

END-TERM EVALUATION OF
THE MATHEMATICS EDUCATION AND
NUMERACY CHAIRS' PROGRAMME
FINAL REPORT

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DISCLAIMER

The author's views expressed in this publication do not necessarily reflect the views of Tshikululu Social Investments, FirstRand Foundation, or the Anglo American Chairman's' Fund.

PREFACE

Khulisa Management Services is pleased to submit this final end-term evaluation of the South African Maths Education and Numeracy Chairs' programme. Khulisa has developed this report based on information provided by stakeholders on the programme including; Funders, Trustees, Administrators, International Panel Reviewers, University and Government representatives, Chairs and members of their research teams and project staff as well as documentation.

ACKNOWLEDGEMENTS

Khulisa Management Services would like to thank all the stakeholders (Listed in Annex 7.2) who were involved in the Key Informant Interviews (KIIs) for contributing to the evaluation.

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ACRONYMS

AI	Appreciative Inquiry
AMESA	Association for Mathematics Education of South Africa
ANA	Annual National Assessment
CFP	Content Focused Project
COP	Community of Practice
DBE	Department of Basic Education
DHET	Department of Higher Education and Training
DMJ	Developing Maths Judgement
DQA	Data Quality Audit
DST	Department of Science and Technology
FET	Further Education & Training
FRF	First Rand Foundation
GET	General Education and Training
Gr	Grade
KII	Key Informant Interview
LEDIMTALI	Local Evidence Driven Implementation of Mathematics Teaching and Learning Initiative
LMP	Learner Mentoring Project
LTSM	Learning and Teaching Support Mathematics
MTEP	Mathematics Teacher Enrichment Programme
MTF	Mathematics Teaching Framework
NECT	National Education Collaboration Trust
NRF	National Research Foundation
OECD	Organisation for Economic Co-operation and Development
PD	Professional Development
RUMEP	Rhodes University Mathematics Experience Programme
SARCHI	South African Research Chairs Initiative
SAARMSTE	Southern African Association for Research in Mathematics, Science & Technology Education
TM1&TM2	Transition Maths 1 and Transition Maths 2
WMC-P	Wits Maths Connect - Primary
WMC-S	Wits Maths Connect - Secondary

1. INTRODUCTION

Khulisa Management Services (Pty) Ltd, was commissioned in 2011 by Tshikululu Social Investments on behalf of the trustees of the FirstRand Foundation and Anglo American Chairman's Fund to conduct two types of evaluations:

1. Mid- and end-term evaluations of individual Chairs' projects, termed Level 1 Evaluations, using the Organisation for Economic Co-operation and Development (OCED) Development Assistance Committee (DAC) criteria and comparing costs;
2. Mid-term and end-term evaluations of the Programme, termed Level 2 Evaluation

While this is the Level 2 evaluation, it draws upon findings from the Level 1 evaluations. The Level 1 evaluations include six end-term and four mid-term evaluations. The Level 1 evaluation considered the programme's inputs, outputs, outcomes as well as any indications of impact on learners, the ultimate beneficiaries. The Level 1 end-term evaluations also served as an opportunity to document changes to the Chairs' projects models, as well as challenges faced by their projects.

The complete list of evaluations conducted by Khulisa can be found in Annex 7.2.

2. EVALUATION PURPOSE AND QUESTIONS

The purpose of the Level 2 final evaluation is to provide funders, programme administrators as well as the Chairs with an independent, overall assessment of the programme model. This evaluation is an update on the mid-term Level 2 evaluation submitted in December 2014. Since the Maths Chairs programme is continuing, this evaluation follows a developmental methodology, offering insight in how the programme is currently implemented and to inform future programme development.

Level 2 Evaluation questions were developed collaboratively at the Evaluation Workshop¹ held in 2012 with the Chairs, key Chair colleagues and Tshikululu staff, which provided the rationale for the evaluation of the funding and operational model of the Maths Education and Numeracy Chair's Programme. These included:

- What's working for the model? How can it be improved?
- What are the "hidden" costs?
- Can the model be applied to other fields such as science, arts & culture, etc.?
- What's the future of the model?

¹ The Evaluation workshop took place at the Premier Hotel the day after the Community of Practice meeting on October 17, 2012. It was facilitated by Feedback Analytics and Khulisa Management Services. During the workshop, the group adapted the OECD DAC evaluation criteria of relevance, effectiveness, impact, sustainability/replicability/generativity and cost effectiveness.

This evaluation is also structured around Professor Phakeng’s framework further described in the Findings and Recommendation section of this report and presented at the Maths Chairs Community of Practice held on 31 August – 1 September 2015 in Port Elizabeth.

3. METHODOLOGY

This evaluation uses a mixed methods approach. It combines qualitative data such as semi-structured key informant interviews of 32 respondents (see full list of respondents in Annex 7) with observational data from participating in five communities of practice (2011-2015).

It builds on the 12 Level 1 evaluations already conducted by Khulisa (for the full list see Annex 7.2) and the interviews with the Chairs and their teams. An adapted OECD DAC² criteria was used for the Chair evaluations. Chairs were assessed against five criteria: relevance, effectiveness, impact, sustainability and cost.

Quantitative data included details from respondents on additional funds or resources provided that support the programme both for the core administrative and programmatic costs. Finally Khulisa analysed attendance at the communities of practice as well as reviewed documentation which included the international panellists’ reviews, Chairs’ annual reports and other programme related documents.

In total, 30 participants were included in the qualitative data collection process for the end-term programme evaluation, for the interview schedule refer to Annex 7.

TABLE 1: NUMBER OF EVALUATION PARTICIPANTS

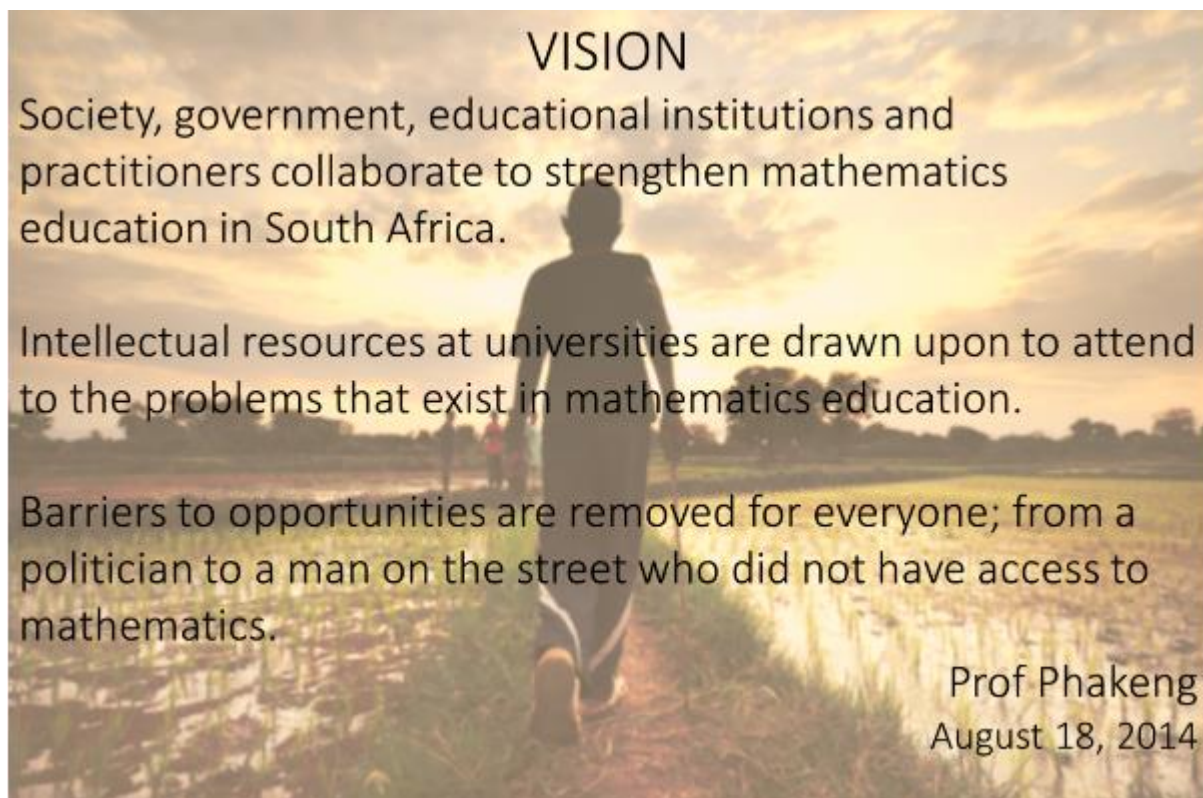
Participant group	Number interviewed
Maths and Numeracy Chairs	6
Tshikululu Social Investments	4
FirstRand Foundation/RMB	5
NRF	5
DST	1
DBE	1
Anglo American Chairman’s Fund	1
University stakeholders (other than Chairs)	8
Western Cape Education Department	1
Total	32

² Chianca, T. (March 2008). The OECD/DAC Criteria for International Development Evaluations: An Assessment and Ideas for Improvement. Journal of Multi-Disciplinary Evaluation.

4. PROGRAMME BACKGROUND

Maths Education and Numeracy Chairs Programme Vision

The vision of the programme, as conceptualised by Professor Phakeng, is for the private and public sectors in South Africa to collaborate and contribute towards improving mathematics education in South Africa. Drawing upon the intellectual resources at universities in the form of academics and researchers, the programme intends to address the problems which create barriers for the people of South Africa to reach their full potential. These barriers often stem from the lack of access to quality mathematics education at school.



The Maths Education and Numeracy Chairs Programme is one of the programmes funded within the education sector. It is a programme initiated by the FirstRand Foundation in partnership with the Rand Merchant Bank Fund, Anglo American Chairman's Fund and the Department of Science and Technology (DST), and administered by the National Research Foundation (NRF) and Tshikululu Social Investments.

Maths Education and Numeracy Chairs History and Model

In 2006, inspired by the South African Research Chairs Initiative (SARChI) Chairs (which started in 2004), Prof Phakeng persuaded a donor to set up a privately funded Maths Chair. The position, which she would take, would build on her conviction that academics needed to “enter the trenches of education” to identify, research and conduct experiments to address poor mathematics attainment. Prof Phakeng and the donor approached the NRF and were met with refusal – there was no mechanism to accept funding of this type and the SARChI policy was open competition for chair positions. In 2008/9, Prof Phakeng, now on the board of the First Rand Foundation (FRF), had the opportunity to establish the Chairs Programme.

Working closely with Tshikululu, particularly the then CEO Margie Keeton and the COO Sarah Rennie at the time, negotiations commenced with the DST and the NRF. The Anglo American Chairman’s Fund (AACF) also became a partner. Because FRF and AACF funding are administered by Tshikululu, an interesting hybrid **development chairs model** emerged.

While the chairs have a direct contract with the NRF, Tshikululu has administrative responsibilities and accountability to the FRF and AACF. Therefore, for the Maths Chair Programme, unlike other government programmes, *the private sector shares management, accountability and leadership roles with the public sector.*

The combined role is important because the NRF is driven by its academic and human capital development mandate and, while the DST is clearly enthusiastic about the development elements of the Maths Chair, *the development focus may have been lost without the private sector.* A strong leadership role is played by Prof Phakeng and the FRF Chair, Sizwe Nxasana, who insisted that evaluation is commissioned by Tshikululu.

This dual role is not always comfortable for either the NRF or Tshikululu, for example:

1. When the evaluation (issued to Feedback Research Analytics with Khulisa as a subcontractor responsible for school level data collection and analysis) was commissioned, the Maths Chairs originally refused to collaborate. Co-operation was achieved only after the FRF Chair intervened with a letter to the chairs.
2. As a key part of the evaluation, Chairs had to work with the evaluators to develop their indicators and to set up monitoring systems. This would not have happened without the Tshikululu commissioned evaluation.
3. Tshikululu has found the process often frustrating, as the accountability is indirect. One respondent stated that the “Chairs submit their reports to the NRF, who in turn gives it to Tshikululu who in turn finds gaps or omissions and has to communicate back to the NRF who passes the queries to the Chairs.”
4. Professor’s Adler and Schäfer’s five year review panellists were only given the Khulisa external evaluations late, and the review meeting had to be rescheduled as the NRF had forgotten to invite the FRF trustee. In addition, Prof Olivier’s NRF evaluation had to be redone after data collection issues and his Chair was still under review in April 2016.

Nonetheless, there is movement towards institutionalising the Maths Chairs model at the NRF. At first, the NRF viewed the Maths Chair as an external project and housed it in Grants Management and Systems Administration Directorate. Then, as the NRF leadership became more committed, the Maths Chairs were moved to Human and Infrastructure Capacity Development. In 2012, the NRF created the Research Chairs and Centres of Excellence Directorate (RCCE) where the Maths Chairs are administered alongside the other SARCHI Chairs. In 2016, the Maths Chairs are still administered alongside the other SARCHI Chairs. The new staff under the RCCE are involved with the Maths Chairs programme and recognise it as a separate set of Chairs. However, their statements that the Maths Chairs are simply “R&D” Chairs demonstrates limited buy-in to the development research model.

Maths Education and Numeracy Chairs Programme

The programme has six chairs, which are divided into two focus areas: the Numeracy Chairs and the Maths Education Chairs. Each Chair was selected competitively on the basis of a quality proposal and is expected to work with at least 10 public schools for a period of five years, and adopt diverse models to attain the programme objectives. Four of these Chairs work in the secondary schools and are known as Maths Chairs and two are in the primary schools and they are referred to as Numeracy Chairs. The six Chairs have overlapping implementation periods: two Chairs started in 2010, three in 2011, and one in 2012.

