

Community Needs Assessment: Mariannridge Schools Maths Project

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Mariannridge as a typical peri-urban township in post-apartheid South Africa

Contemporary South Africa faces a unique set of challenges owing to its history. In many respects, South Africa resembles two countries inhabiting the same land area, one highly developed and the other largely underdeveloped and not participating in the South African economy in a meaningful way. The first-world part includes (but not exclusively) the descendants of the former Dutch and English colonists, who still hold a substantial fraction of the wealth and economic power. Subsets of the Black African, Coloured, and Indian populations have become integrated into this South Africa. On the other hand, for the rest of South Africa, and in particular the bulk of the Black African population, as well as parts of the Coloured and Indian populations, South Africa remains an underdeveloped country. Its communities still remain physically separated from the more affluent communities. In the communities of this other South Africa, the majority of the population is unemployed.

Often South Africa is not regarded as poor country compared to other sub-Saharan African countries. Among sub-Saharan African countries, South Africa and Nigeria have the highest GDPs, and South Africa is among the sub-Saharan African countries with the highest GDP per capita. But South Africa also leads the continent—and also the world—in unequal distribution of wealth as quantified by the Gini coefficient according to World Bank statistics.

As this project aims to address inequalities in education, our survey aims to investigate education in a former township just outside Durban called Mariannridge. Originally, Mariannridge, then farmland, was established by the apartheid government in the 1970s to house coloured populations displaced from other parts of Durban, most notably from Mayville, as part of the implementation of the apartheid policy. Over the years, this community has evolved, and Mariannridge is now majority Black African. Two schools were built, a primary school and a secondary school. Our interviews explored the history of Mariannridge, its present character, and the challenges faced by of this community. We focused on the state of education, in particular in high school, and in mathematics and the sciences.

Genesis of the Mariannridge Maths Project

The initial impetus for this project arose when members of the Durban Umhlatuzana Rotary Club were distributing food in the Mariannridge community during the initial Covid-19 period at a location near the Mariannridge Senior Secondary School on a Saturday. Mr Peggie Naidoo noticed that there was activity at the school, which would normally be closed on a Saturday, and found Principal Mtungwa tutoring students in mathematics. After this initial encounter, a meeting followed between Principal Mtungwa and members of the club at which Principal Mtungwa outlined the situation of the school and its needs. The list of needs was extensive, many of which involved significant capital expenditures beyond the means of the Club. But it was noticed that the difficulties of learners struggling with mathematics was an area that the club was particularly well suited to address given that three of the club members are also UKZN (University of KwaZulu-Natal) faculty members in physics and

mathematics. Principal Mtungwa was asked whether it would be useful to arrange for UKZN students to come to the school to tutor in mathematics.

Principal Mtungwa responded positively, so it was arranged for UKZN tutors to come to the school on Saturdays starting around July 2020 to help final year learner prepare for the Mathematics Literacy Matric exam (taking place in December). This effort in 2020 was evaluated in two ways: by comparing the Matric Scores of the 2020 cohort to that of the previous year, and by conducting a group interview with the tutors and discussing with school management. As a result of this program, the pass rate was increased from 57% (in 2019) to 83% (in 2020).

The tutors reported their experience as positive but recommended that rather than carrying out a crash course to improve exam results at the last minute, it would be better to start at an earlier age. It was also suggested that we should try to encourage the more advanced “Pure Mathematics”, as the simpler “Mathematics Literacy” track severely limits the future options beyond high school for the learners. *(See the explanations of the differences between these tracks further below from the interview with Principal Mtungwa).*

In January 2021 (in South Africa the school year coincides with the calendar year), the tutoring program restarted with the cohort of 8th graders in 2020. The pass rate at the end of the year was 96.3%, much higher than the previous year. In 2022 the program again restarted doubling in size, serving both 8th and 9th graders in 2022.

Together with the school, a plan was put together to add one grade each year, but for this to happen additional funding is required. Our final goal is to expand to five grades at a time, and to identify recurrent funding, mainly from South African corporations, in part incentivized by BBBEE Socio-Economic Development credits that would accrue through donating to this project. However, the BBBEE framework favors established and proven projects. The global grant would serve to expand and demonstrate this project at the size of five grades at a time. Even though the project is based at Mariannridge Senior Secondary School, the program is open to all learners from neighboring schools.

