

# Astro Molo Mhlaba: A Sustainable Approach to Inclusivity in Astronomy

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One of the major difficulties facing interventions tackling inclusivity in astronomy is the extremely wide range of factors that simultaneously need addressing. Efforts to provide support at a particular phase of an individual's academic or professional career can in fact be nullified if no support is provided at the subsequent phase. In order to tackle this, the Astro Molo Mhlaba programme, which works with girls and women in underserved communities in Cape Town, South Africa, has introduced an innovative and sustainable approach, which ensures that development can be consistently provided at all stages of an individual's schooling and professional career. The school behind the programme, Molo Mhlaba, was founded and is led by local, award-winning activists with a six-year track record of well-established social and educational projects. Astro Molo Mhlaba's programmes were therefore specifically designed based on a first-hand understanding of the complex obstacles barring these girls from entering careers in astronomy.

## Introduction

Calls to address the lack of representation of groups identified by their gender, race, and financial background in research, which has been widely documented in STEM (science, technology, engineering, and maths) fields (*Campaign for Science and Engineering, 2018*), have been motivated in several ways.

The most fundamental of all is that the exclusion of these groups is the result of entrenched structural barriers in our societies, ultimately rooted in the discrimination and economic inequality these groups face (*van der Berg, 2005*). Addressing the issue of inclusivity in astronomy, therefore, is to engage in a broader effort to ultimately bring about a fairer and better society.

Other arguments refocus this discussion around the well-documented benefits that a more diverse workforce can bring to the research itself (*Hunt, 2018; D'Ath*).

There is however another way in which promoting the inclusivity of largely underrepresented groups can benefit astronomy: Ensure that research positions are taken by the most brilliant minds in order to maintain the highest standards in the field. But how can we make sure the best people get the best positions if we do not sample from

the full population's potential distribution? In other words, how do we ensure that the largest possible number of people are able to enter the race for research positions, so that it is statistically more likely for these positions to be occupied by the very top performers?

Evidence shows that this distribution of potential is utterly unaffected by factors such as gender, race, and economic background (*Guiso, 2008; Balart & Oosterveen, 2019*), despite continued exclusion of people marginalised by these factors. This points to an answer to the above question: By addressing the lack of representation of marginalised groups identifiable by these variables.

This article discusses the work of Astro Molo Mhlaba (AMM), which focuses on the inclusion of the most underrepresented group in South African science: black girls from underserved communities<sup>1</sup>.

## When to Intervene?

Today, despite representing 41% (*Statistics South Africa, 2019a*) of the population, black women constitute only 0.06% of STEM university graduates<sup>2</sup>.

Anyone bringing them to the race's start line—which we identify as success-

fully enrolling at university in a STEM degree—requires an understanding of the obstacles they face in getting there (*Astro Molo Mhlaba*). These obstacles are severe, numerous, diverse, complex and inter-linked, and are further present at all stages of their personal and academic development. A difficult question to answer then is when is the best stage at which to intervene?

Efforts to provide support at an early phase of an individual's academic or professional career can be undermined if no support is provided at the subsequent phase. Starting from a fragile foundation can lead to no real changes over generations for many individuals, and can also result in extremely ineffective efforts at later stages (*García, 2019*).

For this reason, our approach has been to provide support for students at all stages of their development, from 5 to 20 years old, in order to ensure the sustainability of our interventions.

## Astro Molo Mhlaba (AMM)

The Molo Mhlaba school<sup>3</sup> behind the AMM programme is a network of local, low-fee<sup>4</sup>, independent schools in underserved communities in Cape Town, South Africa. It provides the country's most vulnerable group—black girls from

underserved communities—with unprecedented access to high-quality STEAM (where A stands for “arts”) education and career orientation. Molo Mhlaba believes that girls living in underserved communities have a right to a safe, affordable and quality education to be inspired to pursue STEM subjects and work hard towards achieving their goals.

