

Lessons from Rural Medical Training for Physics Education in Botswana

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Abstract. Despite being classified as an upper middle-income nation by the World Bank, Botswana's economy is undiversified and heavily reliant on resources and commodities. Efforts are underway to drive the economy towards a knowledge- and technology-based one. In support of these efforts the Botswana International University of Science and Technology (BIUST) was recently established. It is foreseen that a future part of the BIUST undergraduate physics curriculum would be an internship placement for final year students. This article aims to provide a framework for the design of such an internship, based on the established practices of the final year internship of (rural) medical students in South Africa.

1. Introduction

Botswana is a landlocked country in central Southern Africa. At its independence from Great Britain in 1966 it was one of the poorest countries in Africa, reliant on cattle farming and beef exports as the main economic activity. Shortly after independence vast diamond resources were discovered. This discovery, as well as other natural resources, have enabled Botswana to be one of the world's fastest growing economies in the four decades post-independence [1, 2, 3]. In 2017 the mining industry remains the largest sector of the Botswana economy, accounting for about a fifth of the country's GDP in current prices [4].

Botswana's post-independence growth took place within a stable, peaceful period of governance coupled with robust institutional capacity and quality of leadership [3]. However, economic growth was (and still is) mostly based on the exploitation of natural resources and associated industries. As such the economy of Botswana has not diversified further post independence. Neither has broad technological change of the economy been affected, nor has there been an overall increase in labour productivity as commonly associated with the structural transformation of developing economies [1]. In June 2016 revenues from diamond exports accounted for 89% of all export revenue, thus leaving the economy vulnerable to international market fluctuations and consumer tendencies [1, 2, 5].

In terms of the population, Botswana is one of the least populated countries in the world. The 2011 census counted just more than 2 million people rendering an average concentration of 3.5 persons/km² [6]. The Botswana population concentration and distributions are given in figures 1 and 2 respectively. From figure 1 it is clear that the population is concentrated

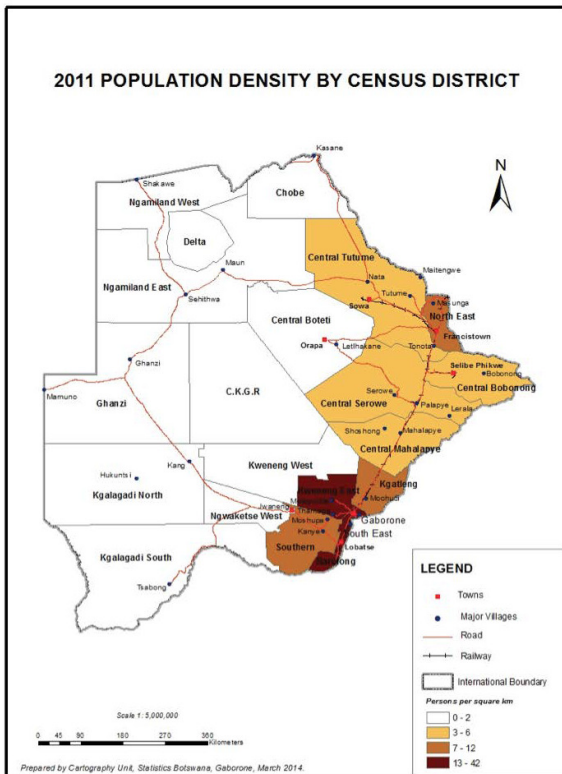


Figure 1. Botswana population concentration per census district at the time of the 2011 census [7].

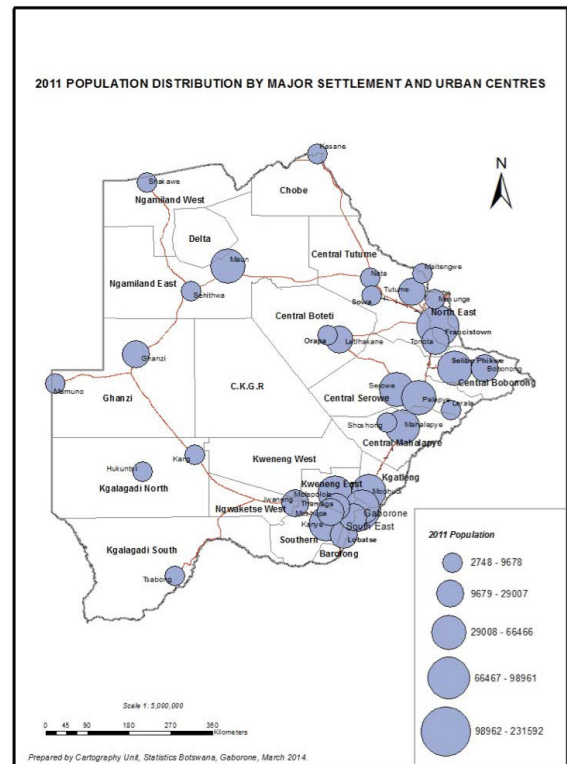


Figure 2. Population distribution centres in Botswana as recorded in the 2011 government census [7].