The present community needs assessment interviews a broader range of stakeholders, beyond the school leadership, which was involved in the original formulation of this project. This community needs assessment was primarily carried out by Dorina Bowes and Martin Bucher, who began by formulating a number of questions informed by the experience in running the pilot version of the proposed project in 2020 and 2021. We carried out a series of interviews based on these questions, which were recorded and transcribed. The raw transcriptions were lightly edited, and in some instances the interviewees were asked for clarification when the responses were unclear or when additional information would be particularly useful. The full transcripts of the interviews will be made available when the correcting and editing process is complete.

To provide a point of view independent of our direct contacts with the school leadership and to learn more about the Mariannridge community, we interviewed the following people:

1. **Ms Elizabeth Arnold** (a recently retired primary school teacher at Mariannridge Primary School, one of the schools feeding into Mariannridge Senior Secondary School)
2. **Ms Jenny Boyce** (who has been active for 31 years as community activist in the Mariannridge community)

3. **Professor Sudan Hansraj**, Professor of Mathematics at the University of KwaZulu-Natal. Hansraj also was formerly a high school teacher and then an Education Professor at UKZN.
4. **Mr Lucky Mtungwa**, principal of Mariannridge Senior Secondary School
5. **Ms Petronella Renton** (a parent whose children attended school in Mariannridge),
6. **Dr Sinenhlanhla “Precious” Sikhosana**, who did both her undergraduate and graduate education at UKZN, ultimately going on to an SKA postdoctoral fellowship in Radio Astronomy. Moreover, Precious was one of the 2019 tutors participating in this programme.

Highlights from Interviews

Description of the Mariannridge community:

Jenny Boyce: Mariannridge was built in the 1970s as part of the separate development program of the apartheid state government. Land was acquired from the Mariann Hill monastery and the borough of Pinetown. At the time two-bedroom flats and two-bedroom semi-detached houses were built. I think there were 602 of those that were established as the first part of Mariannridge. When people came into Mariannridge, they came from different parts of the city, mostly from gray areas in the city, from Thornwood, from Mayville, from Isipingo from Clarmont, from Mpolo farm, and they were settled in Mariannridge. When we arrived in Mariannridge there was really nothing. It was houses, flat-style and semi-detached style with no amenities, and no transport system. And all of this was developed around us as we arrived. There were no schools so we were bused out of the area for education. We had to go to Pinetown for shopping or any kind of supplies. Many of the people worked out in Durban and in Umbilo.

We have very slow development, of people's basic needs like sufficient housing, sufficient schooling, actions outside of a primary and a high school. We don't have any other trade schools or FET colleges close by. If young people are not able to stay in the system, the next option is that they would have to drive out of Mariannridge at an average of about R 50 per day, which is unaffordable for many of the people in Mariannridge. Mariannridge remains a poor society with a lot of people dependent on cash payments from the government, either in pensions, disability grants, or child support grants. I think this drives the levels of unemployment, poverty, and hunger in Mariannridge. We are a community that is struggling with its identity, with its place in the democratic project, with its leadership, particularly its political leadership.

Elizabeth Arnold (recently retired elementary school maths teacher): Mariannridge as a community began during the apartheid era, during the National Party government where there was segregation and different race groups live in different areas. Mariannridge was established as a community or a residential area for colored people, people of mixed dress, as was Chatsworth established for people of Indian descent. During this segregation time, KwaMashu was developed for black people. Mariannridge is comprised mostly of poor, disadvantaged kind of people who earn very little money. I think more than 50% or 60% of the Mariannridge community is at present unemployed, with absolutely no income. The two schools, Mariannridge Primary and Mariannridge Secondary, have children coming from very disadvantaged background.

Education most times takes a backseat to survival. Parents are more likely to prioritize the meals for the day, trying to get to work, trying to find the job. And for that reason, I don't know if I'm just making excuses for them, but alcoholism is rife. Drug abuse is rife.

