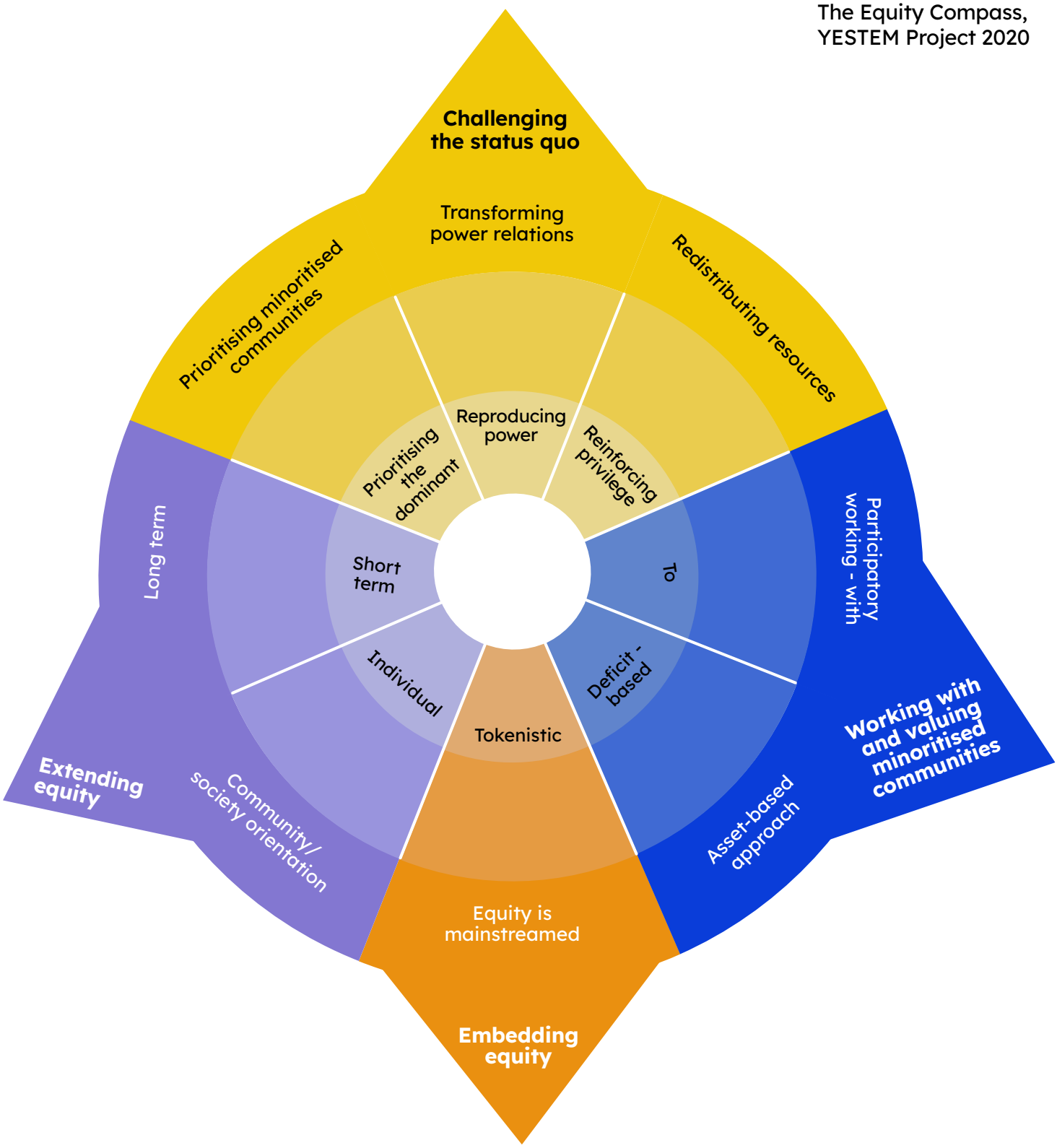
"Our Limit Less campaign is focused on a call of the education sector and sphere around whole school equity approaches and whole school planning. Looking at barries like sexism, racism, anti-LGBT prejudice, classism and how they exist in education and what needs to happen at a whole school approach to break down the bias, prejudice and stereotypes that young people face."

