

# Diversifying the STEM Curriculum

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## INTRODUCTION

The history of science is a complex piece of theatre with many characters, each interacting with their contemporaries and their predecessors. The disciplines of mathematics and engineering, as they are traditionally taught, involve recounting major events of this play, restricting the cast to a narrow list of figures.

This project's objective is to introduce figures, past and present, who, despite their contributions to the field, are often left out of everyday discourse due to systemic and historic prejudices, discrimination and oppression. Our ongoing goal is to show more representative picture of the diversity in the field to the community.

By increasing the visibility of under-represented groups, we hope to inspire a better sense of belonging to students who do not feel a sense of kinship with the traditional story that ignores the efforts of all who had helped create the environment required for the advancement.

## IT'S TIME FOR MORE STORIES

Very few people can relate to the 'geniuses' usually depicted, which contributes to the stigma that these disciplines are too difficult for them.

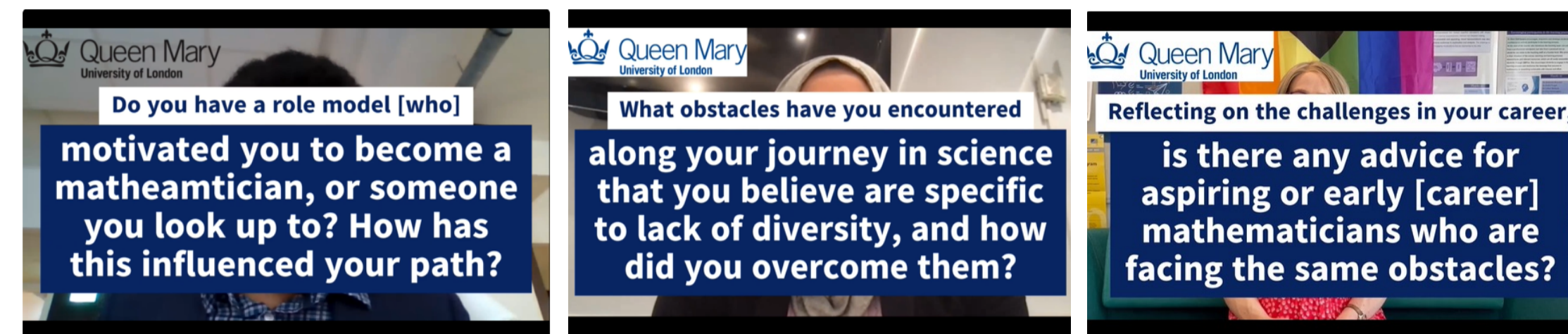
We can fight this stigma with increased awareness of diverse representation; not just with people from diverse backgrounds, but also by showcasing personalities applying their skills in diverse ways. This presents students with inspiring examples of someone who they can one day become.

QMUL has an incredibly diverse cohort of staff and students, so we believed this to be a fantastic opportunity to further educate and engage students.

## BIOGRAPHIES

This project began in Summer 2022 with the creation of a booklet of short biographies of mathematicians, which has been adopted in taught modules of the School of Mathematical Sciences (SMS) at QMUL. The project has been extended to the School of Engineering and Materials Sciences (SEMS) to include additional profiles of relevant figures in science and engineering.

The resource incorporates keywords to categorize profiles, facilitating lecturers in identifying those relevant to specific modules and aiding students in searching for profiles aligned with their interests. This feature makes our toolkit a simple yet powerful resource to showcase diversity and contextualise the learning experience beyond the classroom.