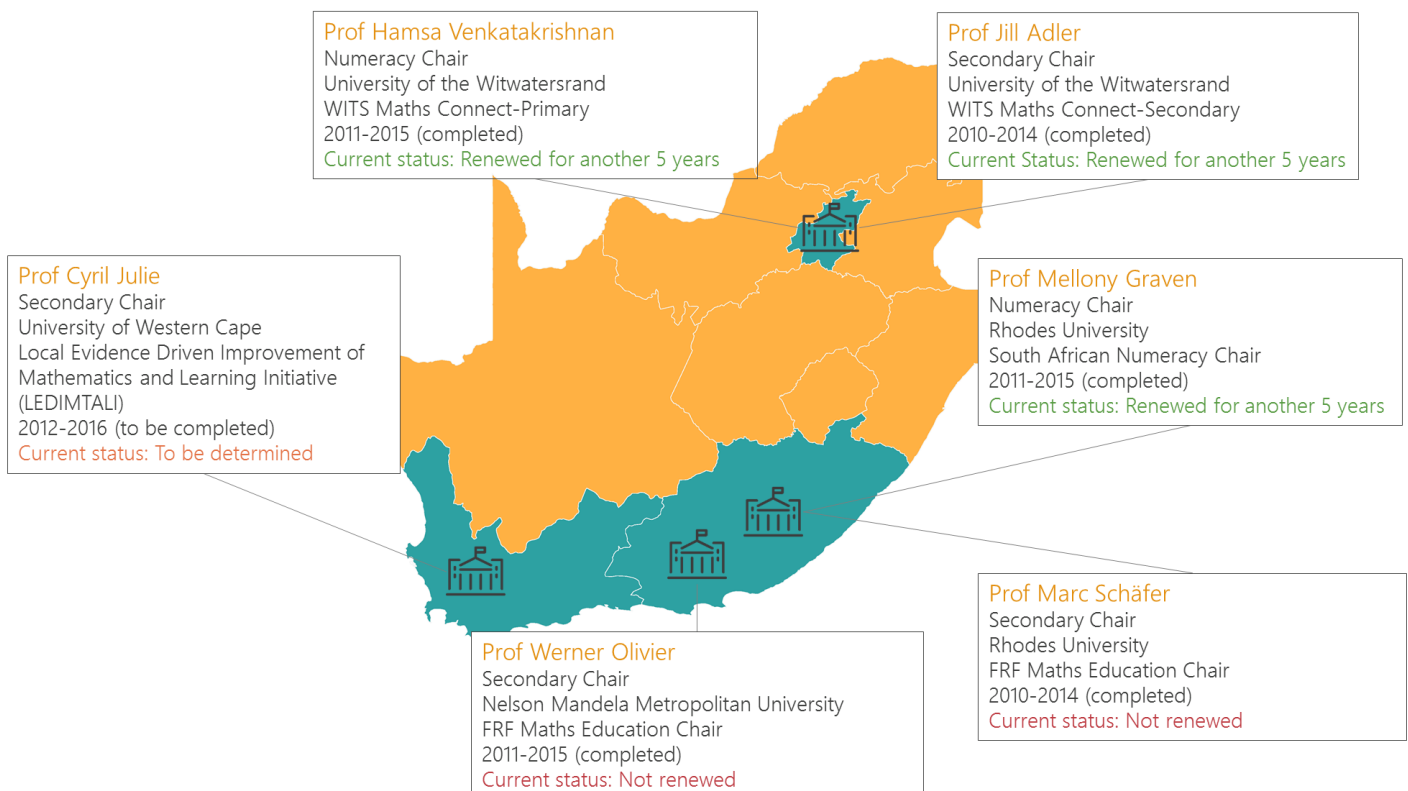


FIGURE 1: MATHS EDUCATION AND NUMERACY CHAIRS

To date, five Chairs have undergone a review process, in which the review panel compared the original proposal with achieved outputs, considered research outputs, contributions to the field, human capital development and Khulisa's end-term evaluations (Annex 7.2). The FRF and NRF have extended three Chair positions by another five years: Prof Adler, Prof Venkat and Prof Graven. Both Prof Schäfer and Prof Olivier did not receive a renewal of their Chairs award, while Prof Julie's review process is currently underway.³

5. FINDINGS AND RECOMMENDATIONS

Programme Objectives

The achievement of overall programme objectives has been explored in the individual Chair evaluations which includes four mid-term and six end-term evaluations (Annex 7.2).

Each of the Maths Education Chairs has been involved in developing and delivering a formal education programme for in-service educators, producing research on sustainable and pragmatic solutions to improve the quality of maths teaching and learning as well as providing leadership through academic citizenship and public engagements. The objective of improving learner performance presents a mixed picture due to averaging marks and fluctuations in matric maths marks year on year. None of the Chairs achieved the contractually required 10% increase in learner marks per school, per year. Other measures of improved learner performance include an increase in the number of learners writing matric maths, an increase in the quality of matric maths passes (over 60% i.e. ABC symbols) as well as an increase in pass rate. Similarly, these objectives were achieved by some Chairs in some schools, and results oscillate yearly.

The Numeracy Chairs focused on improving the quality of teaching of in-service teachers at the primary school level; improving learner performance in primary schools as a result of quality teaching and learning; researching sustainable and practical solutions to the challenges of improving numeracy in schools; and have provided leadership in numeracy and increase the dialogue around solutions for the mathematics education crisis. These objectives were achieved by the two Chairs, in particular the expansion of numeracy research in South Africa, an area that was previously under-researched.

Currently some Chairs have implemented learner-directed activities. However there is mutual agreement by Chairs and stakeholders that to maximise learner improvement and to make the programme more sustainable, educator skills, content knowledge, and attitudes should be addressed.

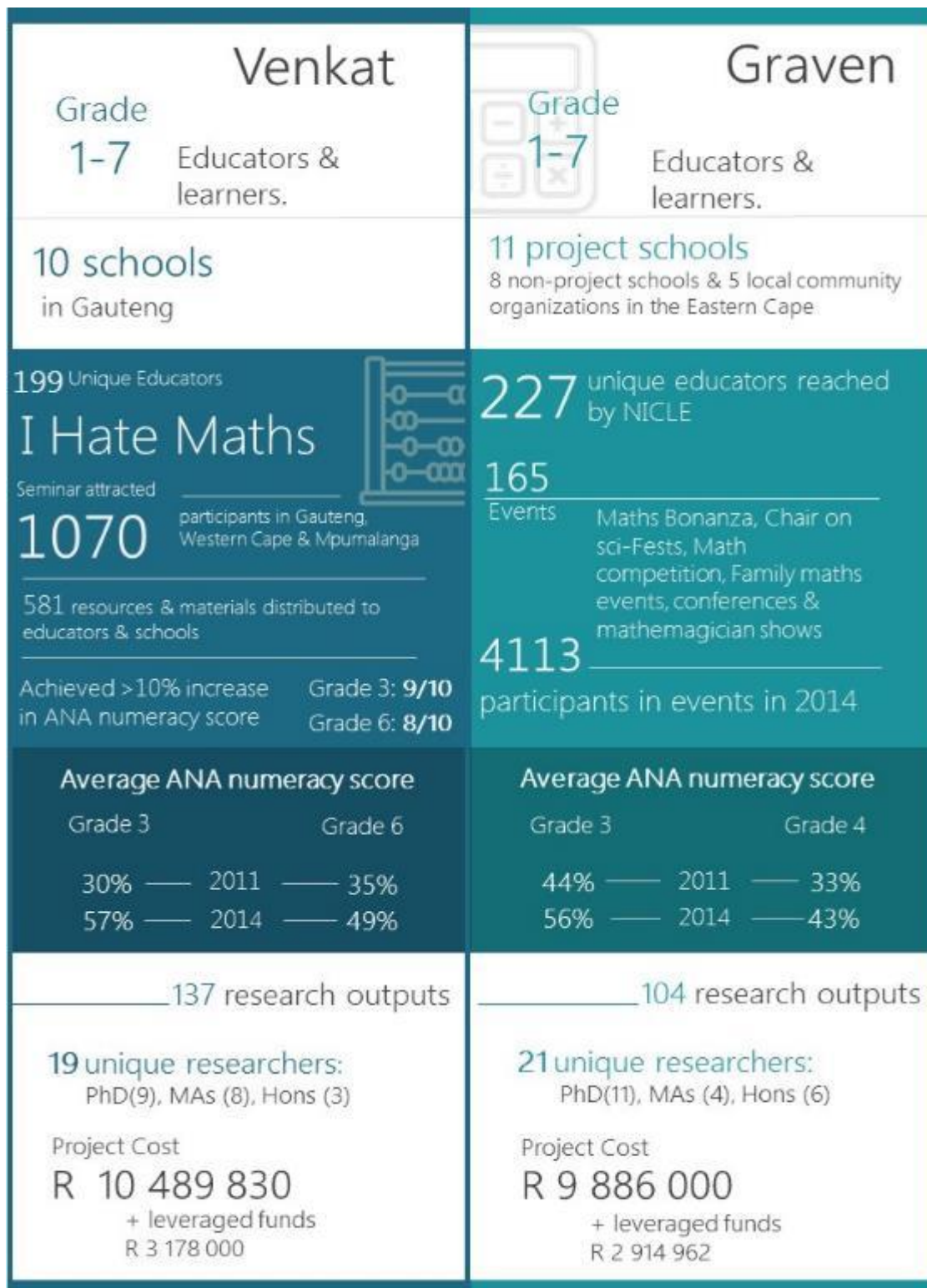
The infographics below provide a brief overview of each Chair's project. For a more detailed outline of Chair achievements on programme objectives, refer to Annex 7.3.

³ There were some problems with the NRF's evaluation process, which led them to re-do Prof Olivier's evaluation. Prof Julie's review panel was waiting for Khulisa's end-term report on his project, which was submitted in April 2016, to make the final decision on his Chair.

FIGURE 2: MATHS CHAIRS AT A GLANCE

<p>Adler</p> <p>Grade 8-12 Educators & learners.</p>	<p>Schäfer</p> <p>Grade 10-12 FET phase educators & learners in Gr 10 only.</p>	<p>Olivier</p> <p>Grade 10-12 Educators & learners.</p>	<p>Julie</p> <p>Grade 8-12 Educators</p>
<p>11 schools in the Johannesburg Area</p>	<p>10 schools in Grahamstown district</p>	<p>10 schools in the Port Elizabeth district</p>	<p>9 project schools 10 non-project schools in the Cape Town district</p>
<p>156 unique educators</p> <p>172 cumulative educators</p>	<p>53 unique educators & 133 cumulative educators</p> <p>532 learners participated in Maths Olympiad</p>	<p>32 educators reached</p> <p>Nearly 400 learners attended maths & science Saturday school.</p> <p>Almost 500 learners have received tablets</p>	<p>50 unique educators from project schools</p> <p>64 educators from non-project schools</p>
<p>97 research outputs</p>	<p>96 research outputs</p>	<p>52 research outputs</p>	<p>28 research outputs</p>
<p>42 unique researchers: Post-doc (4), PhD (9), MAs(10) & HONs (19)</p>	<p>21 unique researchers: Post-doc (2), PhD (7), MAs(12)</p>	<p>9 unique researchers: PhD(3), MAs (6)</p>	<p>20 unique researchers: PhD(11), MAs (9)</p>
<p>Project Cost R 11 069 165 + leveraged funds R6 128 000</p>	<p>Project Cost R 10 000 000 + leveraged funds R 1 316 000</p>	<p>Project Cost R 11 059 000 + leveraged funds R 31 273 500</p>	<p>Project Cost R 7 424 899 + leveraged funds R 2 887 850</p>

FIGURE 3: NUMERACY CHAIRS AT A GLANCE



What has worked for the model?

According to key informants, the programme's unique model which blends development and research is recognised as effective and relevant to maths education in South Africa. Each Chair has conceptualised and implemented different projects with many different approaches and methodologies that are designed to contribute to educator professional development in South Africa.

Khulisa's evaluations demonstrate that Stakeholders continue to report on the relevance and potential of the model to the context of maths education in South Africa. From the beginning, high expectations have been placed on the model and key informants report on the exemplary role the programme can have in setting up new models for educator professional development. Essentially, success of this programme will be in the lessons learned and shared to the educational sector, paving the way for the next steps in education in South Africa.

It's been six years well worth doing. I think it's really great. Every time we've viewed these [programmes] or have one of the professors come and talk to us we felt pretty good about being part of it. It's been successful and anything that is successful you want to continue with. But I'm all thinking 'so what? We've done this, so what?' [...] It's about what could be and what effect leveraging this is going to have on the curriculum or on the way that maths is taught.

– Norman Mbazima, Anglo American Chairman's Fund

According to many respondents the greatest success of the model was that it allowed the Chairs and researchers to ground their research on the realities that educators and learners face in classrooms. It has provided a context for interacting directly with in-service educators; where educators' on-the-ground experiences, concerns and needs can be identified, explored and addressed; an element which is considered to be lacking in the current structure of pre-service training at universities. According to stakeholders, the programme has created a platform for educators to not only expand their content knowledge, but also address specific gaps, improve skills and change behaviours and attitudes positively. The programme ultimately offers the combination of the theoretical approach offered at universities with the practical approach relevant to teaching in a classroom

I still believe that the answer to the complex crisis in Maths Education, particularly at secondary school level, is definitely linked to universities and a specialized applied scholarship of community engagement. No other place has the specialized knowledge and skills sets to develop modern and practical trans-disciplinary models that could have influence in the education system over time.

– Prof Werner Olivier, Chair

The dynamic nature of the model has been highlighted during the individual Chair evaluations. Chairs had to change and reassess their project design according to their experiences with schools, educators and learners and to respond to their research findings. The projects are continually developing and being refined with each lesson learnt. For example, three of the four maths Chairs have adjusted their models to extend to Grades 8, 9 and 10 educators. These Chairs recognised that to improve Grade 12 maths, there should be a solid foundation built in the earlier grades which is maintained and supported through to the senior certificate.

The programme's target, to improve learner scores by 10%, proved to be a transformational and grounding element for the Chairs' research. Initially there was some resistance from the Chairs in developing indicators and targets set by the NRF and the FRF, but that these ultimately transformed the way the Chairs conducted research, leading them to attribute their success to these targets.

If targets are not made explicit, it leads into possibilities for a different orientation of research... Our belief is that our research has to have an impact on the masses. [...] The fact that we work amongst teachers and within real, and often difficult contexts following from the explicit criteria of that development and research [NRF] contract, gives us inroads into research that I think makes it more manageable and real.

– Corin Mathews, Project Manager, WMC-P

A positive unintended outcome of this model continues to be its influence on educators to further their training and studies. Many Chairs have reported that the exposure to research and the increased collaboration between universities and schools have motivated educators to further their studies, mostly in Mathematics Education. Findings from the mid and end-term evaluations support these claims, some educators reported more opportunities to study due to being part of the Chairs' projects.

How can the model be improved?

A number of underpinning factors were identified from the key informant interviews which should be taken into account when assessing the programmes' progress thus far. These challenges were already pointed out to during the mid-term Level 2 evaluation. These include addressing constraints between stakeholders, considering chair rating status and improving programme communications and advocacy. An additional aspect of chair support has been included after interactions with informants for this end-term evaluation.

Communications and Advocacy

The mid-term evaluation pointed out to the requirement of having a focused and direct communications and advocacy strategy. Interactions with key stakeholders showed that although there is acknowledged need for this, no effective action or champion has derived from this recommendation.

During the mid-term evaluation, stakeholders were in agreement that the Chairs were communicating appropriately within their milieu through academic journals, book chapters and conferences. However, communicating to other potential audiences that would be necessary and beneficial for the Chairs to address in terms of sharing best practice, findings and lessons learnt are still not being done. These audiences are listed on the table below.

TABLE 2: CHAIRS PROGRAMME COMMUNICATION AUDIENCES

Key ★ communication does occur ★ some communication occurs ☆ little to no communication

Audience		Communication level	
		2014	2016
1	Direct Academic colleagues, Master's and PhD students employed, etc.	★	★
2	Target schools, educators, districts	★	★
3	Indirect Academic colleagues (pre-service departments) and Maths educationalists	★	★
4	Outside of government (NGOs, activists, textbook writers, etc.)	★	★
5	General Public, journalists, and citizens concerned with the education crisis in South Africa	★	★
6	Parents who would like to improve the quality of their children's grasp of Mathematics in an engaging fashion	★	★
7	Learners who want to improve their own marks and grasp of mathematics	★	★
8	Policy makers at provincial and national education departments	☆	☆
9	Department of Science and Technology which has delivery objectives in human capital development and research outputs	★	★
10	Department of Higher Education and Training which provides funding for pre-service education	☆	☆
11	In-service educator training providers	☆	★
12	Teacher Unions	☆	☆
13	Provincial Departments of Education	☆	★

Little has changed since the mid-term evaluation. The first three audiences continue to be addressed by the Maths and Numeracy Chairs, while the other areas are still neglected and do not have a champion. There has been a slight improvement in communicating with provincial departments of education and with INSET providers.