You asked me to compare Mariannridge to Chatsworth. Chatsworth with is made up of families with different earning capacities. You will find the poor in Chatsworth. You will also find the very rich. Indian people, on the whole, I must say this, have a different mindset when it comes to education. They are very big on education and will go to great lengths to ensure that their children progress academically. They are very academically orientated, but at the same time also suffer from the same kind of social ills that we have here in Mariannridge. No very rich in Mariannridge. You're either making it or you're not making it. And when I say making it, I mean just being able to pay your bills and feed yourself. Westville? There's no comparison, there's no comparison between Marion Ridge and Westville, no comparison between Chatsworth and Westville, or KwaMashu and Westville. Westville is in the league of its own. When people move from Mariannridge and buy a house in Westville, then you say they have arrived. They've made it.

What very roughly is the unemployment rate in the community? What challenges do the people face?

Jenny Boyce: I don't have a clear statistic, but the unemployment rate is very high in Mariannridge. You see this by the visibility of people on any given day. If you drive through Mariannridge on a working day, like a Monday or Wednesday, from the number of people you see just moseying around in streets, you see the level of unemployment. It is quite difficult to put a percentage on the unemployment rate. But we know by other

simple facts. For example, over the years the Olympic Company provided buses that would take people to work. And over the years we watched those buses going from beyond full capacity to half empty, and then to empty, to the point that Olympic Bus Company had to withdraw their service because it wasn't feasible anymore. Those things indicate the level of unemployment in our community.

State of pre-University Education in South Africa

Q: Can you describe pre-University education in South Africa? There is a vast academic literature documenting the inequality in schooling in South Africa. There is also a perception that South African schools are not doing well, but I suppose that perception is not unique to South Africa. What is the impact today of South Africa's apartheid past?

Professor Sudan Hansraj: Now to speak about the inequalities of the past and how the demographics have worked out in terms of the University system right now, one must bear in mind South Africa comes from a history of inequalities entrenched through a law called the apartheid, where it was held that different races should follow their own trajectory. There were once four education systems, with four education departments, one for each race: Whites, Indians, Colored, and what they call Blacks or Africans. There was tremendous disparity. Whites were the most advantaged group. More funding per head was provided for White students than for any other group. Indians, were more advantaged than Coloureds. And the least advantaged were the Africans. The local Africans were least funded per head.

The government had a deliberate policy to prevent Africans from accessing science subjects. The government intended that even bright African students would not go down the line of science, that instead they would go into things such as humanities, Biblical studies, the so-called harmless subjects, and not into subjects such as mathematics, physical science, and so on. Some students did get the chance to go forward, but not in any significant numbers. That is why the quality of teachers that came out of that apartheid system was very poor amongst the African communities. Amongst Indian communities, the apartheid system backfired hopelessly. The top Indian children who could not go to University became teachers, so the teaching system became very sophisticated and could be equal or even better than the White system.

Unfortunately, Africans bore the brunt of the apartheid inequalities. They were never encouraged to do well in science subjects or to enter science disciplines. And their teachers were not at the same level as Indian and white teachers. That's why currently the performance of African students, who mainly come from rural areas and township areas, as we call them here, lags. In Africa, townships are big settlements around cities and urban areas. There are big sprawling townships all over Johannesburg. One example is Soweto. In Durban, you have Umlazi, KwaMashu, where sub-economic housing was provided for African people. Cape Town is similar. Even today people live in shacks, self-built informal housing. Lots of Africans live that way, but they could have a chance for economic progress had it been that the teachers were offered the standard that can provide more high-quality mass education. But as it turns out, there are pockets of excellence all over the place, and these pockets of excellence among the African system provide sufficient numbers of people to come into the university system.

Although they might start off on the back foot as it were compared to their White and Indian counterparts, many of these students eventually do very well. They are able to progress well enough. But their numbers are not reflective of what the society should be. As I said, that was a calculated policy of the past regime. But it is playing itself out now, and I think it will play itself out another 20 years as soon as you see the exit of the whole cohort of teachers that came in in the 80s and so on. Once they depart the entire system, then the new cohort is supposed to be setting a new path. The pass rates in the Matric are very low and they drag down largely because of the township and rural areas where the large number of students come from. I think this background explains why the performance levels are not what you would expect in a developing country.

On the two tracks for high School Mathematics in South Africa: the “Pure Mathematics” Matric and the less ambitious “Maths Literacy” Matric

Dorina Bowes: For people outside South Africa, perhaps you could explain the difference between the Pure Maths track and the Maths Lit track leading to two different Matric high school leaving exams taken in the final 12th grade year of high school. We know that admission to university in the STEM (Science, Technology,

Engineering, and Mathematics) programmes requires a Pure Maths matric certificate. Could you elaborate on the differences?