in the districts located north to south along the South African and Zimbabwean borders with Botswana. From figure 2 it is clear that although there are concentration in and around the major centres a significant fraction of the population lives in dispersed villages and settlements.

Despite the abundant resources, inequality and poverty in Botswana remains high with around 18% of the population below the international poverty rate in 2016 [2]. Infant mortality is also as high as 27 deaths per 1000 live births [6]. However, both the infant mortality rate as well as the extreme poverty rate have been decreasing over the last decade and are projected to continue doing so [2, 6]. In light of this, the Government of Botswana has identified the eradication of poverty as one of its goals within the economic development framework of Vision 2036 [8] as well as the eleventh National Development Plan (NDP11) [9].

Vision 2036 envisions that by “2036 Botswana will be a high-income country, with an export-led economy underpinned by diversified, exclusive and sustainable growth driven by high levels of productivity”. Part of this strategy is the diversification of the economy from a resource-based one to a knowledge-based one [8]. Vision 2036 also states that with regards to Education and Skills Development “Botswana society will be knowledgeable with relevant quality education that is outcome based, with an emphasis on technical and vocational skills as well as academic competencies...” [8].

1.1. Botswana International University of Science and Technology

One of the institutions that is tasked with achieving this vision of the future Botswana is the Botswana International University of Science and Technology (BIUST) [10]. It identifies as its mandate “to provide teaching and learning up to doctoral level in the disciplines of science, engineering and technology with a core engagement in basic and applied research” [11].

BIUST was established in 2005 by an Act of the Botswana Parliament and opened its doors in 2012, graduating its first undergraduate cohort of students in 2016 [11]. The university comprises of two faculties, the Faculty of Sciences and the Faculty of Engineering and Technology, as well as other support centres. It is situated on a 2 500 hectare plot in Palapye in the Central District. In service of the national strategic intent of transforming Botswana’s economy, the plan is to develop a “Science, Engineering and Technology Research Park” that serve as a hub for local and international researchers [10]. At full capacity, BIUST would enrol approximately six thousand full-time equivalent undergraduate and postgraduate students [11].

It is also foreseen that future undergraduate students will undergo an internship placement during their studies. This paper aims to propose a framework for the BIUST physics graduates’ internship programme which is based on the internship programme of South African medical students, in particular with regards to Rural Medical training.

2. Rural Medical training in South Africa

The World Health Organization (WHO) in its 2008 report *Scaling Up, Saving Lives* [12] reported a critical shortage of medical personnel in most countries. The report called for an increase training output, but nevertheless points out there was a migratory trend of medical personnel originally from and trained in countries that are under resourced and with poor infrastructure, to those countries with better resources. Thereby further depriving the under resourced countries of trained medical personnel. Furthermore, of the countries surveyed, the need for primary medical personnel in rural, poor, and far-off areas were, on average, far greater than those of urban areas. Recently the WHO released a further report that estimated the global need for an additional 14 million health workers, who are appropriately trained to meet the needs of the communities they will serve, by 2030 [13]

In South Africa an increase in graduate output would be difficult to achieve with the existing training facilities, especially with regards to clinical rotations. Clinical rotations are traditionally done in teaching hospitals under the supervision of experienced staff, but these resources are already stretched to capacity. Hence alternative or decentralised training sights, away from teaching hospitals, for clinical rotations need to be identified [14]. If such decentralised training areas are in rural areas it would increase the likelihood of graduates continuing to serve patients in a rural areas upon graduation. Thus rural decentralised training centres might also address the skewed distribution of medical personnel between rural and urban areas [14, 15].

2.1. Ukwanda Rural Clinic School

In 2011 Stellenbosch University established a decentralised training centre, the Ukwanda Rural Clinic School (URCS). Stellenbosch University’s Faculty of Medical and Health Science is located in Cape Town, South Africa, while the The URCS is located about 100 km from the traditional teaching hospital in the town of Worcester in the Cape Winelands.