- Beth Bramley, Strategic Lead for Inclusion at Institute of Physics

YESTEM's The Equity Compass is a tool for supporting socially just practice and helps individuals to adopt a 'social justice mindset when developing and reflecting on their policy and/or practice and prompts them to consider multiple dimensions of equity, as represented by the eight segments of the compass' (YESTEM Project UK Team, 2020:2). By using this compass to develop a whole school equity approach, it allows for Educators to identify how and why particular practices may be more or less equitable. Educators are able to map their practice on the compass which will support any future planning or improvements that may need to be made. The YESTEM Project UK Team suggest that to use The Equity Compass in practice you should can:

- Use each axis of the Equity Compass's Guiding Questions to help reflect on practice and/or policy. The Compass can be applied either generally or specifically and can be used from organisation wide policy to individual sessions.
- Reflect critically using the Guiding Questions on each axis - where would your individual practice sit on each arrow at the moment?
- Use the Compass to highlight areas that you think need more work. You may want to prioritise working on areas where your practice sits more towards the centre of the Compass. The questions and axes can help generate thoughts about the future in line with more equitable practice.
- Track your progress towards more justice-orientated practice by tracking from the centre out on the Equity Compass axes.

The Equity Compass,
YESTEM Project 2020




Ruben Pereyra
Anne-Marie Imafidon

This approach ensures that all teachers, regardless of discipline, are working as a cohesive unit to challenge inequality within the classroom. This 'golden thread' of equity should continue outside of the classroom and into form rooms and lunch breaks, in order to not undermine the active work being done by Educators. If we introduced an equitably reformed curriculum without there being an inclusive environment within the school setting, the reforms will fall flat and unravel when marginalised young people are leaving their STEM classrooms. When implementing this approach into schools, the IOP found an increase in girls interested in STEM, with the number of girls choosing post-16 physics tripling over the two years of implementation of a whole school equity approach (IOP, 2023).

After speaking to teachers, current and former, we recommend that stereotyping and bias training be the second step after the curriculum change has happened for Educators towards a Whole School Equity approach. Staff and students can support anti-sexism practice and initiatives by sharing and promoting resources such as the ASPIRES 'Step Up' anti-sexism ally poster and/or by engaging with wider anti-sexism initiatives aimed at tackling the sources of sexism. Not only would bias and stereotyping allow for teachers to actively challenge language and behaviour that is deterring marginalised young people from pursuing STEM, it would help with unconscious bias in grading, assessments and wider classroom behaviours. Staff and students can support anti-bias practice and initiatives by sharing and promoting resources such as the 'ASPIRES Step Up' resources and by engaging with wider anti-bias initiatives aimed at tackling the sources of bias (ASPIRES3, 2023). support anti-bias practice and initiatives by sharing and promoting resources such as the 'ASPIRES Step Up' resources and by engaging with wider anti-bias initiatives aimed at tackling the sources of bias (ASPIRES3, 2023).

Researchers have found that teachers can often unconsciously ask more questions to boys than to girls, give boys more chances to take turns and allow boys to hold the conversation floor for longer and to interrupt their classmates (Swann, 2008). Most teachers are not doing this intentionally but it can have a profound effect on the aspirations of girls and non-binary individuals.

"Staff training is really important, ensuring that staff are aware of gender stereotyping and the language that they're using, not saying things like 'don't do chemistry it's really hard' and so making it seem like it's not a possibility."

- Angharad Morgan, Gender Action Programme Co-Ordinator at DECSY and Teacher

"We have to try and not lean on the teachers to facilitate and deliver this stuff either, but we also need them to be encouraging and get the students through these courses."

- Chelsea Slater, CEO at InnovateHer

Educators need to demonstrate that they, too, are committed to wanting this change rather than the burden being placed on teachers to do supplementary work for their classes. We recommend that school leaders, teacher union leads and governors should start to apply pressure on the Department for Education that they too want to see this change in the curriculum. Individuals with the capacity to influence change within the education sector should be striving to support teachers to ensure equity to be added within the classroom. Teachers can access resources from educational organisations, but there will be no tangible change until there is an imperative to change. This needs to be top-down, from senior members of schools and trusts, but ultimately from the Government.

For Parents and Carers

After consulting with parents and carers from across the UK, we recommend that parents and carers work to reframe the narrative around STEM with their young people and advocate for inclusive curriculums in their schools.