Principal Mtungwa: Maths is very important. To get a bursary, they must have Pure Maths. If you do not do Pure Maths, you cannot do a big number of courses at university. You cannot become a doctor, you cannot become an engineer. Not doing Pure Maths is basically an obstacle. If you went for Maths Lit, you can only do simple courses such as teaching and nursing.

On the need and effectiveness of the maths tutoring programme :

Q: Do you think bringing UKZN students to tutor maths and give extra lessons on Saturdays has benefited the learners? Has this led to better results?

Jenny Boyce: Absolutely. I think the results speak for themselves. That has to be our first confirmation of how we went from an underperforming school to a school that was achieving over 60%, and I think in the last year, 80%. Bringing the UKZN students down to Mariannridge brought a whole new fire to the learners and to the community. The fact that these were young people I think spoke to a lot of young learners, who may have been struggling with the classroom teacher relationship, and even some of the chaos happening Monday to Friday at the school. On Saturdays there was just a different ambience and a different attitude. I think the first cohort of young people who have the support of UKZN tutors built the impetus for the next cohort because again we move from "we can't do it" to "it can be done." I think that bringing in the University tutors has been absolutely critical in turning around the attitude, the competency, the confidence of our learners in Mathematics.

Q: Can you now tell us about your experience tutoring Matrics, the grade twelve students in Mariannridge? What were the needs of the students at the school? Did you feel that the program was impactful? Do you have any recommendations?

Sinenhlanhla "Precious" Sikhosana: It was a great experience. I love outreach and the impact it has on individuals. I think it did really have a positive impact. A challenge at first was having to work in partnership with teachers who were teaching Mathematics Literacy, or Maths Literacy. The students were saying, "Maths is hard." "But math is enjoyable. Maths is very nice." "No, it is not." It's drilled in to them. I know this from coming from my school where it was drilled into us that maths is hard.

The fun components and the everyday applications are hidden in the background. Once we break that "Math is hard" stereotype, progress starts. I liked making real life examples to make maths tangible, something they can relate to as well.

Another more material challenge was textbooks and study guides. The school did not have enough math books for everyone. We asked, "How do you do homework?" And the reply was, "We share them in school." If you have a textbook and work through homework examples every day, that improves problem solving skills because you are working on that continuously.

Once we moved students away from thinking that math is hard and let them start enjoying math, they engaged a lot more. Previously they were scared to say anything, for fear of saying something wrong. An important step is to get them to open up and to understand that it's okay to be wrong. Even the greatest scientists are sometimes wrong. Getting them to engage with the material, to make it more fun, helps a lot. Then they actually want to study. Making math fun and relatable for the students is the starting point. The resources of course are very important. The donation of the study guides was also crucial to improving results. They could take the study guides home, work out examples, and later go over these examples.

Principal Mtungwa: I hope that as time goes on, the Rotary Club, UKZN, and Martin Bucher are still going to carry on, because this program has assisted the school a lot. If it wasn't for this program, we would never come to discuss Pure Maths, because most our learners were failing maths dismally in grades eight and nine. But now that they have these extra classes, they are coping. As a result of that they've passed math in grade eight. They're doing very well now. When you talk about the number of learners who should be doing Pure Maths, I would be

happy if everybody had Pure Maths. But at the same time, this will depend on how long is the program that is implemented by Rotary Club and UKZN is going to be in this school.

Regarding access to computers and the internet:

Q: What is the access to the internet for learners in Mariannridge? Do most of them have mobile phones? Do they have sufficient bandwidth to read what is on the web? Do they have other access to the internet?

Jenny Boyce: A lot of young people have smartphones. Access to WiFi continues to be a challenge. The library does provide some free WiFi. It's very limiting. But a lot of young people sit around at the library because they have access to WiFi. There is also WiFi at the clinic, and a lot of them sit on the football field because they have access to WiFi there. But there is no WiFi in the school. There isn't WiFi at home where they should be doing homework or where they could be doing stuff in the evening. Access remains a huge challenge for a lot of our children. I think any school unable to provide access to WiFi is failing young people because a lot of learning is taking place in those spaces. A school must provide computer technology as a subject. What we're finding is that in the whole process of applying to university, nowadays everything is done online, on a computer. The universities are not printing prospectuses anymore. All that you have to find online. When you have to choose your subjects, you have to do this online too. You have to start learning, and you have to do it online. And I think it impedes the progress of our children if those things are not available for them at high school level already, we know they're not available at home. They are too poor to have those things at home.