There final year medical and allied health students spend their entire final year in a longitudinal integrated clerkship (LIC). The LIC students are placed in a single clinical setting, for instance a day clinic or hospital. A specialist family physician is primarily responsible for their

supervision and learning for the year, supported by regular visits by medical specialists from the regional hospital. Thus the LIC students benefit from both the continuity of the clinical setting and supervision, instead of traditional rotations between departments and supervisors in teaching hospitals [16].

Since the URCS is a departure from the traditional training, a comparison was made between the performance of URCS graduates and their peers at the traditional teaching hospital. It was reported that on average URCS graduates performed on par or even better than their traditionally trained peers in the final examination [17]. The benefits of the LIC seems to not be limited to students gaining practical experience in an undifferentiated and challenging clinical setting, but clinical supervisors also reported the experience as enriching as well as beneficial to their own practices [16].

3. Framework for BIUST Physics Internship

Based on the experience of the URCS, as well as that of similar initiatives by other medical schools in South Africa, a workshop was held in 2015 to try and obtain some consensus within the South African context with regards to decentralised medical training. It was noted that at the time of the workshop there was no ideal model for this type of training on the African continent to serve as reference, hence experts from various stakeholder organisations were also invited to participate [14].

The findings of the workshop [14] is summarised in table 1. For the sake of this article the findings was generalized and only the sections relevant to a physics and/or general science internship were reproduced here.

Based on the finding of [14], as presented in table 1, we focus on five generalized defining aspects of the LIC/decentralized training:

- The experience must be immersive.
- It must be well supported and all stakeholders must be briefed and agree on the outcomes of the placement.
- It must be an enabling experience for the student, in which the student should add value to the placement organisation without being exploited.
- It must be diverse exposure to different aspects of the placement organisation.
- A clear framework for engagement of all stakeholders must be in place.

4. Discussion

Although Medical Health Sciences are distinct from the Physical Sciences, the parallels in terms of the (broadly defined) community engagement of the proposed internship cannot be ignored. In essence, the medical professionals apply a specialized scientific knowledge to very practical situations which require the active participation, some understanding, but very importantly trust and buy-in from their patients, to be effective.

The drive to diversify the Botswana economy needs to come from outside the dominant mining and public sectors, especially if the transformation is to be driven in part by recent graduates with limited work experience.

We are of the opinion that the same approach and attitude of the LIC in South Africa needs

Components	Key factors
Responsive student curriculum and assessment	Based on the needs of placement Fit for purpose, socially accountable Immersive experience Critical thinking Sensitive to national and local needs
Transformative student experience	All stakeholders' roles clearly defined Working with colleagues at placement Briefing and debriefing, including safety aspects Logistics and operational needs learning space, accommodation at placement
Enabling training environment	Briefing mentors of intended reporting/learning outcomes Adequate infrastructure, equipment, space, security at placement Optimal numbers, student-to-trainer ratio
Community engagement	Exposure to different aspects of placement organisation Engagement of community in governance Encouragement of peer engagement while on placement
Effective leadership and oversight	Dedicated leadership and oversight, identified champions Mission alignment, placement facility becomes learning organisation University must actively participate and engage during placement Develop community of practice with placement organisation Demonstrate students contribution/adding of value to placement organisation

Table 1. Adapted description of the proposed key factors of an internship imbedded in a rural setting as originally reported in [14].

to be applied to the internships which are to be undertaken by BIUST final year students, and in particular Physics graduates. It would equip them to be valuable contributors to the transformation, possibly from as early as graduation. It is likely that through the experience of a well-structured internship, students would be sensitized to opportunities they could apply their knowledge in new and innovative contexts in the small and dispersed communities of Botswana. Increased economic activity in these areas would lead to general economic upliftment and the reduction of poverty.

One key factor from the literature regarding the LIC and the establishment of the URCS was the consultative and community driven approach. It appears thorough consideration was given to the needs of students and the outcomes of the programme while balancing it with the expectations of the potential supervisors. We believe the success of the BIUST internship programme will be very much determined by the level in which a similar approach is adopted.

5. Conclusion

The paraphrased description of the South African consensus regarding medical internship in table 1 provides a road map for the design of BIUST internships. However, it would be unfair to expect that the proposed internship by itself would provide the necessary transformative experience that would enable recent graduates to be successful drivers of transformation. Rather the internship should be the culmination of a continuous process throughout the undergraduate education. As noted with regards to the South African medical context:

“It is important to explore the way in which students are deployed and the activities that they carry out during decentralised training. It needs to be established how students can contribute to the service, the enhancement of care and improve academic standards thereby adding value during their decentralised training” [14].

Acknowledgments

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