Parents and carers play a vital role in empowering girls and non-binary individuals to pursue further education and careers in STEM. Many researchers have regarded family as the most significant social learning group in which children learn science from every day experience. (Ellenbogen et al, 2004). Many young people conceive of STEM as subjects that are exclusively for boys or are too hard/only for the highest achievers in school, so we need parents and carers to help rewrite this. By engaging young people in conversations and informal educational activities, parents and carers can make a real difference in dismantling the mindset that STEM is not for them.

"To promote diverse role models outside of the classroom we should be talking to our children - allowing them access to magazines and texts that feature diverse role models. Helping them to see that a role model doesn't have to be labelled as such in order to be one."

- Parent, East Sussex

Language is often highlighted as the most important cultural tool that mediates young people's construction of knowledge and participation in learning activities. Through language, young people construct and share an understanding of the world with others. As parents and carers are speaking with their children about their STEM education and future, they can actively alter their perception on whether these subjects are attainable or not. Parents and carers should be moving conversations away from STEM being a male-centric discipline and ensuring that girls and non-binary individuals know this is a subject for them to pursue too.

"I have to do a lot of extra work to counteract the influences my eldest gets from society, from her friends, from school and from the curriculum. So she'll come home talking about a male technician or a male scientist and I have to buy five books about a woman in STEM to counter that."

- Hind Naciri, Head of Impact and Engagement in Europe at Standard Chartered

These conversations need not be rooted in additional research, as we understand that parents and carers are often pressed for time. However, should caretakers want to improve their understanding on equity within STEM, there is a plethora of free resources available online from educational institutions, including Mathematics in Education Innovation, The Black Curriculum, Institute of Physics, and Stemettes. 100% of all parents that we surveyed said it would be beneficial for them to be provided with supplementary resources to aid in raising the awareness of role models, career choices and alternative pathways into STEM. The YESTEM project reinforces that although these resources and programmes may support positive outcomes, parents and carers should focus on equitable youth outcomes that "challenge, disrupt and transform unjust dominant power relations and practice" (YESTEM, 2021). Parents can also reflect on The Equity Compass, featured in the recommendations for Educators, to decide if the informal STEM education they are engaging their young people with is truly equitable in its practice.

"It has been a long time since I was in education and I am not sure of all the options out there anymore for my child."

- Parent, Worcestershire

"As a parent and teacher, I feel more confident in including role models in interactions with young people if I have access to diverse and well-researched resources. This includes resources such as books, documentaries, and online platforms that feature a wide range of STEM role models."

- Parent, Greater London

Stemettes provides free monthly 'Takeaway Menus' aimed at parents and guardians that include a selection of STEM content from across our sessions, send out a monthly newsletter and publish inspirational articles on our Zine. In order to ensure that diverse representation within the STEM curriculum is impactful and inspiring for young marginalised individuals, we need for the conversation to be continued outside of the classroom.

"If students are going home to a perhaps negative perception of STEM or a perception that STEM is kind of out of their league, it will give them mixed messages. So having that consistency in messages is key to making STEM accessible."

- Angharad Morgan Gender Action Programme Coordinator at DECSY and Teacher

As well as moving the STEM discourse from being male-centred to something that all young people can do, it is important for parents and carers to challenge the idea that STEM subjects are hard and only for the smartest of students. By situating STEM subjects within a young person's more immediate experiences of their every day life, concepts can seem less imposing.

Parents and carers are well-suited to help girls and non-binary individuals connect every day experiences with relevant STEM concepts or practices because they have extensive knowledge about their children's knowledge and shared experiences. As well as working at reframing young people's narratives around gender roles within STEM, parents and carers can reach out to schools to ask for this change. If pressure is placed on schools by parents and carers, Educators may be more likely to support this campaign and demonstrate their commitment to equity within teaching. By challenging the idea that success in STEM is an unachievable target and boosting a marginalised young person's self-esteem, caretakers are aiding in the wider picture of empowering their children. If parents feel equipped with the information to help raise the aspirations of why a STEM career is desirable and should be celebrated, we can collectively change girls and non-binary individuals' perceptions on their place within STEM.

Conclusion and Next Steps

Role models are a powerful tool for influence, and so, need to be diverse, representative, and available to every young person in education. Marginalised young people rarely see someone that looks like them existing and thriving in the STEM Industry. Curriculum change to provide more and diverse representation within the UK GCSE and A-Level STEM statutory subject content is an imperative.