In 2019, the school launched the AMM project<sup>5</sup> with the aim of creating exposure to astronomy for girls at the school as well as neighbouring schools. Astronomy easily captures the imagination of students of all ages, making it the ideal subject through which to encourage these young girls to pursue STEM careers.

AMM was structured around the following programmes, which we were able to realise thanks to the support of our sponsors, the International Astronomical Union Office of Astronomy for Development (IAU OAD) and the University of the Western Cape (UWC):

**Astro Club:** Weekly after-school programmes for primary school girls which engage them in fun and creative astronomy activities. The aim of this programme is to:



**Figure 1.** Students in Astro Academy think of different ways to verify that the Earth is round during a visit from Dr. Marisa Geyer of the South African Radio Astronomy Observatory. Credit: Astro Molo Mhlaba

- Transmit fundamental astronomy concepts to young girls;
- Promote an association of astronomy with enjoyable and stimulating activities;
- Develop the girls’ confidence in approaching scientific subjects to empower them to pursue their scientific curiosity with assurance.

**Astro Academy:** Weekly after-school classes and a STEM-career mentorship

programme for Grade-11 students with excellent grades in maths and physics. The lessons are taught by female astronomers, who also provide advice and support on how to pursue a degree and a career in science. The activities are structured around their school curriculum (Figure 1).

**Facilitator programme:** Bursary programme for female graduates with good grades in maths and physics who have not enrolled at university. They attend the Academy classes, are trained and paid to run the Astro Club activities, and receive career advice and support for their next step. There are currently four facilitators.

**Network:** The AMM programme goes well beyond Molo Mhlaba, and actively works to involve more local schools in underserved communities in its initiatives. The programme currently collaborates with five neighbouring schools in the communities of Khayelitsha & Philippi in Cape Town. Across Molo Mhlaba and the neighbouring schools, about 230 girls and women have taken part in AMM programmes.

**Astro festivals:** Events on astronomy and STEM careers organised for children, their parents and the wider community. Through these, girls from the Astro Club can showcase what they have learnt to their parents and peers, increasing their confidence and enthusiasm in the programme. Children and parents alike can learn more about not only astronomy, but also about the career



**Figure 2.** Girls from the Chumisa Primary School’s Astro Club showcase what they have learnt about the planets in the solar system to their parents, fellow students, and astronomers during the Molo Mhlaba Astro Festival, which celebrated the IAU Astronomy Day in Schools. Credit: Tasman Weir



**Figure 3.** Palesa Nombula, a commercialisation young professional at the Square Kilometre Array and astrophysicist, speaks with students and family at the Molo Mhlaba Astro Festival. Credit: Tasmin Weir

options offered by a degree in the scientific research field (Figure 2, Figure 3).

### Our Strategy

The programmes previously outlined were designed to simultaneously tackle a number of barriers, which take place at different stages of girls' personal and academic development, by doing the following:

#### Break down Early Internalisation of Gender Stereotypes

In South Africa, like many other places in the rest of the world, social influences and gendered toys (*The Institution of Engineering and Technology, 2016*) translate into early internalisation, by children of both genders, of a presumed lack of potential in girls to successfully engage in science- and maths-based activities. We ensure that from an early age girls are directed away from this stereotype.

#### Transform Internalised Stereotypes of Subject Choice

Gender stereotypes can dangerously affect teenage girls who, despite obtaining excellent results in maths and science, may shy away from pursuing those subjects for fear of being less talented than their male peers (*Institute of Physics, 2012*). By having female astronomers teach in the Academy, we are able to provide the girls with hard evidence that women can be scientists too.

#### Increase Understanding of Pursuing a Career in Science

A major contributor to exclusion from STEM fields is the concern around the financial stability of a career in STEM, compounded by a lack of understanding of what a career in STEM actually is. We provide information to parents and pupils in underserved communities on how a career in STEM provides skills—both direct and transferable—which are highly sought-after in research and industry alike.