There is still a mismatch between the NRF incentives provided for communications (peer reviewed journals, presentations at academic conferences, Masters and PhD dissertations) and the type of communication expected by development practitioners to influence policy and practice. The Chairs' academic language is not accessible, and having a development specialist capable of dissecting key messages from each of the Chair's projects and diffusing them through the right channels would create greater visibility to the programme.

It is difficult for the Chairs [to communicate and advocate their work]. Academics are not great at communicating. I think you need more targeted and more focused way on how they communicate with the rest of the stakeholders. Especially because typically all of the Chairs would use [the fact that they are Chairs] also for their own academic purposes including research and typically the communication in that environment works through peer review journals and papers and forums where you can recognise them as academics; and that world is completely isolated form the real world.

– Sizwe Nxasana, FRF Trustee

Presently the findings from the Chairs are communicated through invited presentations made by Chairs at conferences and other forums, such as journal articles. There are selected public sessions, such as the "I Hate Maths" seminars, an initiative run by Prof Venkat's Wits Maths Connect- Primary (WMC-P) project. In addition, several of the chairs have shared their work through BRIDGE Communities of Practice⁴ and through FRF sponsored sessions. These presentations are accessible and show that there is a real opportunity to communicate the Chairs' work to NGOs and other organisations through forums such as the BRIDGE Communities of Practice. Despite this, the Chairs are not invited to participate in crucial forums routinely held by government departments that would allow for influencing policy.

I have raised the issue of the DBE which hosts a roundtable every year for maths education and they always invite me and I get there and I am the only one from the universities.

– -Prof Phakeng, FRF Trustee

⁴ BRIDGE is an NGO running both a knowledge hub and a series of Communities of Practice. "By facilitating both face-to-face and online engagement, BRIDGE shares knowledge, working practice and resources within the education community and improves the quality of teaching and learning in the country." www.bridge.org.za



PHOTO 1: PROF JILL ADLER PRESENTING AT BRIDGE COMMUNITY OF PRACTICE MARCH 2016

Some newspaper articles which refer to the Maths and Numeracy Chairs work have been published, but these still remain fairly rare. There is a need to focus on further channels of communication to have greater influence.

Maths resources for learners and their families have been produced by Prof Graven.

Several of the chairs are now producing resources, textbooks and other materials for educator and learner use. Prof Adler reports that she is prepared to hand over her INSET course to another provider or to the government to research if it is an effective if offered by another service provider. This is one step closer to scaling up an initiative.

However, the Chairs are not skilled at the style of communication needed by policy makers such as packaging summaries, using visual methods to communicate and creating policy briefs for government.

Academics do the maths on poor results

22 AUG 2014 00:00 | SARAH WILD



Six research chairs are devoted to analysing South Africa's maths problem and hope to come up with solutions to raise the level of competency.



PHOTO 2: MAIL & GUARDIAN ARTICLE ON MATHS AND NUMERACY CHAIRS

Stakeholders acknowledge the need for a clear communications strategy and recognise that this should be a priority for the future phase of the programme.

There has been some movement on communications and advocacy, but it is definitely still an area for improvement. For the past few months we have been designing a 'support plan' for the chairs, of which communications and advocacy is a central part. Finalising this is a priority in the next six months, and will be driven throughout the next five years.

– Adam Boros, Tshikululu

One of the critical issues related to the lack of communications and advocacy of the programme is that the concept of a 50% research and 50% development model has fallen flat, instead of picking up the previously established momentum. According to some stakeholders, there is still an opportunity for the programme to influence the NRF SARChI model, but this requires a clear advocacy strategy.

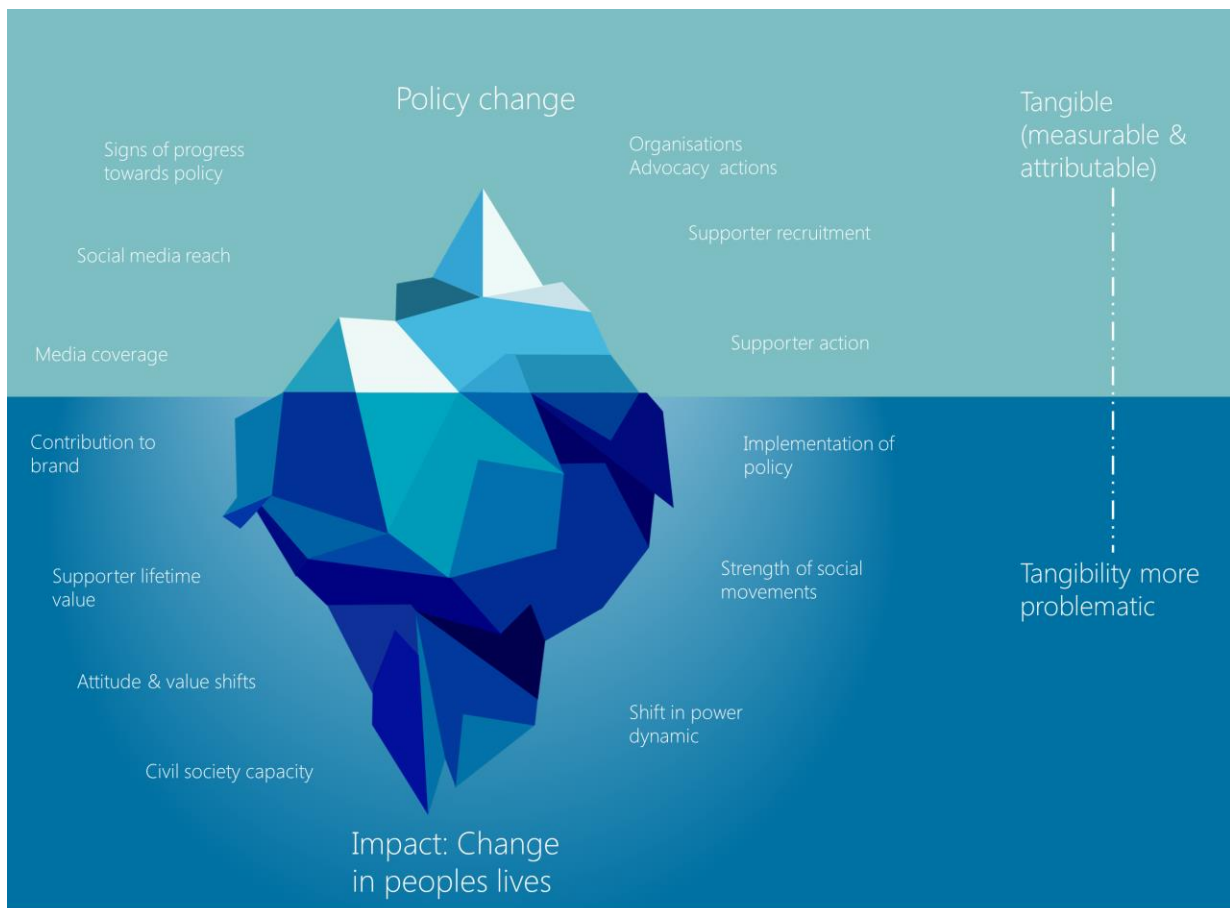


FIGURE 4: CAMPAIGNS AND ADVOCACY VALUE ICEBERG⁵

The campaigns and advocacy iceberg depicted on the mid-term evaluation report remains an important reference for understanding the importance of a communications strategy and the impact this has at different levels. In value terms, advocacy and campaigning is an iceberg: most of the impact may be submerged, difficult to see. And the temptation to focus only on the part that is visible risks creating a false picture that generates misleading information and encourages poor decision making.

⁵Schlangen, R. & Coe, J. (2014). The value iceberg: Weighing the benefits of advocacy and campaigning. See http://betterevaluation.org/blog/the_value_iceberg to download full paper.

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The programme requires a focused and direct communications and advocacy strategy that:

- Clearly denotes roles and responsibilities
- Reaches and segments the audiences through multiple but innovative platforms. In particular, the programme should expand its online presence through social media networks, blogs, and relatively new strategies such as TED talks.
- Addresses all parts of the *advocacy iceberg*, and measure its effect and impact.

Ideally, the programme should place a development communications specialist in the programme that would be able to move across projects and identify key messages for dissemination. It is important that this person has:

- Experience in advocacy
- Knowledge of Mathematics education
- Understanding of the various audience segments
- Sufficient status to deal with the stakeholders

This responsibility needs to be clearly articulated in the many contracts associated with the programme (e.g. between FRF, Tshikululu and NRF as well as with the Chairs and communications provider).

Stakeholder Relationships

While there was unanimous agreement that the Maths Education and Numeracy Chairs is an important and potentially very influential programme, stakeholder relationships, and especially the setting of roles and responsibilities remains unchanged.

The diagram below still depicts the way various stakeholders interact in relation to the programme. These relationships have not developed much since the mid-term evaluation. Relationships between the universities and DHET still need to be strengthened. While there has been marginal improvement in the relationships between the NRF and the FRF, as well as the involvement of the DBE in the annual communities of practice, these incremental changes are not meeting the programme's full influence potential.

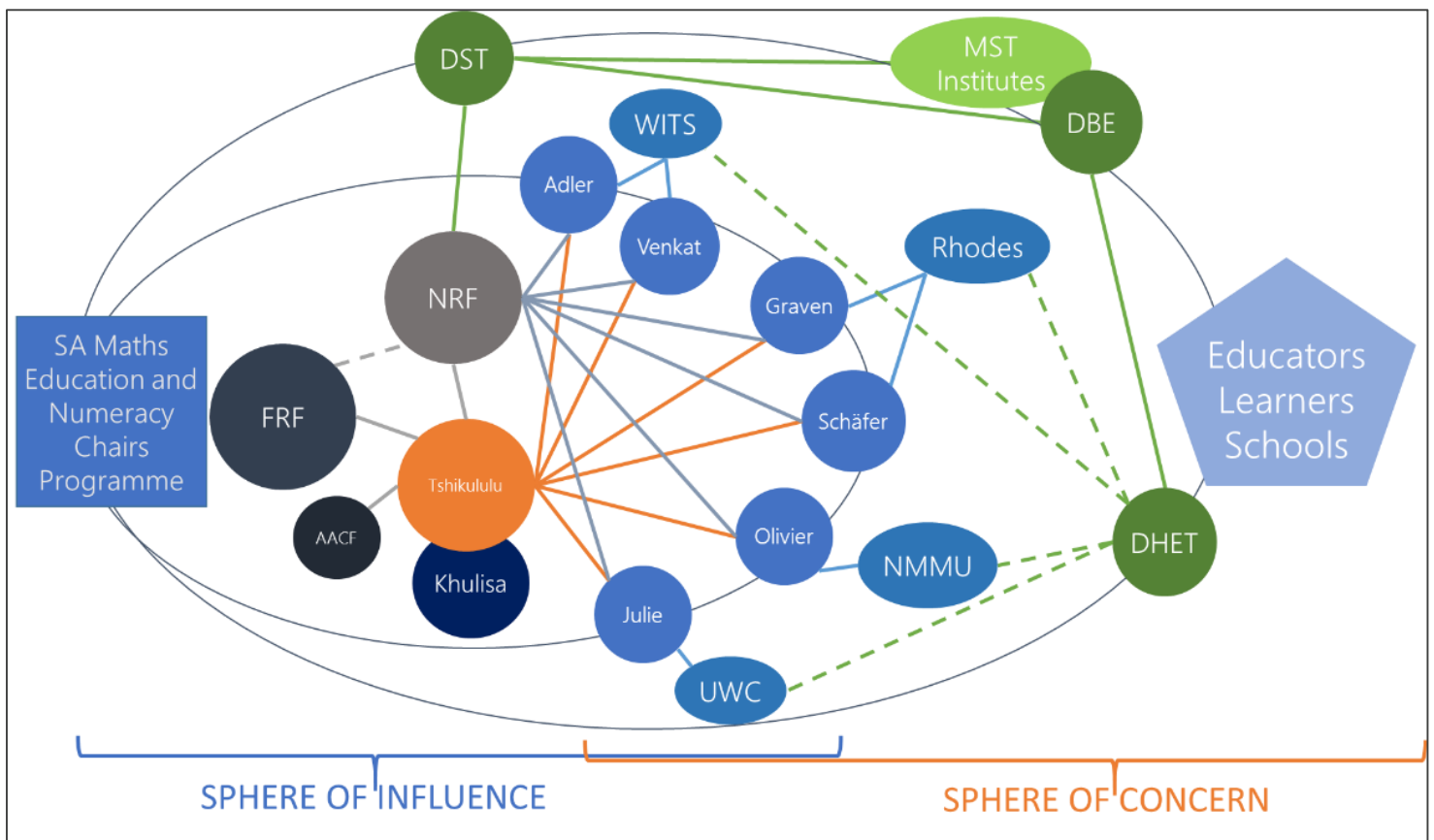


FIGURE 5: STAKEHOLDER MAP

The lack of communications and advocacy shows especially in the lack of directed action towards establishing stronger and strategic relationships between the programme and the Department of Basic Education (DBE) as well as the Department of Higher Education and Training (DHET). Since 2013, relationships with districts and provinces have strengthened for five of the six chairs⁶ Apart from the district and provincial level representatives involved in some of the Chair projects, there is no further connection between the programme and the DBE. Furthermore, existing links are not formalised, apart from two Chairs, Prof Graven and Prof Julie who have shown evidence of relationships with provincial government.

Establishing and strengthening the connection between the programme and DHET could yield many benefits, especially considering the programme's potential to improve pre-service training offerings and inform pre-service curriculum at universities. In addition, the programme should link to relevant existing initiatives that are currently implementing similar interventions within schools such as the National Education Collaboration Trust (NECT) and the MST at the DBE.

During interviews with the DST and the NRF it is evident that these entities have stopped seeing the Maths and Numeracy Chairs programme as a separate model, rather seeing these

⁶ Prof Schäfer reported no links with either the province or the district.

Chairs as another set of SARCHI R&D Chairs. Notably, R&D chairs do not have a target, such as the 10% increase in mathematics scores. In some ways, this is step backwards that can be attributed to the lack of a strong advocacy campaign pushing for the institutionalisation of “developmental” chairs that differ from pure research chairs.

I don't know about the success of this model. So, sitting from where I am it's very difficult for me to say that it is working. We are aware of a lot of researchers who do R&D (Research and Development). But not have it mapped out for them to this level of detail. So what becomes difficult for me to ascertain is whether this tight formulation would work for everybody. Otherwise R&D is what some researchers already do.

– Dr Phethiwe Matutu, DST

Nonetheless, the model of Public-Private Partnerships (PPP) that developed between the FRF and the NRF as a result of the Maths and Numeracy Chairs programme is regarded as relevant and that its lessons could potentially be applied between the NRF and other organisations/companies. For instance, the NRF reports that they are now working with Nedbank to potentially fund a set of Chairs. Whether these will be pure SARCHI Chairs or will have a “developmental” approach like the Maths Chairs is still to be decided.