STEM learning environments have the potential to engage diverse communities, but the sector, in itself, does not have a diverse range of participants. There is a need for a shift in mindset within Industry to allow for more individuals to engage with, and understand, the depth behind issues of equity and social justice, in policy and practice. We ask for Institutes to lift up their diverse membership pools and mirror the incredible work that their members are doing into Government consultation work. Educators should be shifting towards a more inclusive and equitable whole school approach, providing their staff with anti-bias training and backing the campaign for a reformed STEM curriculum. Parents can seek out resources and engage with their young people to reframe the narrative around a gendered STEM and also put pressure on their schools to push for equitable subject content. This curriculum change need not be seen as radical. Accessible resources on role models, which can be integrated into established lesson plans, already exist. We need a top-down measure to spark the realisation that 'STEM is for everyone' back into the classroom.

In line with the recommendations from the Regional STEM Skills Inequality Report published by the APPG on Diversity and Inclusion in STEM (2023), we pledge to work consciously to combat regional disparities in STEM education within the UK.

Since 2022, we have been looking at areas facing indices of multiple deprivation and developing equitable regional outreach strategies in order to engage, inform and connect girls and non-binary individuals in areas such as the North East and West Midlands. These areas report low uptake of STEM-related subjects at GCSE level by girls and non-binary individuals, therefore are seen as a 'STEM Cold Spot'. To continue Stemettes' growth and impact, we are committed to build on these foundations, targeting our delivery in areas of the UK and Ireland where there is low engagement from girls and non-binary people in STEM.

We will continue to push for equitable representation within the UK STEM curriculum and commit to being available to support policymakers to make this reform a reality. We believe in meaningful action as part of the puzzle that is bringing gender balance to the STEAM field. We also know that not everyone needs a gender-focused activity in order to reach their full potential. We are privileged to form a part of a rich tapestry of STEM and STEAM outreach organisations who have differing audiences and focuses. We are working to deconstruct social norms for a historically marginalised group, whilst striving to reflect a constantly evolving society. Working as a collective, we can achieve an inclusive future where STEM is for all. But for now, the aim of the UK being a 'Science and Technology Superpower' by 2030 is just an unfulfilled dream whilst we continue to shut the door prematurely on marginalised individuals with the capacity for Industry-changing innovation.