**71 The ENIAC Six: Betty Holberton, Jean Jennings Bartik, Kay McNulty, Marlyn Wescoff and Ruth Lichterman and Frances Bilas Spencer**

**Computing and Programming**  
**Keywords:** Female, Uncredited, Coding, Awards, Human computers

These six women were pioneers in programming and were tasked with successfully programming the world's first modern computer. In 1943, the U.S army recruited, McNulty, Jennings, Snyder, Wescoff, Bilas and Lichterman to program the Electronic Numerical Integrator and Computer (ENIAC). This was needed urgently so that ballistic missile trajectories could be calculated during World War II. The roles of these mathematicians involved solving complex equations associated with firing tables, and they were given very little guidance to complete this massive task. At the time, the women were not granted clearance and were basing their work off of blueprints and interviews with engineers. Despite this, they were able to develop and create sub-routines, nesting and more, all of which still remain relevant today. The computer was used until 1955 when it was decommissioned, but up until then was used in the nuclear fission calculations and weather simulations needed in order to create the hydrogen bomb.

Ultimately the credit for this exceptional piece of work has been credited to the designers of the ENIAC, John Mauchly and John Presper Eckert, and the work of the programmers has been not widely credited. This was largely due to the stigma surrounding mathematical computation at the time as it was considered 'too tedious' for the male engineers. The neglect of these 6 mathematicians was carried on, with none of them being invited to the celebratory dinner, and when photographs emerged, suggestions of Wescoff and Lichterman being models as opposed to large contributors to the project.

In 1997, the work of these six women was finally recognised as they were inducted into the Women in Technology International Hall of Fame.

Read more via [The Medium's Article](#); ['Remembering the ENIAC Six'](#)

**77 Ron Buckmire (1968 - present)**

**Fluid Dynamics; Numerical Analysis; Mathematical Education**  
**Keywords:** Queer, Grenadian, Outreach

Ron Buckmire (1968-) is a Grenadian-American applied mathematician and mathematics educator. His love for mathematics truly kicked off when doing an undergraduate research project on hypergeometric functions, stating "I could not believe that they would pay you to learn mathematics!" His Ph.D. work looked at computational fluid dynamics, and much of his research uses non-standard finite difference methods to provide numerical analysis for real-world financial models.

In recent years, Buckmire has stepped into the roles of Associate Dean for Curricular Affairs at Occidental College (Oxy) and as Program Director with the National Science Foundation (NSF) in the USA. In his role with Oxy, he oversees all academic initiatives and is responsible for improving the curriculum, and in his role with the NSF he has the responsibility of allocating funding to initiatives which improve undergraduate mathematics education throughout the US. He takes particular pride in his students who graduate with a mathematics degree and go on to teach school children.

Buckmire is also a proud advocate for opening up opportunities in STEM for marginalised groups. He is a co-founder of the LGBTQ+ mathematical organisation, Spectra, holds positions in many committees for improving mathematics education, equity, diversity and inclusion, and publishes many articles in these areas.

Read more in this [brief summary](#), [his profile at Oxy](#), or [this interview](#).



## VIDEO INTERVIEWS & POSTERS

We filmed short video interviews of mathematicians from diverse backgrounds and fields. The interviews prompted the participants to talk about what they enjoy about mathematics, who or what motivates them and brought to light lesser-known challenges they faced.

We also expanded several profiles covered in the biography booklet into a set of posters which are now on display in the SMS building at QMUL.

This very visible celebration of diverse figures beyond our modules promotes an inclusive culture at QMUL, for both students and academic staff.

## IMPACT & FUTURE WORK

We have received positive feedback from both students who enjoy the incorporation of these figures in their curriculum, and from academics who support this practice. We have also presented this project at various universities and secondary schools in the UK.

Additionally, the profiles of mathematicians are being disseminated through the Schools' social media accounts on a weekly basis, while also including featured figures and video excerpts from time to time.

This project is constantly evolving, with resources continuously being added and updated over time. A possible future direction is to conduct research into the learning outcomes of students following the pilot implementation of the resources within several first and second year undergraduate modules across both Schools.

## CONCLUSION

By providing students with relatable role models from a range of backgrounds, which are in line with the multicultural society that the curriculum serves, our resources take one step closer to destigmatising and broadening access to a successful future in STEM. This project gives a glimpse into the vast number of individuals overlooked by the curriculum and aims to identify the resultant impact on students' perception of STEM subjects.

## ACKNOWLEDGEMENTS

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