Constraints in Stakeholder Relationships

On the mid-term evaluation, Khulisa identified several relationship challenges between key stakeholders involved in the Maths Education and Numeracy Chairs Programme which were regarded as a barrier to success, as well as sustainability of the programme.

Key informants pointed out that these relationships have improved, with the NRF and Tshikululu Social Investments meeting more regularly, increasing their engagement, ensuring higher level of trust and possibly creating a sense of ownership and responsibility of the programme by the NRF.

Over the last year or two [the relationship between Tshikululu and the NRF] definitely [improved]. The relationship has become stronger. We actually have scheduled quarterly meetings (and often ad-hoc) to meet and discuss any issues pertaining to the management of the Chairs. They have become more involved in the programme, in terms of taking note of all the issues that the Chairs have raised. [...] We have actually been a team effort, together with Tshikululu.

– Selelo Matimolane, NRF

During the first round of funding the six chairs (2011 to 2016), Tshikululu Social Investments commissioned Khulisa to evaluate the development outcomes with a minor focus on research outcomes. In addition to the fieldwork and document review (including the Chairs' NRF annual reports), Khulisa commissioned international panellists in 2013. These panellists provided expert assessments and recommendations on both the developmental activities as

well as the research elements. The NRF reporting requirements concentrated on the Chairs' peer-reviewed research outcomes and human capital mandates. The NRF Maths Chairs panel review considered Chair research outputs; student support (postgraduate students and postdoctoral fellows); support from their host institutions and funds leveraged from other sources; as well development outputs measured by the Khulisa evaluations.

In 2015, there has been a transition, whereby Tshikululu and the NRF have agreed that the NRF will gradually take over the full evaluation responsibilities. However, several Chairs commented that adapting the normal SARChI reporting format to add developmental outcomes is problematic. For example, the numeracy chairs noted that format requires matriculation results, which are obviously not available from the primary schools.

Other challenges relates to the inflexibility of the forms, which did not allow for entering performance data that would reflect their projects more accurately, especially since their programmes are constantly being adapted and thus measuring different aspects every year.

The NRF had one form with one assessment. But we had multiple assessments. It was cutting a tiny slice of [something] and not the most relevant slice. So forms constrain. When they give you the pre-form to fill in schools, etc., it constrains. They must rather say 'you give us your data and your indicators.'

– Prof Mellony Graven, Chair

To minimise the duplicate reporting efforts and simplify reporting systems, Tshikululu is developing an M&E plan for the programme with inputs from the NRF, which would be a mean of coming to a common point of measurement between the FRF and the NRF where possible, and ensure that measurement intentions are clearly communicated with the NRF. Moving forward, the NRF will become responsible for the evaluation of the Chairs in its entirety. However, it must be emphasised that the NRF will have to rethink their focus on Research, and focus their evaluation activities on measuring development elements.

R Khulisa recommends that the NRF adapt the report forms to the requirements of the Maths and especially Numeracy Chairs, who have different performance indicators for their programmes. These forms should be flexible and focus on both research and development indicators.

Chair Rating

Maths and Numeracy Chairs were selected by a committee made up of the FRF Trustee representatives, and decisions were based in part on the NRF rating of academics, which began in 2002.

The NRF rating of academics and researchers in the country is a voluntary process run by the NRF annually using criteria and peer review to rate academics. The detailed description of this rating and the process is included in the Terminology section in Annex 7.5.

Over time academics can submit a request for reconsideration and can move up from their current rating; this is mostly based on a local and international peer evaluation of the quality and impact of the academics' research outputs over the past eight years. This process identifies lead researchers in their fields of expertise and acknowledges researchers who continually produce high quality research outputs.

The current ratings of the 6 Maths and Numeracy Chairs initially selected are included in the table below.

TABLE 3: NRF RESEARCH RATING

Name of Chair holder	Name of Research Chair	Host Institution	Actual Start Date	Current NRF Rating	NRF Rating Valid Until
Professor J. Adler	Mathematics Education	WITS	2010-01-01	A2	31-Dec-17
Professor C. Julie	Mathematics Education	UWC	2011-01-07	B3	31-Dec-18
Professor M.H. Graven	Numeracy Education	RU	2011-01-01	C1	31-Dec-20
Professor H. Venkatakrisnan	Numeracy Education	WITS	2011-01-02	C2	31-Dec-16
Professor M Schäfer	Mathematics Education	RU	2010-01-01	Not Rated	Not Applicable
Professor W. A Olivier	Mathematics Education	NMMU	2011-01-03	Not Rated	Not Applicable

The NRF stated that Prof Adler's high rating entitled her for consideration as a SARChI Chair. In 2014, 13 Research Chairs hold A ratings. Prof Adler is the only researcher specialising in mathematics education with an A rating. The table below outlines the number of Research Chairs who are currently operating according to their category of rating. According to 2014 data, of the 150 SARChI Chairs, two thirds (101) have NRF ratings. In 2016 over 3300 researchers are rated by the NRF. See the rating criteria in Annex 7.5.

Due to Prof Adler's rating as an A2 researcher, she has been allocated additional NRF funding. During 2010-2014, she was allocated an additional R1.9 million (compared to the other Chairs). For the next phase, she will be given up to the R3.2 million annual ceiling for an additional 5 years. Similarly, Prof Graven has moved her NRF rating from a C2 to C1, which means that she will get an additional 3.45 million per annum as her total Chair

funding. Additional funds are always beneficial as these can be used to expand reach of the project and add necessary resources.

A successful rating allows the researcher an option of applying for incentive funding from the NRF, the amount of which is directly proportional to the researcher's rating. The NRF rating is used as a national indicator of excellence and is to the advantage of the Chairs' faculty and the University in terms of benchmarking.

The rating also may be an indication of the Maths and Numeracy Chair potential to produce research outputs and build human capital by encouraging research students. Prof Schäfer and Prof Olivier did not have an NRF rating during their tenure, one potential factor which may contribute towards their non-renewal.

In 2014 and 2015 the NRF released a call for 20 new Research SARChI Chairs per year that was directed to only female South African citizens and permanent residents. These calls speak to the larger need for gender diversity among the current SARChI Chairs:

"The rationale for the award of the Chairs to female South African citizens and permanent residents at both Tier 1 and Tier 2 is due to the current statistics on the 143 filled Chair positions in which only 34% are female (August 2013)."⁷

In 2015, Minister Naledi Pandor announced the appointment of 42 new research chairs for female academics.

This increases the total number of chairs under the South African Research Chairs Initiative (SARChI) to 197, strengthening the ability of the country's universities to produce good postgraduate students and high-quality research and innovation outputs, she said in a statement.

Speaking at the launch, Minister Pandor said that so far SARChI had involved mostly men, with four out of five research chairs going to male professors.

"Today, that changes. Today, we make history. Today, we have 42 new female research professors.

"From now, nearly half of our 201 research professors are women," said the Minister.

Published in the Times Live on September 2, 2015

The fact that the three Maths and Numeracy Chairs that have been renewed are all female fits into this broader focus on gender diversity of the NRF.

⁷ NRF SARChI Guide for Applications 2015. Available from:
http://www.nrf.ac.za/sites/default/files/documents/SARChI%20Guide%20for%20Applications_%202015.pdf

Rating is a voluntary process, but there is growing compliance among academics to be rated by the NRF. For the Maths Chairs programme to become institutionalised, it is important to promote adherence to this method of measuring academic status and ensuring that the Chair is capable of balancing both research and development aspects of the model.

Khulisa recommends that in selection of Chairs there should be a minimum requirement that current and future chairs complete the NRF rating process.

Chair Support

One of the key Chair success factors appears to be linked with the way the Chairs who have been renewed approached their tenure and work as a Chair. More specifically, their ability to self-reflect and re-assess their project design according to their experiences with schools, educators and learners as well as their research findings. In addition, the Chairs' understanding of the task at hand and the way they went about their projects also seems to have influenced their outcomes.

I think Jill, Hamsa and Mellony understood the wide demands of the chair's task – doing research work, doing development work, building research capacity, etc. They understood these demands from the outset although none of us realised how hard it would be to bring all these together in the contexts in which we have worked and continue to work

– Craig Pournara, Project Manager, WMC-S

The support network developed between Prof Adler, Prof Venkat and Prof Graven seems to have influenced the way the Chairs understood their research and development objectives, and ensuring that they were in line with the FRF's objectives. Prof Adler played an interesting leadership role, guiding the other two Chairs in her network in the same direction. This collaborative element was less present with the other Chairs. While the annual community of practice is designed to foster collaboration, the other three chairs mainly operate in silos. Prof Adler, Venkat and Graven all attributed a portion of their success to this active collaboration.

There are times when they [Prof Adler, Prof Venkat and Prof Graven] work together, they write together. There is a collegiality that they share.

– Prof Phakeng, FRF Trustee

Strong institutional backing and support, and a culture of research at the universities is also a critical element in both the success and the renewal of the Chairs. This culture positively influenced the way the Chairs accessed to post-graduates and were able to produce research

outputs. For instance, being based under the science faculty at NMMU, rather than the education faculty like all other Chairs, meant that Prof Olivier struggled to get research students that would use his data in maths education research. In this sense, a strong research institutional capacity has impacted the way the Chairs were able to balance the research and development work.

R Khulisa recommends that a stronger and more formal network between the Maths and Numeracy Chairs is established, which will allow for more collaboration and greater sense of community between the Chairs. For instance, through more regular meetings between the Chairs to disseminate or discuss their research results and the implications thereof.

This will allow lessons learnt to be cross-pollinated between the Chairs'

Community of Practice

Chairs are also expected to present progress and achievements of their individual projects at the annual Maths Education and Numeracy Chairs Community of Practice. Although this does provide a platform for the Chairs to present and share, the CoP was run more like a "university" seminar from 2011 to 2014. The 2015 CoP began a new more useful process, but still was largely "inward" looking with few of the desired external stakeholders who might learn, collaborate and identify policy interventions. It is important to keep feeding the CoP with useful material and information and to share information on visiting experts and other relevant events that are held in the sector, to keep members energised through stimulating, quality discussion and real dialogue around cutting edge issues.

The CoP objective was to create a forum in which stakeholders would engage with the work of the Chairs and generate a discussion surrounding their research. Despite the latest CoP held in 2015 being less structured like a university seminar, the CoPs have ultimately not met their full potential. Nonetheless, they continue to be a relevant forum for stakeholder interaction, which needs to be facilitated and managed in a more fruitful way for all parties.

Stakeholders have noted that the best part about these CoPs is the non-formal time, where different stakeholders get to engage and discuss the Chairs projects. In fact, the Chairs have developed informal CoPs amongst themselves that are more effective than the official one. For instance, the vibrant community formed between Profs Adler, Venkat and Graven; as well as the community formed between Prof Graven and Prof Schäfer who are both based at Rhodes. In addition, Prof Julie and Prof Graven have formed a CoP with their provincial departments of education, constantly engaging in dialogue and involving them in their programme activities.

Stakeholders have also mentioned that the CoPs are not action-oriented enough, as there has not been any uptake on decisions or promises made by different stakeholders during the CoPs. This is important if the programme is to have increased collaboration with government stakeholders as well as having real influence in Maths and Numeracy education policy.

The numbers of people invited to attend the CoPs has increased substantially since its first year, reaching a high of 148 invitations in 2015 to a variety of stakeholders which include universities, Government departments, organisations working in education, etc. Despite this number, only 44 stakeholders attended – only 30% of the number invited.

TABLE 4: COMMUNITY OF PRACTICE ATTENDANCE 2010-2015

	2010	2011	2012	2013	2014	2015
No. invited	66	77	92	82	74	148
No. attended	36	55	50	66	59	44

The CoPs fail to be a platform for Chairs to reach all the required audiences listed earlier on this report. When examining attendance at the CoP from 2010 to 2015, the primary attendees are the Chairs and the project teams which include staff, collaborators and students. Expectedly, there is high consistent attendance from administrators and evaluators which consists of Tshikululu, NRF and external evaluators. FRF and the trustees have been represented by Prof Phakeng. Government has been minimally represented (except in 2012, where there was no government representation) with occasional attendance by representatives from the DST, DBE and DHET. Few other educational stakeholders attend, with only minimal representation from other educational thought leaders.

In drafting the programme structure of the CoP held in 2015, the NRF consulted extensively with the Chairs and Tshikululu, making it a more collaborative effort than previous years. However, there is still room for making this a more dynamic forum with greater involvement from the various stakeholders with tangible, actionable decisions.

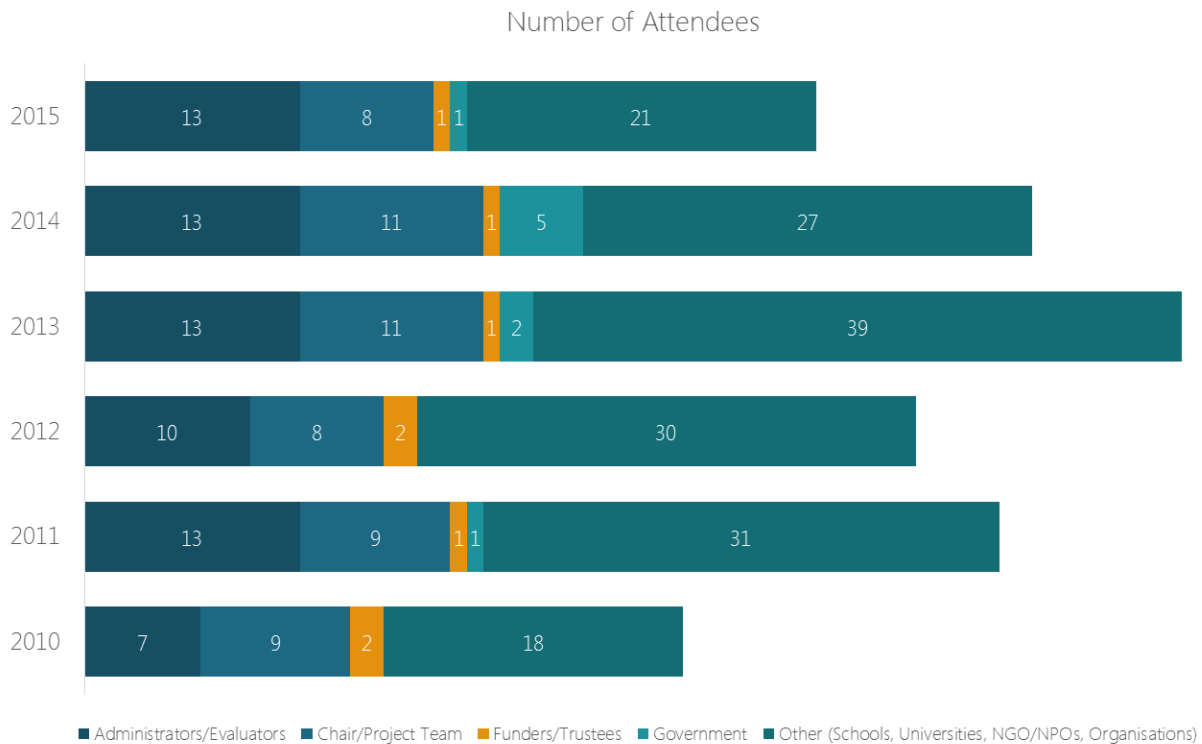


FIGURE 6: COMMUNITY OF PRACTICE ATTENDANCE 2010-2015

R One of Khulisa’s previous recommendations was for the programme to consider a neutral external facilitator who was experienced in running CoPs within the education sector. This should still be considered in the next phase. This facilitator would also serve to follow-up on the decisions made at each CoP and be the link between the Chairs and the various stakeholders that attended the CoPs.