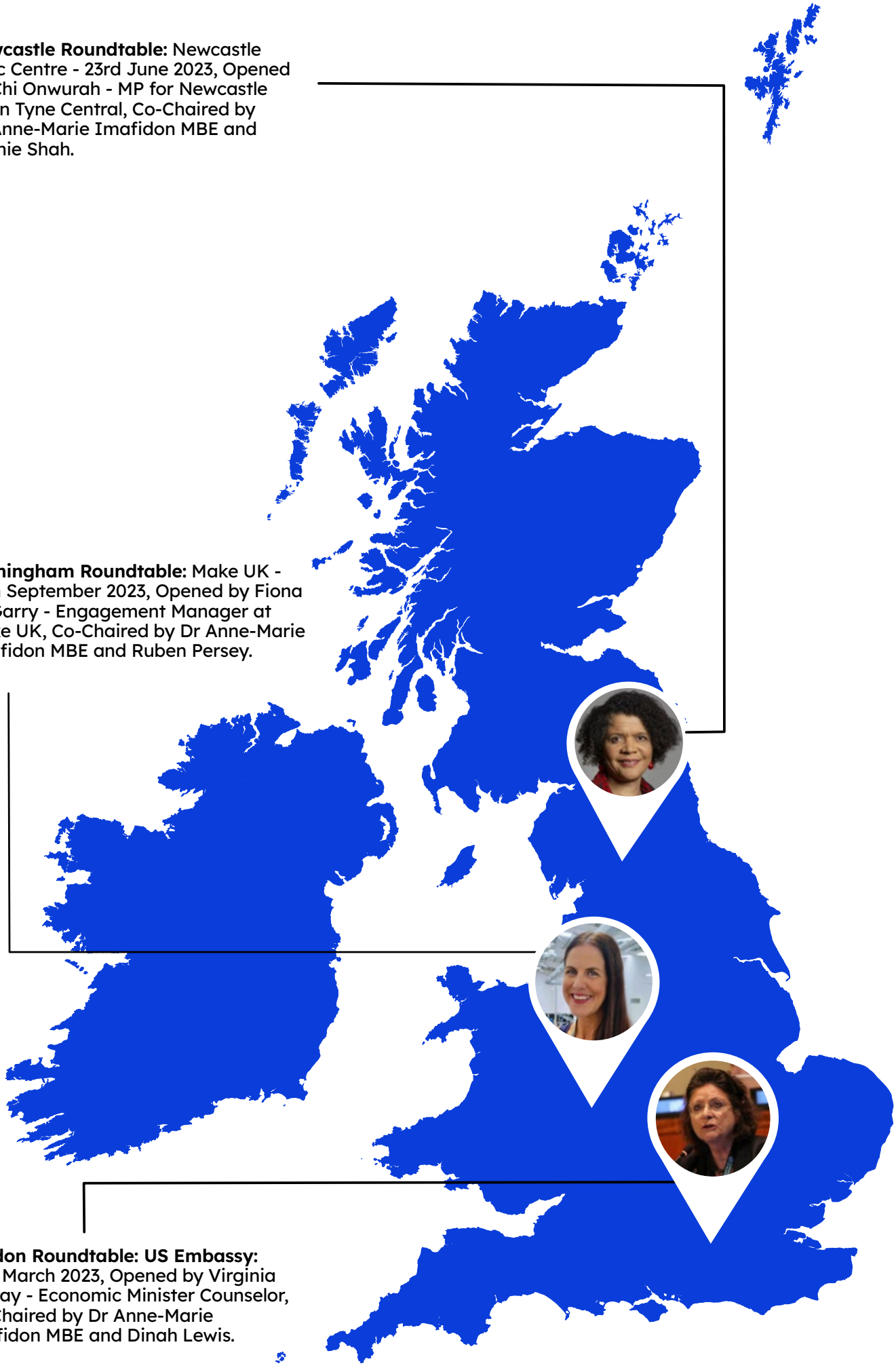
Methodology

Work for this White Paper began with the London Roundtable discussion held in March 2023. This was followed by the Newcastle Roundtable in June 2023 and the Midlands Roundtable in September 2023.

Invites were sent to organisations and individuals across the outreach, educational and STEM & STEAM landscape, compiled to reflect those with an overlapping lived, learnt or remitted overlap with the topic. We sought to include those studying the curriculum, deciding on it, employing those who had completed it, those delivering the curriculum, those in support of those studying and parents/community groups. We also wanted a geo-diverse set of inputs so in addition to physically hosting the roundtables across the country, had an intentional set of local voices present.

Having worked in this space for a decade, Stemettes also reconnected with academics and interested parties from previous collaborations, roundtable discussions and panel events. Stemettes undertook further activities to support this inquiry over five months total; occurring between October 2023 and February 2024. Evidence for this White Paper was gathered via a series of oral evidence sessions, a structured online survey, interviews with additional stakeholders and third-party research from a range of organisations.

Newcastle Roundtable: Newcastle Civic Centre - 23rd June 2023, Opened by Chi Onwurah - MP for Newcastle Upon Tyne Central, Co-Chaired by Dr Anne-Marie Imafidon MBE and Jaynie Shah.



Birmingham Roundtable: Make UK - 25th September 2023, Opened by Fiona McGarry - Engagement Manager at Make UK, Co-Chaired by Dr Anne-Marie Imafidon MBE and Ruben Persey.

London Roundtable: US Embassy: 14th March 2023, Opened by Virginia Murray - Economic Minister Counselor, Co-Chaired by Dr Anne-Marie Imafidon MBE and Dinah Lewis.

Stemettes would like to thank all the individuals and organisations that participated in this research, with particular thanks to the co-chairs of the sessions, Jaynie, Dinah and Ruben, and all of our roundtable discussion members.

The views in this report are those of the author and Stemette Futures / Stemettes. While these were informed by our contributors, they do not necessarily reflect the opinions of these individuals or organisations.