#### Address a Lack of Funding to Attend University

University fees are prohibitive for many students from underserved communities (*Statistics South Africa, 2019b*). However,

many funding opportunities are offered by the South African Radio Astronomy Observatory (SARAO) for higher degrees in physics to excellent students with an interest in astronomy. By engaging high school girls in astronomy activities, we can both motivate them to pursue a degree in physics, give them useful experience to include in their CV, and provide them with support at the time of application.

#### Provide Career Guidance at the Time of Graduation

Through our Facilitator programme, we are able to give a second chance to girls that, despite graduating successfully from high school, did not enrol at university because it was never considered as a viable option or they lacked understanding of how to do so practically. By incentivising them with a steady income while teaching the Club, we provide them with the support and guidance necessary to apply to university the following year.

### Conclusions

Truly caring about the quality of science we produce comes hand-in-hand with ensuring that research positions are occupied by the very best in the population's pool of scientific talent. Those top performers, however, are statistically less likely to be found if a great portion of this pool is excluded prior to the selection process.

Astro Molo Mhlaba wants to ensure that the top talent in one of the most under-represented groups in South African science—black girls from underserved communi-



**Figure 4.** Header for the Molo Mhlaba Astronomy Facebook page. Credit: Astro Molo Mhlaba; Sky Image Credit: A. Das





**Figure 5.** The girls in Astro Molo Mhlaba talk with Ewine van Dishoeck, president of the International Astronomical Union and Leiden University professor. Credit: Astro Molo Mhlaba

ties—are not missed. In order to ensure its efforts are truly sustainable, its interventions simultaneously target obstacles present at all stages of these girls' personal and academic development—from their early years of primary schooling, through their high school studies, and after their graduation from school.

We want Astro Molo Mhlaba to become a permanent, well established programme in Khayelitsha, and eventually expand to reach more schools in the community<sup>6</sup>. Only in its second year of implementation, the programme has high hopes that the young girls taking part in our initiatives today will one day be able to fulfil their true scientific potential, and contribute to the future success of astronomical research.

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## Notes

- <sup>1</sup> "Black" here refers to Black Africans in South Africa, rather than Coloured Africans in South Africa.
- <sup>2</sup> No direct statistics are available, so the quoted number was obtained as follows: 13% of STEM graduates in South Africa are female ('The Global Gender Gap Report 2018—World Economic Forum', World Economic Forum [online], 1 Oct 2018, <https://www.weforum.org/reports/the-global-gender-gap-report-2018>)
- <sup>3</sup> Of 200 black pupils who start school, only one can expect to do well enough to study engineering ('South Africa has one of the world's worst education systems', *The Economist* [online], 7 Jan 2017, <https://www.economist.com/middle-east-and-africa/2017/01/07/south-africa-has-one-of-the-worlds-worst-education-systems>)
- <sup>4</sup> Molo Mhlaba school website: <https://molomhlaba.org/>
- <sup>5</sup> There are school fees required for both public and private schools, with public schools having widely varying levels of government support and academic rigour. The school fees for private Molo Mhlaba were based on the 2018 amount of government-paid child support grants, guidance from the Khayelitsha Early Childhood Development Forum, and a survey of over a hundred local parents. Based on a 3/3 system, parents only pay one-third of the true schooling cost, with grants, donations or sponsorships making up the remaining cost.
- <sup>6</sup> Astro Molo Mhlaba programme website: [www.astromolomhlaba.org](http://www.astromolomhlaba.org)
- <sup>7</sup> People can support our program through monetary donations ([www.astromolomhlaba.org/donate](http://www.astromolomhlaba.org/donate)) or by remote volunteering to help with the development of material.

## Biography

**Margherita Molaro** is a postdoctoral researcher at the Centre for Radio Cosmology of the University of the Western Cape in Cape Town, South Africa. She is the founder and coordinator of the astronomy outreach project Astro Molo Mhlaba ([www.astromolomhlaba.org](http://www.astromolomhlaba.org)).

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