Furthermore, the CoP should consistently assess its success by level of stakeholder participation, diversity of stakeholder participation, stakeholder development, satisfaction and stories of problems and challenges solved through the CoP. Following up on why government stakeholders and other educational thought leaders do not attend is critical to further improve the CoP.

10% Maths Learner improvement expectation

A common concern which arose during the mid and end-term evaluations was the contractual requirement that Chairs demonstrate a 10% increase in the maths pass rate at school for matric learners to measure learner improvement. There was a consensus that this objective was an impossible reach, and certainly not within the five year timeframe. School performance fluctuates from year to year and averaging scores masks learner improvements.

Key informants, particularly during the mid- and end-term evaluations, proposed alternatives to measuring learner performance. According to some Chairs, the programme should create unique learner assessments which are designed, piloted and validated by the Chairs and their research teams. In this way, the Chairs can establish baselines and use a comparable and valid measure of learner gains which can be built into project interventions. Additionally, this instrument can be adapted to all Grades the Chairs are working in. Stakeholders suggested that this initiative can be funded by the programme and will be a beneficial method to determine learner improvement in the future. Such pre- and post-assessments may help establish real improvement among learners.

Furthermore, there was general consensus, particularly among Chairs, that to achieve a systematic improvement in learner performance, the programmes need to focus their work with educators, which requires a long-term approach and therefore learner performance would only be evident in the future.

The renewed Maths Chair, Prof Adler, has submitted a proposal which states the outcomes for the second phase and it does not include the 10% learner improvement, as this is not the focus of her work in this phase.

R Although learners are the ultimate beneficiaries of the programme, the emphasis should be on the programmes' effect on educators and Chairs' successes around improved educator skills, attitudes and behaviour as well as increased content knowledge. As far as I know, the programme does not ignore teacher performance. It is very much part of what the programme assesses in addition to learner performance.

Context Matters

Considering the results of the programme as a whole, specifically looking at learner improvement, it is important to remain cognisant of contextual factors which contribute significantly to learner, educator and school performance. It is widely known that in South Africa, there are varying levels of functionality within schools; Gauteng and the Western Cape have higher functioning schools compared to the Eastern Cape. As the Chairs work in different provinces, results should be viewed with the context in mind. These contextual factors significantly affect the Chairs' results. For instance, one of the 10 project schools Prof Julie was working with dropped out of the project in 2014 due to the low number of learners who enrol for FET mathematics.

The Chairs are for the most part aware of the necessity to identify contextual factors that contribute to educator and learner performance, specifically related to the school (leadership, management, educator attendance, qualifications, attitudes and the community context. Social and economic factors often affect schools and their learners; within the school factors such as the ethos and discipline structure can also contribute to success of its learners and educators. However, despite this recognition the Chairs still do not, for the most part, collect data on school-based factors information or use it effectively.

R Due to the differing contextual factors faced by the Chairs' project schools, it would be beneficial for the programme to place more emphasis on identifying and addressing these aspects in relation to their project design. Furthermore, using the school based factors information more deliberately to improve educator and learner performance and ultimately contribute to defining the education crisis within South Africa, on a district, provincial and national level.

Prof Phakeng's Shared Conceptual Lens

At the 2016 COP, the FRF Trustee and Educational Thought Leader, Prof Phakeng presented the "Shared Conceptual Lens" for the Maths and Numeracy Chairs programme. She spoke about how the Maths Chair fits into the broader FRF systemic approach to the challenges of Mathematics education in South Africa. This approach is based on three main pillars:

- Emphasise the importance of **partnerships** and **collaborations**
 - Establish, build and strengthen partnerships with civil society, other donors and government to accomplish our goals
- Attend to **systemic problems** to achieve lasting change rather than short-term success.
 - This is different from funding individual learners to attend private schools or funding NGOs to improve matric results
- Take the **long-view** of activities
 - Look for impact over 5, 10 or even 15 years – while also searching for short-term wins

"AFTER FIVE YEARS THERE IS A NEED FOR A COMMON CONCEPTUAL LENS OR THEORETICAL FRAMEWORK THAT WILL ALLOW THE DIVERSE PARTNERS IN THIS PROGRAMME TO REACH A SHARED UNDERSTANDING. ALL FOUR ASPECTS OF THIS MODEL REQUIRE ATTENTION, NOT ONLY PRODUCTIVITY."

PROF PHAKENG, AUGUST 2015

Prof Phakeng suggests re-focusing the lens on four main aspects: productivity, transformation, influence and sustainability. According to her, all four aspects of this conceptual lens are all interconnected and are critical for the success of the Maths and Numeracy Chairs programme:

- Productivity is important for sustainability;
- But productivity without transformation is not sustainable;
- There is no influence without productivity;
- Influence without productivity is not sustainable;
- And productivity without influence is not sustainable.

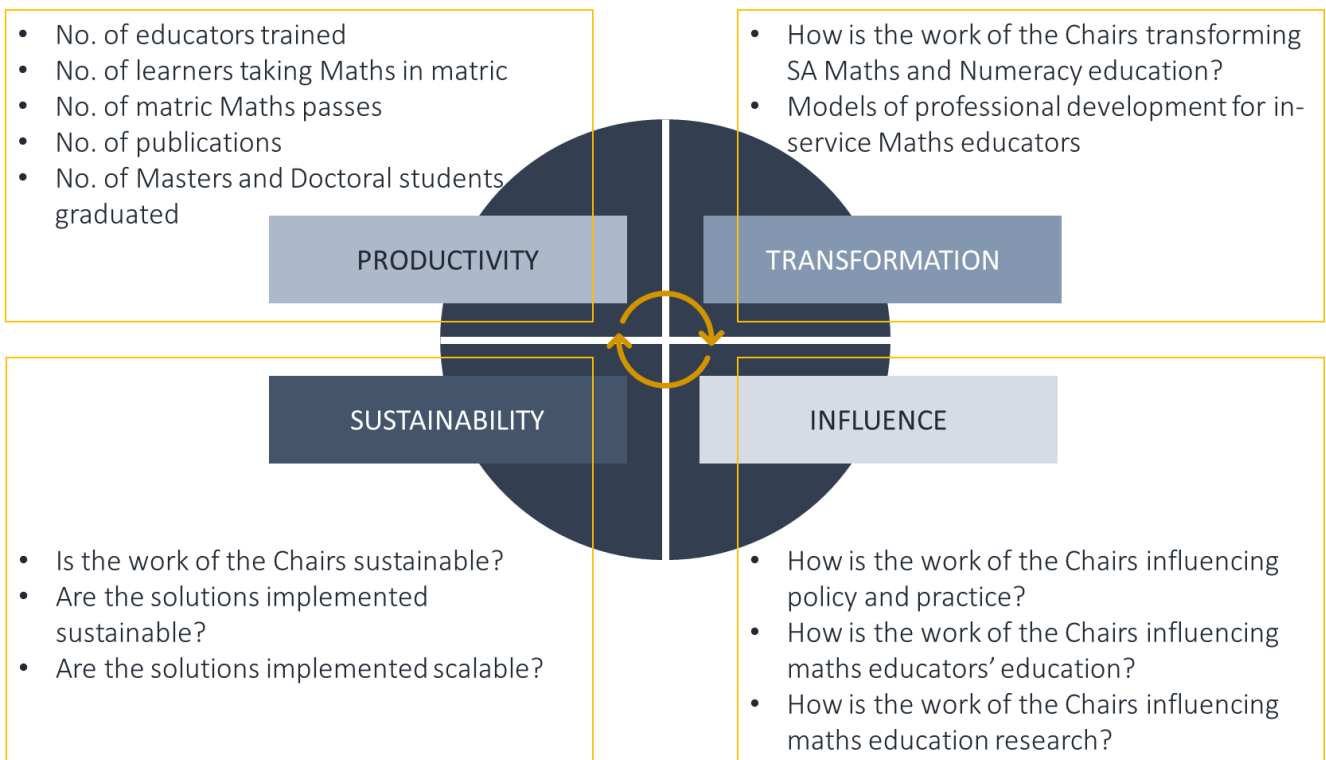


FIGURE 7: PROF PHAKENG'S CONCEPTUAL LENS

PRODUCTIVITY

To understand the productivity of the Maths Chairs Programme we examined the achievements of the individual Chairs in their specific projects. These performance indicators refer to, for instance, the number of educator that participated in the projects, learner improvements and research outputs produced. Below are summary infographics that provide a view of each Chair's programme's at a glance.

ADLER

WMC-Secondary

SITUATION

The WMC secondary programme's approach is to provide a programme which aims to enhance and improve teaching through the following activities.

Maths crisis

Educ. content knowledge and skills gaps

Poor learner participation and performance

Low quality of mathematics teaching

APPROACH

The WMC secondary programme's approach is to provide a programme which aims to enhance and improve teaching through the following activities.

Transition Maths 1 & 2



In-school workshops



OUTCOMES

The Chair's programme consists of four active development focused projects which has addressed the issues of educator development:

IMPROVE QUALITY TEACHING

27 workshops and 4 TM courses

156 unique educators reached

All educators increased their scores on pre and post test in both TM1 & TM2 in 2013

RESEARCH SUSTAINABLE AND PRACTICAL SOLUTIONS

23 honours, masters and doctoral students supervised by the chair

The mathematics teaching framework is an example of sustainable resources that can be used in practical settings and could be utilized by educators not in the programme

IMPROVE LEARNER PERFORMANCE

15% increase in quality Matric passes over 4 years

70% of schools demonstrated improvements in matric passes from year to year

Educator training resulted in more:

GET phase learners prepared for FET mathematics

Matric learners prepared for University

PROVIDE LEADERSHIP AND DIALOGUE

97 Research outputs with local and international audiences

13 collaborative research projects with other South African and International Academics

14 research presentations and other forums

SCHÄFER

Rhodes FRF Maths Education Chair

SITUATION

Rhodes FRF's approach is to provide a programme which aims to enhance and improve teaching through the following activities.

Maths crisis; Under resourced communities

Lack of conceptual teaching

Low educator confidence and passion

Educator content gaps

Large learning backlog

APPROACH

Rhodes FRF's approach is to provide a programme which aims to enhance and improve teaching through the following activities.

Mathematics Teaching Enrichment Programme (MTEP)



In-school support



OUTCOMES

The Chair's programme consists of four active development focused projects which has addressed the issues of educator development:

IMPROVE QUALITY TEACHING

83 MTEP sessions held

Average 25 educators participate annually

Evidence of

- Improved attitudes
- Mathematical repertoire
- Changed behaviour

RESEARCH SUSTAINABLE AND PRACTICAL SOLUTIONS

96 research outputs

20 researchers

Development of VITALmaths video clips

Innovations in conceptual and strategic teaching

IMPROVE LEARNER PERFORMANCE

Increase in pass rate

Increase in quality pass rate

Increase in maths marks

Learners are practicing more maths

PROVIDE LEADERSHIP AND DIALOGUE

5 ongoing research and development affiliations

7 collaborations

VITALs achieved international use and reach

OLIVIER

NMMU FRF Maths Education Chair

SITUATION

NMMU FRF's approach is to provide a programme which aims to enhance and improve teaching through the following activities.

Maths crisis

Educ. content knowledge and skills gaps

Low confidence to teach certain topics

Lack of pedagogic knowledge around certain topics

Lack of maths educators to teach maths in schools

APPROACH

NMMU FRF's approach is to provide a programme which aims to enhance and improve teaching through the following activities.

Mathematics educator skills upgrade project (MATHSUP)



Mathematics Skills Upgrade



OUTCOMES

The Chair's programme consists of four active development focused projects which has addressed the issues of educator development:

IMPROVE QUALITY TEACHING

Increase from pre to post test having taken MATHSUP course.

GeoGebra significant to changing educator pedagogy and behaviour

Increase in educator confidence

Increased knowledge of course content

RESEARCH SUSTAINABLE AND PRACTICAL SOLUTIONS

52 unique researchers

2 MAs currently with programme

IMPROVE LEARNER PERFORMANCE

Increase in matric pass rate

Over 60 bursaries to support learners

Higher percentage of learners enrolling with NMMU

More quality passes

PROVIDE LEADERSHIP AND DIALOGUE

8 actionable, practical products

5 Sustainable activities

Over 80 presentations

Replication in new districts

JULIE

LEDIMTALI

SITUATION

LEDIMTALI's approach is to provide a programme which aims to enhance and improve teaching through the following activities.

Maths crisis

Educ. content knowledge and skills gaps

Low confidence to teach certain topics

Lack of maths educators to teach maths in schools

APPROACH

LEDIMTALI's approach is to provide a programme which aims to enhance and improve teaching through the following activities.

Workshops



Extended Teacher Institutes



In-school support



- Co-teaching
- Classroom Observation & feedback

OUTCOMES

The Chair's programme consists of four active development focused projects which has addressed the issues of educator development:

IMPROVE QUALITY TEACHING

50 teachers

- Improved attitude towards maths (increased confidence, enabled empowerment, promoted professional growth)
- Strengthened pedagogy (improved learner interaction)
- Enhanced content knowledge (equipped with new skills and strategies, supported to use resources)

IMPROVE LEARNER PERFORMANCE

LEDIMTALI schools performed better than control schools

More learners

- write matric maths
- pass matric maths

Small increase in quality passes

RESEARCH SUSTAINABLE AND PRACTICAL SOLUTIONS

20 unique researchers

10 resources developed and distributed

1 Book in progress

1 Classroom observation and analysis tool

PROVIDE LEADERSHIP AND DIALOGUE

28 research outputs

10 collaborative research projects

3 invited presentations

Numerous international conference proceedings

VENKAT

WMC-Primary

SITUATION

WMC Primary programme's approach is to provide a programme which aims to enhance and improve teaching through the following activities.

Maths crisis in South Africa

Numeracy education has not been a priority and is under-researched

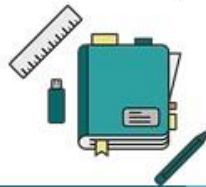
APPROACH

WMC Primary programme's approach is to provide a programme which aims to enhance and improve teaching through the following activities.

I Hate Maths Seminar



Lesson Starter Project (LSP)



Opportunity to Learn Maths (OTLM)



OUTCOMES

The Chair's programme consists of four active development focused projects which has addressed the issues of educator development:

IMPROVE QUALITY TEACHING

199 teachers

- Improved attitude towards maths (increased confidence & renewed love for teaching maths)
- Improved educator's classroom behaviour
- Enhanced content knowledge
- Improvement in pre to post test cores for educator

IMPROVE LEARNER PERFORMANCE

- All 10 schools showed an improvement in grade 3
- Improved ANA scores in Grade 3 & 6
- Higher number of learners performed at proficient levels

RESEARCH SUSTAINABLE AND PRACTICAL SOLUTIONS

21 unique researchers

Foundation Phase Blitz Mental Maths series of workbooks and teacher guides

AB Ed Honours course focusing on primary maths added as a module at Wits University

PROVIDE LEADERSHIP AND DIALOGUE

104 research outputs

38 memberships, affiliations and collaborative research projects

16 invited presentations

GRAVEN

SANC Rhodes University

SITUATION

SANC's approach is to provide a programme which aims to enhance and improve teaching through the following activities.