Roundtable attendance, oral and written evidence

Association for Black Engineers

Bank of America Foundation

BCS, The Chartered Institute for IT

British Science Association

Development Education Centre South Yorkshire

Engineering UK

FLUX

Ilford Ursuline Academy

Imperial College London

InnovateHer

Institute of Physics

Kings Priory School

Make UK

Marra

Mathematics in Education and Innovation (MEI)

MediaCityUK

National Education Union

Natural History Museum

Newcastle County Council

Oasis Academy

OCR

Ørsted

Pearson UK

QA Apprenticeships

Roche

St Wilfrid's RC College

Standard Chartered

Tech Talent Charter

The Black Curriculum

Ulster University

University College London

University of Arts London

WJEC

XTX Markets

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The views in this White Paper are those of the author and Stemettes / Stemette Futures. While these were informed by our contributors, they do not necessarily represent the opinions of these individuals or organisations.

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It has not been approved by either House or its committees.

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Paul Evans at WJEC, Amy Brewer at OCR, Angharad Morgan at Development Education Centre South Yorkshire and Olivia Wolfheart at BCS, The Chartered Institute for IT for participating in additional interviews.

We also wish to thank our partner organisations that were consulted and provided invaluable evidence and input over the course of this enquiry.

Final thanks go to TeamStemette, Head Stemette Anne-Marie Imafidon, and colleagues Floriane Fidegnon and Julia Piekarczyk, for their support in delivering the White Paper.

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Annex 1

7 Feb 2023 | Initial Letter

Dear Secretary of State,

We are writing to you because the majority of GCSE and A-Level Science curricula fail to mention the work and achievements of any women scientists. We believe that this stark lack of representation is contributing to the continued gender disparity in science, from the uptake of STEM subjects by girls at A-Level to the number of women in senior positions in the STEM Industry. A compelling solution to this would be to introduce visible and diverse women role models to instil girls with confidence and the belief that science is a field in which their skills and ideas are not only welcome and valued, but necessary. For these reasons, we would like you to add and enforce a new requirement in your subject content documents, stipulating that exam boards must include women scientists in their GCSE and A-Level specifications.

It is our experience, and indeed that of many of our peers, that the GCSE and A-Level curricula currently neglect to represent science from the perspective of women contributors in the field. At present, exam boards can and do publish specifications that create an illusion of science being a space for only men. In AQA A-Level Physics, the topic 'Turning points in Physics' details the discoveries of twelve male scientists and fails to mention the achievements of any women. However, throughout history, it is clear that many women scientists' work links to the content in GCSE and A-Level science, leaving us confused as to why these women have been omitted from the specifications. For example:

Kathleen Lonsdale proved that benzene is a planar molecule, and Mildred Dresselhaus investigated and developed our understanding of graphite, laying the groundwork for the discovery of fullerenes and carbon nanotubes.

Nettie Stevens discovered sex determining chromosomes, and Marie Maynard Daly discovered the relationship between high cholesterol and clogged arteries.

Lise Meitner pioneered our understanding of nuclear fission, and Cecilia Payne-Gaposchkin realised the sun is composed of hydrogen and helium using spectroscopy.

These women scientists are just a few of many that have been forgotten throughout history and need to be brought to the attention of students as they progress through their education, in order to inspire the next generation. Future scientists need to know that all genders can contribute to, and have a lasting impact on, the scientific advancement and technological development of our society.

The noticed absence of women scientists in specifications contributes to three times more boys than girls taking A-Level Physics in 2021. This in turn leads to fewer women taking sciences into further education, with 19% of Engineering and Technology students being women in 2017-18. There is also a lack of women in the STEM workforce. In 2019, women made up only 24% of scientists. Developments in science and engineering influence the technology, medicine and materials that surround us and that are used by everyone, so we must ensure that all genders, and a diverse range of perspectives, are involved in their creation.

Research from Teach First (2020) has shown that 50% of British adults are not able to name a single women scientist and research from Stemettes and the British Science Association has found that one in three young people say they have not been, or do not remember being, taught about a women scientist in the past two school years. This highlights the public's lack of awareness of the pioneering work women have carried out, reinforcing the need for young people to be educated on the lasting impact of women scientists' work, and how it is applied today.

Adding the requirement for women scientists to be included in GCSE and A-Level science courses would not only benefit girls by showing them STEM role models, but also highlight to everyone in the classroom, particularly boys, that girls are an integral part of the classes, lectures, and labs where they may find themselves in the future.

We urge you to make these vital changes and we would welcome the opportunity to meet with you and be involved in further discussions on this topic.

Yours sincerely,
Dinah Lewis, Jaynie Shah, Ruben Persey

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