Martin Bucher: Let's talk a bit about computers, access to computers and knowledge of computers. There are so many things where knowledge and familiarity with computing is so important, and this is not just for people going to university. What is the access to computers for learners at the school? Are learners being taught computing?

Principal Mtungwa: You are touching on a very important aspect because nowadays in South Africa we are talking about a Fourth Industrial Revolution. Number one: we have a computer lab, but the lab is empty. All the computers the school had were stolen. I would be very happy if we can secure some computers for the school. We could introduce CAT (Computer Application Technology) and IT studies. You can see that not having these skills is an obstacle in their way to university and elsewhere.

Before 2016, Mariannridge was on the verge of being classified as a failing school, as measured by pass rates compared to other schools, but despite the many challenges in Marriannridge, the new principal has been successful in turning the school around. Here is some evidence:

Principal Mtungwa: In 2016 before I came, only two learners went to university, in 2017 only ten went to university, in 2018, 12. In 2019, 68, in 2020, we had 106 learners that went to university. And why such an increase in the number of learners going to university? Number one, it's because the pass rate improved drastically. Number two, in 202, I was busy helping the learners to apply to get a place at university and then also assisting them to apply for NSFES, which is the funding scheme for university studies.

Importance of role models:

Q: Is it important for university students have role models to succeed in their careers? What are your thoughts on this? **Sinenhlanhla "Precious" Sikhosana:** I think it's very important to have a role model. There is a quote that says, "You cannot become what you cannot see." For example, before I knew or saw that astronomy student, I had no idea that I could study astronomy at all. Once I saw that person, she became a role model of that, that is attainable, that is reachable. Without that it is very hard to break boundaries and to reach outside the box. A role model makes you see what you can achieve. A role model who is also someone you can relate to has a more significant impact. When I was going to conferences, I would often speak to women who are either postdocs or married, and would ask, "Can you really have a family and still stay in academia and succeed?"

Conclusions

1. Marriannridge is a township located approximately 20km from central Durban. Mariannridge was originally established in the 1970s as a township for coloured by the apartheid government under its policy of separate development. Today many new people have moved to Mariannridge and it has become more diverse. The vast majority of the learners at Mariannridge Senior Secondary School are Black Africans, many of whom speak isiZulu at home. The community suffers from substantial unemployment and faces many challenges, including its geographical separation from most jobs and lack of educational opportunities.
2. Quality education in mathematics is essential to improving post-high-school outcomes. In South Africa there are two tracks for high school mathematics: a more advanced “Pure Mathematics” track, which is required for many tertiary education programs and also for obtaining bursaries to finance tertiary education, and a lower “Mathematics Literacy” track, which severely limits future options. Because of inadequate preparation in the lower grades, many learners in disadvantaged schools opt for the “Maths Literacy” option, partly of out fear of not being able to pass the Matric exam with “Pure Maths.”
3. The school principal, and other members of the community interviewed, have emphasized the importance of encouraging learner to opt for the Pure Maths track. The UKZN upper division and postgraduate tutors have proved highly effective in helping learners catch up and develop the skills needed to follow the more advanced Pure Maths track. While the tutors do not have any formal training in teaching, their similarity in age and demographic has made them more “relatable,” instilling self-confidence in the learners and dispelling the myth that “Maths is hard”.
4. Mariannridge Senior Secondary has recently evolved from being classified as a failing school to a success story following the recruitment of Principal Lucky Mtungwa. This improvement is due to a number of interventions, and Principal Mtungwa stresses the positive role of this programme, citing evidence of its effectiveness in terms of improvement in pass rates and Matric scores. He has also expressed the hope that the programme can be extended to more grades, from grade 8 through grade 12.
5. A need for computer education has also been expressed, both by parents and by the school leadership. Lack of access to computers and knowledge how to use them were identified as major problem.