Maths crisis in South Africa

Numeracy education has not been a priority and is under-researched

APPROACH

SANC's approach is to provide a programme which aims to enhance and improve teaching through the following activities.

Numeracy Inquiry Community of Leader Educators (NICLE)



Maths Clubs



Community Maths Buzz



OUTCOMES

The Chair's programme consists of four active development focused projects which has addressed the issues of educator development:

IMPROVE QUALITY TEACHING

Changed attitudes & behaviour
Increased pedagogic knowledge
Increased:

- educator content knowledge
- class time spent on numeracy
- learner numeracy activity

IMPROVE LEARNER PERFORMANCE

Improved numeracy scores (internal tests & ANAs)
Improvement in learners' numeracy disposition & ability levels
Provision of opportunities for learners to practice mathematics

RESEARCH SUSTAINABLE AND PRACTICAL SOLUTIONS

Mobilising & building the capacity of new cohort numeracy researchers
Opportunities for SANC researchers to test their findings in practical setting with learners
12 actionable, practical series produced

PROVIDE LEADERSHIP AND DIALOGUE

137 research outputs
48 contributions to broader maths education community
12 invited presentations

TRANSFORMATION

How is the work of the Chairs transforming SA Maths and Numeracy education?

There has been wide agreement between the Chairs and other stakeholder interviews that the programme is informing research in a unique and extremely valuable way. By creating synergies between research and development, the Chairs have been able to focus on real issues educators and learners are facing in their schools and communities.

... [The Maths and Numeracy Chairs] must really be proud about [...] the way in which they've nurtured relationships between schools and between the university and schools. Because they work with ten schools, they were able to create a community of teachers in a particular district. Because these Chairs were required to work in one or two districts only, they couldn't spread themselves thinly. [...]. So they nurtured relationships between the university and the schooling sector, and even within the school sector itself. And, most importantly, I think they've made teachers, who are already in service, aware of the importance of continuing improvement of their own learning and an awareness of their own practices.

– Prof Ruksana Osman, Dean Faculty of Humanities: Wits

The work of the Chairs has created a space for innovation in Maths and Numeracy education in South Africa, and has the potential to influence the way maths and numeracy education is approached in the country. A great potential exists in the models for professional development for in-service maths educators that the Chairs have created, which could be taken on by key government stakeholders if the key messages are disseminated.

INFLUENCE

How is the work of the Chairs influencing policy and practice?

While there was unanimous agreement that the Maths Education and Numeracy Chairs is an important and potentially very influential programme, there was concern that the key achievements and lessons from the Chairs were not reaching policy circles.

Khulisa interviewed Seliki Tlhabane, Acting Chief Director of Maths, Science and Technology (MST) and Curriculum Enhancement Programmes at the DBE, a natural partner to the programme. He referred to the Maths Chairs as "our national thought leaders". Despite minimal involvement of the DBE in the Maths and Numeracy Chairs project, there is an opportunity to create stronger ties between the Chairs and relevant existing initiatives that are currently implementing similar interventions within schools as well as the resources produced and distributed by the DBE.

There is still an opportunity for the FirstRand Foundation to influence the way the NRF and the SARChI chairs operate through this Maths and Numeracy programme. However, a strong communications and advocacy strategy is necessary to 'sell' this model to the NRF.

This model is an important one and there is enormous potential to influence in fact what the NRF should be encouraging other SARChI Chairs to do.

– Prof Mellony Graven, Chair

Several stakeholders mentioned that the NRF recently appointed a new CEO, Dr Molapo Qhobela. He is familiar with the Maths Chair programme given his previous positions (listed with the most recent first):

- Vice Principal of Institutional Development at UNISA, where he worked directly with Prof Phakeng;
- Deputy Director General (DDG) Human Capital and Knowledge Systems at the DST, thus responsible for the NRF;
- DDG at the DBE; and
- DDG and Acting Director General at DHET.

His formal and informal linkages to the Maths Chair programme provides an opportunity for the programme.

In addition, Chairs' projects have begun influencing practice at the universities. For example, Rhodes University had the first intake of 45 students in 2015 for a newly developed foundation phase literacy programme focused on African languages. Prof Graven's project is assisting with developing the mathematics elements of the curriculum and employs one of the research graduates to be part of the leadership cohort for the programme. Similarly, research collaborators of Prof Julie's project at UWC are now involved in developing a Foundation Phase Programme in the Education Faculty.

How is the work of the Chairs influencing maths educators' education?

Currently DHET seems to be unaware of the Maths and Numeracy Chair Programme. DHET is responsible for the framework of teacher education, while each university offering teacher training interprets the framework independently. JET Education Services recently assessed teacher education and found that the framework is weak and not always adhered to. In particular, there is a major gap in the intermediate (grades 4 to 6) and senior phases (grades 7 to 9). The numeracy chairs are contributing to a reference group making recommendations about the intermediate phase, while Prof Adler is actively working in the senior phase group.

In particular, Prof Julie's project at UWC influenced the restructuring of maths content for future teachers. Taking into account the programme's focus on teacher training, creating avenues to shape pre-service teachers is a critical sustainability factor that can bear wider systemic change. These are excellent beginning points, but must continue to be nurtured to reach its full potential.

Because we found that the maths that was being offered in the science faculty wasn't appropriate for trainee teachers. Because if you are going to be teaching the senior phase at that stage, grades 7, 8 and 9, you don't really need maths to become a scientist or a physicist. So a lot of them were not coping with maths there (under that faculty), plus it was the same course for the science students and for our (maths education) students. They didn't get any special attention and we felt that our students needed special attention and so we asked for their modules to be moved to our faculty.

– Prof Zubeida Desai, Dean of Education: UWC

In addition, all Chairs created opportunities for continuous professional development of in-service educators, encouraging the development of content knowledge, new teaching techniques and gain in confidence.

The creation of innovative models of professional development for in-service Maths educators that would lead to improved learner results is one of the key objectives of the programme. However, to be able to greatly transform the existing models, the Chairs' projects must obtain South African Council of Educators (SACE) accreditation⁸ and strategically communicate with the relevant stakeholders. SACE accreditation would mean that participating teachers would earn CPD points, thus providing a participation incentive.

How is the work of the Chairs influencing maths education research?

Stakeholders have reported that this model is extremely relevant to the context of maths and numeracy education in South Africa. The programme has started a tradition of maths - and especially numeracy - research and analysis that was lacking in South Africa and established a strong network of academics and researchers that are working in innovative ways to address the mathematics crisis in South Africa.

The big contribution of the FRF investing this money is to actually get a whole cohort of people going who are obsessed with the problems of maths and numeracy success in the SA context. So even if they haven't got every problem solved yet, what they've done is kick off this movement that is going to do it over time. So the big contribution seems to be the birth of this specialist study area that this country desperately needs.

– Peter Clayton, Rhodes University

After five years of this research and development model, the Chairs reported that it has deeply transformed their practice through connecting research with real-world problems and establishing important, direct ties with the schools and educators. In addition, university

⁸ SACE is currently accrediting INSET courses allowing teachers to earn continuous professional development (CPD) points as agreed by the Education Labour Relations Council which includes all educator related unions and the DBE.

stakeholders spoke highly about the quality of the research produced by Chairs, and how the link with development is critical to move away from merely theoretical research that dominates most academic institutions. By having a development component, the Chairs research becomes more grounded and action oriented.

For me this is the ideal model because I don't believe in doing research where you are not partnering with communities. [...] Through developing stronger relationships with communities and giving something back and doing the development work one in fact gets better buy-in and access to much deeper and valid research data. And then of course doing the research means that one is so much better informed for the actual development work that you do.

– Prof Mellony Graven, Chair

The Chairs have produced 514 research outputs altogether and this has added to the pool of available research on maths education in SA, and specifically informed by practice. More importantly, it has encouraged extensive research in numeracy, which was a previously under-researched area. Prof Graven's research, for instance, has been cited on Google Scholar 679 times. The other Maths and Numeracy Chairs appear not to have created a profile on Google Scholar, therefore it is difficult to assess how many times their research has been cited.

In 2012, Prof Venkat and Prof Graven co-organised the Early Childhood Education Research and Development conference, with the theme 'Numeracy in Early Learning'; the first numeracy research and development focused conference in South Africa.

Prof Adler's recognition in the international community depicts the ability these Chairs have to influence beyond South Africa. For instance, in 2015 she received the Hans Freudenthal Medal in recognition of her outstanding research program dedicated to improving the teaching and learning of mathematics in South Africa; and she is former Vice-President of International Commission on Mathematical Instruction (2003-2009).

From a systemic point of view, through attendance at international conferences, involvement in international mathematics communities, etc.; the Chairs are able to put South Africa on the Mathematics research map and also raise awareness about issues facing the education sector.

SUSTAINABILITY

Is the work of the Chairs sustainable? Are the solutions implemented sustainable? Are solutions implemented scalable?

Sustainability is a key factor in the Maths and Numeracy Chairs individual projects and for the programme overall. In each of the individual projects, Khulisa examined whether the benefits of the projects were likely to continue after donor funding is withdrawn. This was measured through the various Chairs' commitment to producing practical and actionable products; sustainable outcomes derived from the projects; level of government support/buy-in; etc.

All Chairs have produced several resources that could be used by educators in schools across the country. The main concern now would be to have some control groups that would shed some light into how best these products and activities could be scaled and what key elements need to be present for them to be successful in settings beyond the Chairs' direct supervision.

Moving forward, collecting some evidence and comparing the intervention to some controls is really important – it is important for [the funders] to figure out what works.

– Prof Jeremy Hodgen, University of Nottingham

Another sustainability concern is related with the phasing out of the Chairs.

Although the evaluators were informed by several key actors that Prof Schäfer's chair was not extended for a second term, Prof Schäfer reported in an interview with the evaluators that he had a conversation with the NRF in April 2016. The NRF stated that his chair was still under review and may be renewed. Prof Olivier's review process which was meant to be finalised in December 2015 was reportedly still underway in April 2016. Prof Julie scaled down his fifth year activities due to his uncertainty around funding continuity.

R The NRF and Tshikululu should work together to improve communication with the Maths and Numeracy chairs on the review process and continuity of their positions.

Ultimately, for the programme to be sustainable a set of considerations need to be taken into account:

1. The relationship, roles and responsibilities between Tshikululu (with skills in managing development initiatives) and the NRF (with skills in managing research grants), **needs to be further developed with efforts to build collaboration, trust and a clearer division of labour;**
2. **Key actors** in the education space (the DBE, DHET, Teacher training universities, Provincial Education Departments, curriculum developers, etc.) **need to be drawn into the programme;**
3. While all stakeholders agree that the chairs are communicating academically, unspoken assumptions and expectations for reach and advocacy are not being met. **A neutral organisation which is skilled at advocacy should be employed to distil learning and behaviour change messages from the chairs and disseminate them through the appropriate channels.**
4. **The Chairs renewal must be clearly communicated ahead of time in order for Chairs to either plan for the following phase of the programme or to phase out their project.**

Can the model be applied to other fields?

Part of the Maths Chairs success has been working closely with teachers to identify issues, misconceptions and difficulties, then identifying a variety of interventions to overcome these barriers. It is easy to imagine the Development Chairs model working effectively on other educational subjects such as science and technology. A SARChI Chair focussing on these areas might be able to identify blockages and work closely with practitioners to change these perceptions.

There was agreement among stakeholders that the model of this programme can be applied to other fields and subjects. University stakeholders interviewed during the mid and end-term evaluations similarly expressed that adopting the model of development and research for other subjects can be beneficial.

What is the future of the Model?

Other than the possibility of expanding the model to other fields, the future of the Maths Chairs model can be viewed on many different facets.

The next step would be to contribute to mathematics education in South Africa through documenting the failures and successes of the projects, consolidate this and communicate these findings through a strong communications strategy.

The model is viewed as a mechanism for developing the next generation of researchers in South Africa, who will ultimately transform Maths and Numeracy education in the country. Thus far, most Chairs have built this capacity and the programme has succeeded in starting this new movement in this specialist area, as mentioned previously on this report.

Research and capacity is very important to have in your system. South Africa is moving towards a tipping point of having enough research capacity to make a difference. You need a critical mass of researchers to do that and for some years it has been a very small number of researchers [working on Maths and Numeracy education]. The FRF Maths and Numeracy chairs initiative has made an important contribution towards enabling key senior researchers to build this critical mass.

– Prof Jeremy Hodgen, University of Nottingham

The Chairs who have been renewed also regard the next phase of the programme as giving them an opportunity to consolidate their findings and continue to improve on what they were previously doing.

Another success of the model continues to be the practical element related to the dual model of research and development which results in a long-term effect on the educators working with the Chairs and their teams. What sets this model apart from traditional research is the collaboration and relationship that is built over time working with schools and educators.

Ultimately, the FRF should look at the Maths and Numeracy Chairs programme as an opportunity to contribute to system change. However, a few issues stand in the way: the programme is not being expanded; the DST and the NRF do not see this “development” chair model as separate from the SARChI model; and the lack of a strong communications strategy means that key messages are not reaching circles of influence.

The next step would be to then address and communicate the key findings of the Chairs’ programmes as well as design and implement sustainable solutions. However to contribute to systematic change, the programme needs to work with all necessary agents of change; educators, learners, funders, researchers, implementers, and education departments. In doing so, successes can be identified and shared and contributions can be made to education discourse in South Africa.

The model has great potential to influence teacher training in South Africa, with a real opportunity for systemic piloting of the Maths Chairs programme through recognition of the work that the Maths and Numeracy Chairs have done and continue to do in the mathematics and numeracy education space.

We really appreciate the words of compliments from our thought leaders in mathematics and numeracy in this country. We really respect their opinion and their insight and their experience. It has shaped our approaches to education, taking note of what they always say.

– Seliki Tlhabane, DBE

Is the model cost effective?⁹ What are the “hidden” costs?

Outlined below are the other costs and the total “true” cost of the Maths Chairs programme as well a comparison of leveraged funds ratio and cost per educator.

Leveraged funds

The leveraged funds ratio was calculated according to the total cost of each Chairs programme; comparing every Rand of Maths Chair funding to the external funds raised by each Chair.

For every Rand of Maths Chair funding

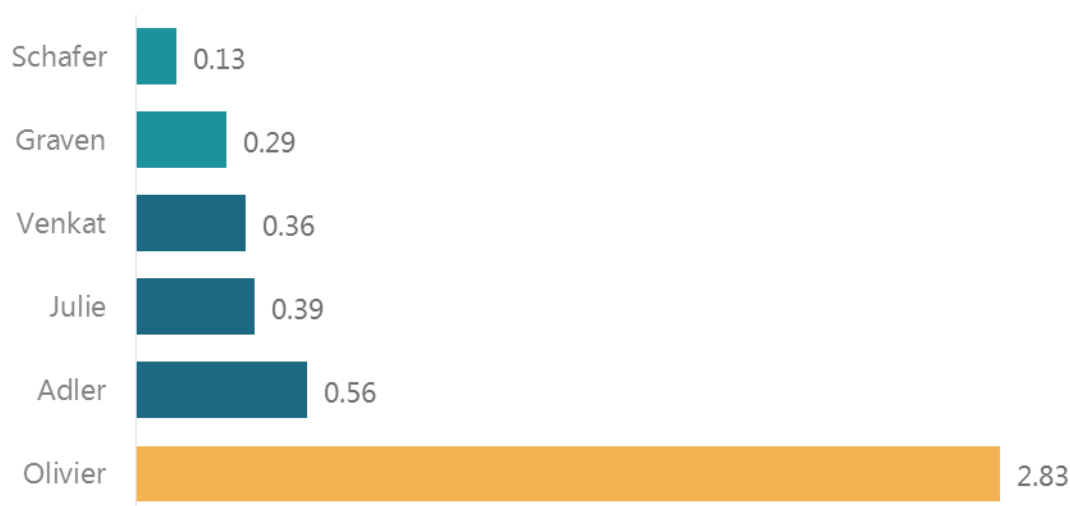


FIGURE 8: CHAIRS' LEVERAGED FUNDS RATIOS

Prof Adler and Prof Olivier have been the most successful in leveraging funds. For Prof Olivier, leveraged funds provided the necessary resources to expand his technology driven project. Cost effectiveness for his project was reached through scale which is common for most programmes but especially projects that are technology driven.

⁹ As stated earlier this evaluation is more focused on a cost analysis.

Prof Schäfer leveraged the lowest amount of external funds - R0.13 for every Rand from 2010 to 2014. Prof Olivier leveraged the highest amount of funds from external sources, with a ratio of R 2.83 for every Rand of Maths Chair funding.

Findings during the mid- and end-term evaluations indicated that leveraged funds is largely due to the Chairs standing and repute. This is further evident through Prof Adler’s additional funding due to her A2 rating.

On average, for every Rand of Maths Chair funding, an additional R 0.75 has been leveraged from external sources. Leveraged funds provide additional funding for expanding the reach of the programme, to reach more schools, educators or learners and thus improving scalability. Furthermore, leveraged funds can be used to improve or increase resources as well as provide funding for more research students.

Cost per educator

To determine cost effectiveness of each Chair, the costs per educator was calculated during the mid- and end-term evaluations. These results are outlined in the figure below. The limitation to comparing this across Chairs is the different approach that was used for their projects, some focused on using the same educators each year, whereas others used a new cohort of educators. Khulisa examined cost per unique educator¹⁰, the core development costs for each project divided by the total number of unique individuals who have participated in a Chair project.

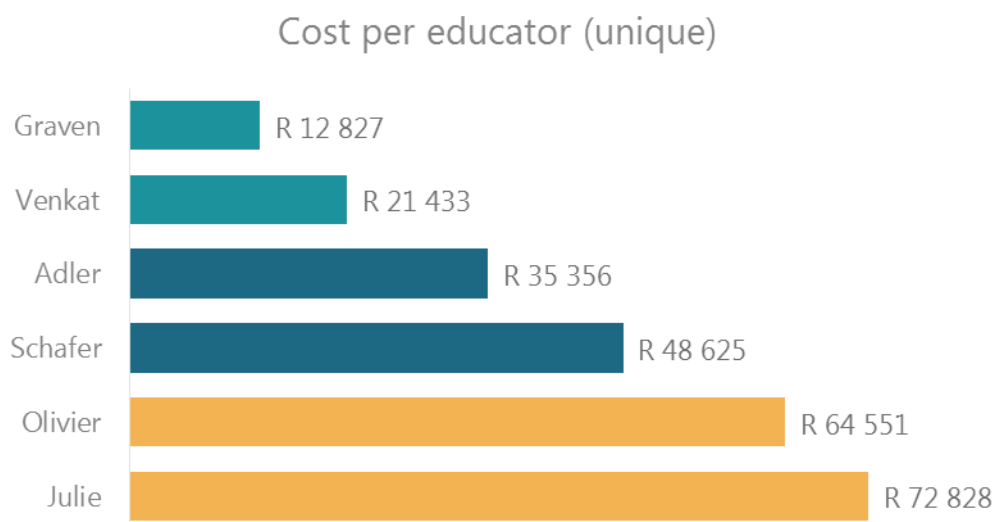


FIGURE 9: COST PER EDUCATOR (UNIQUE)

¹⁰ Unique educators are defined as individuals who participated in the project. The same educators who participate each year are only counted once when defining unique educators.

Looking at cost per unique educator, Prof Graven’s cost per unique educator is just over half the amount compared to Prof Venkat. This is due to the different approaches used in the Chairs’ projects, as Prof Venkat primarily works with the same educators each year. Comparably, the secondary Maths Education Chairs have somewhat higher amounts for both cost per unique and cumulative educator. Prof Adler has the lowest cost per unique educator making her project the most cost efficient in this regard, her project is aimed at a new cohort of educators each year. Prof Oliver and Prof Julie currently have higher cost per unique educator amounts. Prof Olivier uses a techno-blend model which are usually more expensive. Prof Julie on the other hand works with the same educators year on year.

To understand the cost per cumulative educator, Khulisa divided the core development costs for each project by the total number of educators reached overall. This would include projects which were designed to work with the same cohort of educators each year, such as Prof Adler, Prof Graven and Prof Julie. The amounts per educator change for some Chairs. If looked at it in this way, Prof Julie’s cost becomes similar to Prof Schäfer, reducing his amount to about a fourth of the initial cost per unique educator. Prof Olivier works out to be the most expensive, as stated above this is expected when using a techno-blend model which involves distribution of technological resources. Prof Schäfer reduces his amount by more than half. For the detailed amounts refer to Annex 7.4.

Costs

The total true cost of the programme; inclusive of the Maths Chairs funding (from the various donor partners), additional NRF funding¹¹, leveraged funds, administrative costs of Tshikulu and the NRF as well as evaluation costs, amounts to approximately **R 117,9 million**.

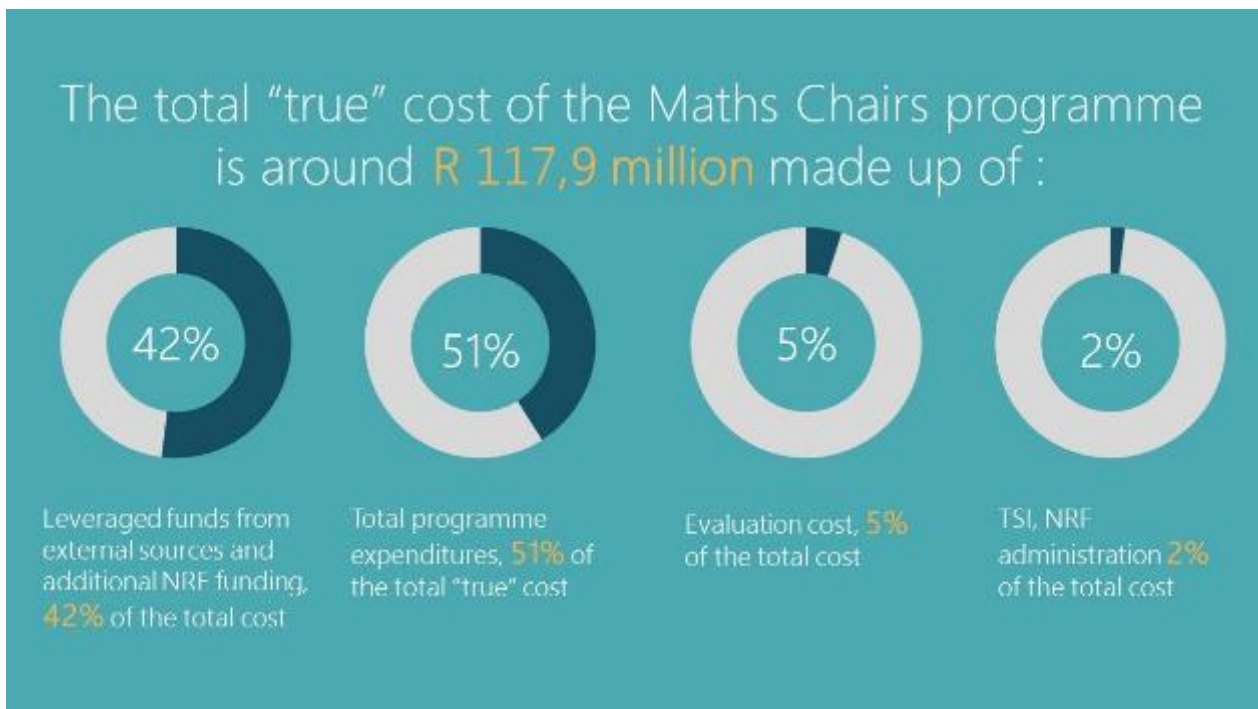


FIGURE 10: COST OF THE PROGRAMME

¹¹ Prof Adler received an additional R1, 9 million from the NRF due to her Chair rating of A2.

For every Rand of Maths Chair funding, an additional R0.04 has been used towards administrative costs¹².

Evaluation costs between 2011 and 2016 amount to approximately 5% of total programme costs.

The Maths Chairs programme costs from 2011 to 2016 amounts to **R 59, 9 million**, almost R 1,5 million above the projected funding amount. This amount includes actual costs reported by Chairs for the five years of their programmes, and excludes leveraged funds and administrative costs.

For the entire Maths Chair period, from 2011 to 2016, the projected “true” cost amounts to **R 117, 9 million**, inclusive of Maths Chair funding, leveraged funds amounts for 2011-2016 as well as estimated administration and evaluation costs. This takes into account evaluation costs from 2011 to 2016 as well as Tshikululu and NRF administration costs from 2010 to 2016. This surpasses the projected amount estimated on the mid-term evaluation by around R 21, 6 million.

For the detailed outline on programme costs refer to Annex 7.5.



The estimated total cost of the SA Maths Education and Numeracy Chairs programme between 2011 and 2016 = **R 117, 9 million**

¹² NRF did not provide Khulisa with administrative costs, these figures are based on estimates using Tshikululu’s costs. Additionally this estimated amount does not include the NRF evaluators’ time and related costs as well as panel reviewer time and related costs.

6. CONCLUSIONS

Overall, the model can be summarised as following:



1. Harnessing the power of academics to address key developmental issues
2. Combining private sector forces with government efforts to solve human capital development needs

The various funder stakeholders have not found common ground and the vision of the FirstRand Foundation seems to be less aligned with the DST-NRF Research Chairs Initiative. However, key informant interviews and findings from the mid and end-term evaluations point to the success of the Maths Chair programme and to the potential it has to continue to transform maths education research and maths educators' education.



For the programme to further its impact, efforts should continue to implement recommendations made on here (some of which were made during the mid-term report) and effectively address the programme's sustainability factors. For a detailed table of programme sustainability factors refer to Annex 7.7.




The table below provides a status update of the recommendations made during the mid-term evaluation.





TABLE 5: STATUS ON MID-TERM RECOMMENDATIONS

LEVEL 2 EVALUATION MID-TERM RECOMMENDATIONS			
	Previous recommendations	Status	Progress made
Increase collaboration between all administrators and stakeholders			
1.	<p>Khulisa recommends quarterly Tshikululu and NRF face-to-face meetings as well as monthly teleconferences to enable more collaboration and cohesiveness in terms of reporting, managing and administering the programme.</p> <p>This increased collaboration should help to:</p> <ul style="list-style-type: none"> • More clearly define roles and responsibilities for stakeholders of the programme, taking into consideration what has and has not worked thus far. • Synchronise the reporting cycles to reduce uncertainty and decrease administrative burden on Chairs and their staff. 		<p>Tshikululu and the NRF report meeting more regularly, which has created space for more collaboration:</p> <ul style="list-style-type: none"> • Tshikululu is creating an M&E Plan with inputs from the NRF with the aim of clarifying programme expectations and measurements. • The NRF will take on evaluation activities starting in 2017, which should decrease the administrative burden on Chairs and their staff.
Use NRF rating in Chair selection process			
2.	<p>Rating is a voluntary process, but there is growing compliance among academics to be rated by the NRF. Since the Maths Chairs programme is becoming institutionalised, it is important to promote adherence to this method of measuring academic status.</p> <p>Khulisa recommends that in selection of Chairs there should be a minimum requirement that current and future chairs complete the NRF rating process. In particular, Prof Olivier should apply to be rated.</p>		<p>Recommendation has not been addressed and should still be considered for the next phase.</p>

Improve communications and advocacy

<p>3.</p>	<ul style="list-style-type: none"> • The programme requires a focused and direct communications and advocacy strategy that: • Clearly denotes roles and responsibilities • Reaches and segments the audiences through multiple but innovative platforms. In particular, the programme should expand its online presence through social media networks, blogs, and relatively new strategies such as TED talks. • Addresses all parts of the advocacy iceberg, and measure its effect and impact. 		<p>Recommendation has not been addressed and should be considered a priority for the next phase, especially considering that programme influence and capacity to transform Maths and Numeracy education in SA is reliant on this.</p>
<p>4.</p>	<p>An appropriate communication platform and facilitator is critical to the success of Communities of Practice. Any method of communication the community uses should be managed and monitored continuously, the communication platform should:</p> <ul style="list-style-type: none"> • Serve as an ongoing learning venue for practitioners who share similar goals, interests, and concerns. • Help connect members to the right people and provide a platform for rapid responses to individual inquiries from members. • Provide news of community activities and events to members. • Develop, capture, and transfer good practices on specific topics by stimulating active sharing of knowledge. • Promote partnership arrangements with interested knowledge hubs and other networks. • Influence development outcomes by promoting greater and better-informed dialogue. • Promote innovative approaches to address specific challenges. 		<p>The NRF selected Daryl Ilbury, Media Coordinator for the NRF, as facilitator for the CoP in 2015. However, there is still a lack of communication with the community after the CoP takes place, meaning that the recommendation should still be considered for the next phase of the programme.</p>

<p>5. It is important that whoever is selected to manage the communications has:</p> <ul style="list-style-type: none"> • Experience in advocacy • Knowledge of Mathematics education • Understanding of the various audience segments • Sufficient status to deal with the stakeholders <p>This responsibility needs to be clear and articulated in the many contracts associated with the programme (e.g. between FRF, Tshikululu and NRF as well as with the Chairs and communications provider).</p>		<p>Recommendation has not been addressed and should still be considered for the next phase of the programme.</p>
<p>6. The CoP should consistently assess its success by level of stakeholder participation, diversity of stakeholder participation, stakeholder development, satisfaction, and stories of problems and challenges solved through the work of the CoP. If stakeholders do not attend or RSVP and do not attend, it is important to try to find out why.</p> <p>Furthermore, it is recommended that the programme consider a neutral external facilitator who is experienced in running COPs within the education sector.</p>		<p>Recommendation has been partially addressed. The CoP held in 2015 had a facilitator and had a format which was less academic. However, there is still a need to assess stakeholder attendance, participation and follow up on work done at the CoP.</p>
<p>Revisit measures and indicators</p>		
<p>7. The programme should revisit the contractual requirement of a 10% improvement of learner scores per school, per year.</p> <p>Stakeholders agreed that learners are the ultimate beneficiaries of the programme, but that improvement of learner scores should be regarded as an attached outcome, the focus should be on the programmes' effect on educators.</p>		<p>Although Khulisa did not have access to the Chairs' contracts, Prof Adler's renewal was based on a proposal that did not include the 10% improvement of learner scores, as this is not the focus of the programme.</p>

Consider other factors		
8.	Due to the differing contextual factors faced by the Chairs' project schools, it would be beneficial for the programme to place more emphasis on identifying and addressing these aspects in relation to their project design. Furthermore, using the school based factors information more deliberately to improve educator and learner performance and ultimately contribute to defining the education crisis within South Africa, on a district, provincial and national level.	 <p>Although the Chairs acknowledge the impact of contextual factors in their projects/work, there has been no directed effort to collect data on this. This recommendation should be considered for the next phase of the programme.</p>
Overall Key Recommendations		
9.	The relationship, roles and responsibilities between Tshikululu (with skills in managing development initiatives) and the NRF (with skills in managing research grants), needs to be further developed with efforts to build collaboration, trust and a clearer division of labour.	 <p>Efforts to strengthen the relationship between Tshikululu and the NRF are underway and should continue in a more deliberate way.</p>
	Key actors in the education space (the DBE, DHET, Teacher training universities, Provincial Education Departments, curriculum developers, etc.) need to be drawn into the programme.	 <p>The DBE recognises the Maths and Numeracy Chairs as thought leaders. However, there is still no formal engagement between the Chairs and the DBE or DHET, apart from minor participation of government stakeholders at the CoPs.</p>
	While all stakeholders agree that the chairs are communicating academically, unspoken assumptions and expectations for reach and advocacy are not being met. A neutral organisation which is skilled at advocacy should be employed to distil learning and behaviour change messages from the chairs.	 <p>There has been no focus on establishing a strong communications strategy. This recommendation should be considered a priority for the next phase of the programme.</p>

7. ANNEXES

7.1. INTERVIEW SCHEDULE

1. How have you been involved in the Maths Education and Numeracy Chairs Programme?
2. What has worked for the Programme?
 - What didn't work? What are your concerns?
 - Do you think that the work of the Chairs is:
 - Transforming SA Maths and Numeracy education in any way?
 - Influencing policy and practice?
 - Transforming Math's educators education (link to pre-service)
 - Transforming Maths education research (50/50 model)
 - What major factors influence the success of the Programme? What do you think about the:
 - *10% improvement in learner scores expectation was not met for all Chairs? Is it reasonable/ a true measure of effectiveness & impact?*
 - *Contextual and other factors which Chairs encountered (different for each)?*
3. What can be improved?
 - Lessons learned?
 - Communications and advocacy?
 - Collaboration among administrators and stakeholders?
 - Involvement of key actors in education – DBE, DHET...?
4. Do you see the model being applied in other fields/ subjects?
 - Importance of language
 - Link between literacy and numeracy / mathematics
 - Need for a Literacy Chair?
5. Have there been any unintended consequences of the programme? Major surprises?
6. What is the future of the Programme?
 - Should it continue?
 - What would you do differently, or change?
 - What's next for this Programme? Scale to more schools? More Chairs? More universities, etc.? If so, what would need to happen?

Cost Analysis – Understanding total, “true” cost of the Programme

What do you think the hidden costs are? (e.g., salaries, non-monetary contributions, cost to university (cost recovery), supervisory time)

7. 2 INTERVIEW LIST

Name	Organisation	Role
Professor Mamokgethi Phakeng	FirstRand Foundation (FRF)	Trustee
Sizwe Nxasana	FirstRand Foundation (FRF)	Chairman
Beth van Heerden	FirstRand Foundation (FRF)	CSI Executive
Carolyn Waterhouse	Rand Merchant Bank (RMB) Fund	Chair of the RMB Fund and FirstRand Foundation Trustee
Yvette Nowell	Rand Merchant Bank (RMB) Fund	RMB Fund Manager
Norman Mbazima	Anglo American Chairman's Fund (AACF)	Chairman
Dr Makobetsa Khati	National Research Foundation (NRF)	Executive Director: Research Chairs and Centres of Excellence (RCCE)
Dr Romilla Maharaj	National Research Foundation (NRF)	Executive Director: Department: Human and Infrastructure Capacity Development (HICD)
Thabile Sokupa	National Research Foundation (NRF)	Director: Research Chairs and Centres of Excellence (RCCE)
Selelo Matimolane	National Research Foundation (NRF)	Professional officer: Research Chairs and Centres of Excellence (RCCE)
Dr Nana Boaduo	National Research Foundation (NRF)	Professional officer: Research Chairs and Centres of Excellence (RCCE)
Dr Phethiwe Matutu	Department of Science and Technology	Chief Director of Human. Capital and Science Platforms (DST)
Deepa Patel	Tshikululu Social Investments	CRM Anglo American Chairman's Fund
Adam Boros	Tshikululu Social Investments	Senior CRM FirstRand Foundation
Asgar Bhikoo	Tshikululu Social Investments	Monitoring and Evaluation Specialist
Phillip Methula	Tshikululu Social Investments	Education Specialist
Seliki Tlhabane	Department of Basic Education	Chief Director: MST & Curriculum Enhancement Programmes
Peter Clayton	Rhodes University	Deputy Vice-Chancellor Research and Development
Professor Di Wilmot	Rhodes University	Dean of Education
Professor Zubeida Desai	University of the Western Cape	Dean of Education

Name	Organisation	Role
Professor Beverley Thaver	University of the Western Cape	Assoc. Prof Higher Education / Member of Council on Higher Education
Professor Jeremy Hodgen	University of Nottingham	Professor of Mathematics Education
Dr Peter Beets	Western Cape Education Department	Chief Director: Curriculum Development and Teacher Development
Professor Ruksana Osman	University of the Witwatersrand	Dean: Faculty of Humanities
Professor Jill Adler	University of the Witwatersrand	Chair
Craig Pournara	University of the Witwatersrand	Project Manager, WITS Maths Connect - Secondary
Professor Hamsa Venkatakrishnan	University of the Witwatersrand	Chair
Corin Mathews	University of the Witwatersrand	Project Manager, WITS Maths Connect - Primary
Professor Marc Schäfer	Rhodes University	Chair
Professor Werner Olivier	Nelson Mandela Metropolitan University	Chair
Professor Cyril Julie	University of Western Cape	Chair
Professor Mellony Graven	Rhodes University	Chair

7.2. LIST OF EVALUATIONS COMPLETED BY KHULISA

LIST OF EVALUATIONS COMPLETED BY KHULISA (BY FINAL SUBMISSION DATE)
July 2012
Maths & Numeracy Chairs Programme School Functionality 63 Ordinary Schools
September 2012
Evaluation of South African Maths Education and Numeracy Chairs Programme Project Descriptions
October 2012
Maths Chairs Programme School Functionality Prof Adler
Numeracy Chairs Programme School Functionality Prof Graven
Maths Chairs Programme School Functionality Prof Julie
Maths Chairs Programme School Functionality Prof Olivier
Maths Chairs Programme School Functionality Prof Schäfer
Numeracy Chairs Programme School Functionality Prof Venkatakrishnan
DQAs
February 2014
Data Quality Assessment Maths Chairs Programme Wits Maths Connect – Secondary Project University Of Witwatersrand
Data Quality Assessment Maths Chairs Programme FRF Mathematics Education Chair Rhodes University
Evaluations
February 2014
Mid-term Evaluation Numeracy Chairs Programme SA Numeracy Chair (SANC) Rhodes University
Mid-term Evaluation Maths Chairs Programme FRF Mathematics Education Chair Nelson Mandela Metropolitan University
Mid-term Evaluation Numeracy Chairs Programme Wits Maths Connect – Primary University Of Witwatersrand

LIST OF EVALUATIONS COMPLETED BY KHULISA (BY FINAL SUBMISSION DATE)

June 2014

End-term Evaluation Maths Chairs' Programme
Wits Maths Connect – Secondary
University Of Witwatersrand

End-term Evaluation Maths Chairs' Programme
FRF Mathematics Education Chair
Rhodes University

October 2014

Mid-term Evaluation Maths Chairs Programme
FRF Mathematics Education Chair
LEDIMTALI
University of Western Cape

May 2015

End-term Evaluation Maths Chairs Programme
FRF Mathematics Education Chair
Nelson Mandela Metropolitan University

June 2015

End-term Evaluation Numeracy Chairs Programme
SA Numeracy Chair (SANC)
Rhodes University

October 2015

End-term Evaluation Numeracy Chairs Programme
Wits Maths Connect – Primary
University Of Witwatersrand

April 2016

End-term Evaluation Maths Chairs Programme
FRF Mathematics Education Chair
LEDIMTALI
University of Western Cape

7.3. PROGRAMME OBJECTIVES AT A GLANCE

	WMC-S	FRF Maths Education Chair – Rhodes	FRF Maths Education Chair- NMMU	LEDIMTALI
Develop and deliver a formal education programme for in-service educators				
Core in-service educator training programmes:	Transition Maths 1 & 2 (TM1 & TM2) In-school workshops	Mathematics Teaching Enrichment Programme (MTEP) In-School Support	Mathematics educator Skills Upgrade Project (MATHSUP) *Accredited Mathematics Skills Upgrade (MSUP)	Educator Workshops Extended Teacher Institutes In-school Support
Produce research on sustainable and pragmatic solutions to improve the quality of maths teaching and learning				
Research outputs:	97	96	52	28
Research team:	42 unique researchers: Post-Doc (4), PhD (9), MAs (10) and HONS (19)	21 unique researchers: Post-Doc (2), PhD (7), MAs (12)	9 unique researchers: PhD (3), MAs (6)	20 unique researchers: PhD (11), MAs (9)
Provide leadership through academic citizenship and public engagements				
Memberships and affiliations & Collaborative research projects:	24	12	40	10

Improve learner performance				
NO. OF GRADE 12 MATRIC MATHS PASSES				
Achieve an increase in the no. of grade 12 Maths passes in each of the 10 schools (2010 – 2013)	Achieved in 5 of 10 project schools	Achieved in 6 of 10 project schools	Achieved in 7 of 10 project schools	Achieved in 7 of 9 project schools
Total no. of learners passing matric maths:	2010: 321 2013: 325 1% increase	2010: 40 2013: 56 40% increase	2011: 186 2014: 198 6% increase	2011: 81 2015: 146 101% increase
IMPROVED MATRIC MATHS PASS RATE				
Achieve an increase in the matric maths pass rate in each of the 10 schools (2010 – 2013)	Achieved in 7 of 10 project schools	Achieved in 5 of 10 project schools	Achieved in 5 of 10 project schools	Achieved in 6 of 9 project schools
Average matric maths pass rate 10 project schools:	2010: 44% 2013: 66%	2010: 33% 2013: 56%	2011: 29% 2014: 44%	2011: 31% 2015: 39%
IMPROVED QUALITY OF MATRIC MATHS PASSES				
Achieve improvements in the quality of maths passes in each of the 10 schools	Achieved in 7 of 10 project schools	Achieved in 5 of 10 project schools	Achieved in 7 of 10 project schools	Achieved in 3 of 9 project schools
Total no. of quality passes (50% or higher):	2010: 136 2013: 157	2010: 3 2013: 11	2011: 52 2014: 60	2011: 21 2015: 36

	SANC	WMC-P
Develop and deliver a formal education programme for in-service educators		
Core in-service educator training programmes:	Numeracy Inquiry Community of Leader Educators (NICLE)	Opportunity to Learn Maths (OTLM) Lesson Starters Project (LSP)
Produce research on sustainable and pragmatic solutions to improve the quality of maths teaching and learning		
Research outputs	137	104
Research team 2013:	19 Researchers: PhD (8), MAs (8) and HONs (3)	21 researchers: PhD (11), MAs (4) and HONs (6)
Provide leadership through academic citizenship and public engagements		
Academic citizenship:	Co-organised 1 st numeracy research and development focused Conference in SA	
Memberships, affiliations and collaborative research projects¹³:	48	38
Improve learner performance annually in each of the 10 primary schools		
INCREASE IN ANNUAL NATIONAL ASSESSMENT (ANA) RESULTS		
Achieved a 10% increase or more in ANA numeracy scores (2011-2014)	N/A	Grade 3: Achieved in 9 of 10 project schools Grade 6: Achieved in 8 of 10 project schools
Average ANA numeracy score in project schools (2011-2014)	Grade 3 2011: 44% 2014: 56% Grade 4 2011: 33% 2014: 43%	Grade 3 2011: 30% 2014: 57% Grade 6 2011: 35% 2014: 49%
ADDITIONAL LEARNER ASSESSMENTS (CHAIR SPECIFIC)		
Askew Test	2011: 34% 2014: 45%	N/A

¹³ An indicator to measure Chairs' citizenship in the broader maths/numeracy education community which includes new memberships, affiliations or collaborative research projects with relevant maths/numeracy associations and/or organisations and academic institutions.

Four Operations Assessment (average % increase)	Gr 3 2011 – Gr 4 2012 :11.05% increase Gr 3 2012 – Gr 4 2013 :11.29% increase Gr 3 2013 – Gr 4 2014 :11.35% increase		N/A		
	Leverhulme Test	N/A		<p>2012: 7 of 10 schools achieved 10% or more increase between the pre- and post-test.</p> <p>2015: 8 of 10 schools achieved 10% or more increase between the pre- and post-test.</p>	
Learning Framework in Numbers (LFIN)	N/A		Levels	2011	2014
			0-2	14% of learners	6% of learners
			3-5	19% of learners	30% of learners

7.4. COST ANALYSIS

Tshikululu Social Investments¹⁴

Tshikululu's hidden costs in managing this programme amounts to just over **R 130 000 per annum**, reaching its highest in 2016 with **R 140 484** spent in administrative costs. This is comprised of **+/- 500 hours (+/- 65 days spent)** which is divided among several staff members at various levels at the organisation including the; FRF client relationship manager, RMB client relationship manager, AACF client relationship manager, Education specialist, Education practitioner, M&E specialist, Administrative and finance staff.

Tasks include:

- Monthly internal meetings to determine the progress with the initiative.
- Meetings with the NRF, Prof Phakeng and the Chairs.
- Meetings with Khulisa to discuss the evaluation (as well as Tshikululu's own M&E activities).
- Reviewing reports and writing an annual report to the RMB Fund and FRF trustees.
- Attending the COP.
- General administrative matters, including payments to the NRF.

NRF¹⁵

Estimated total costs: **R 330 000 per annum**

Administration: **R 130 000 per annum**

Community of Practice: **R 200 000 per annum**

Evaluation

Tshikululu Social Investments commissioned Khulisa to conduct external evaluations of the Chairs and the programme between 2013 and 2016 which amounts to **R 3 994 901**.

Previous evaluation costs between 2011 and 2012 are **R 1 964 986**. An additional **R150 000** was spent on accommodation and travel cost of hosting the international panellist reviewers,

Tasks include:

- International Panellists review
- Indicator workshop and development
- DQA
- Evaluations

Other admin costs e.g. attending the CoP

¹⁴ On request, Asgar Bhikoo, Monitoring and Evaluation Specialist, Tshikululu Social Investments provided Khulisa with the approximate administrative costs.

¹⁵ NRF did not provide Khulisa with administrative costs, these figures are based on estimates using Tshikululu's costs.

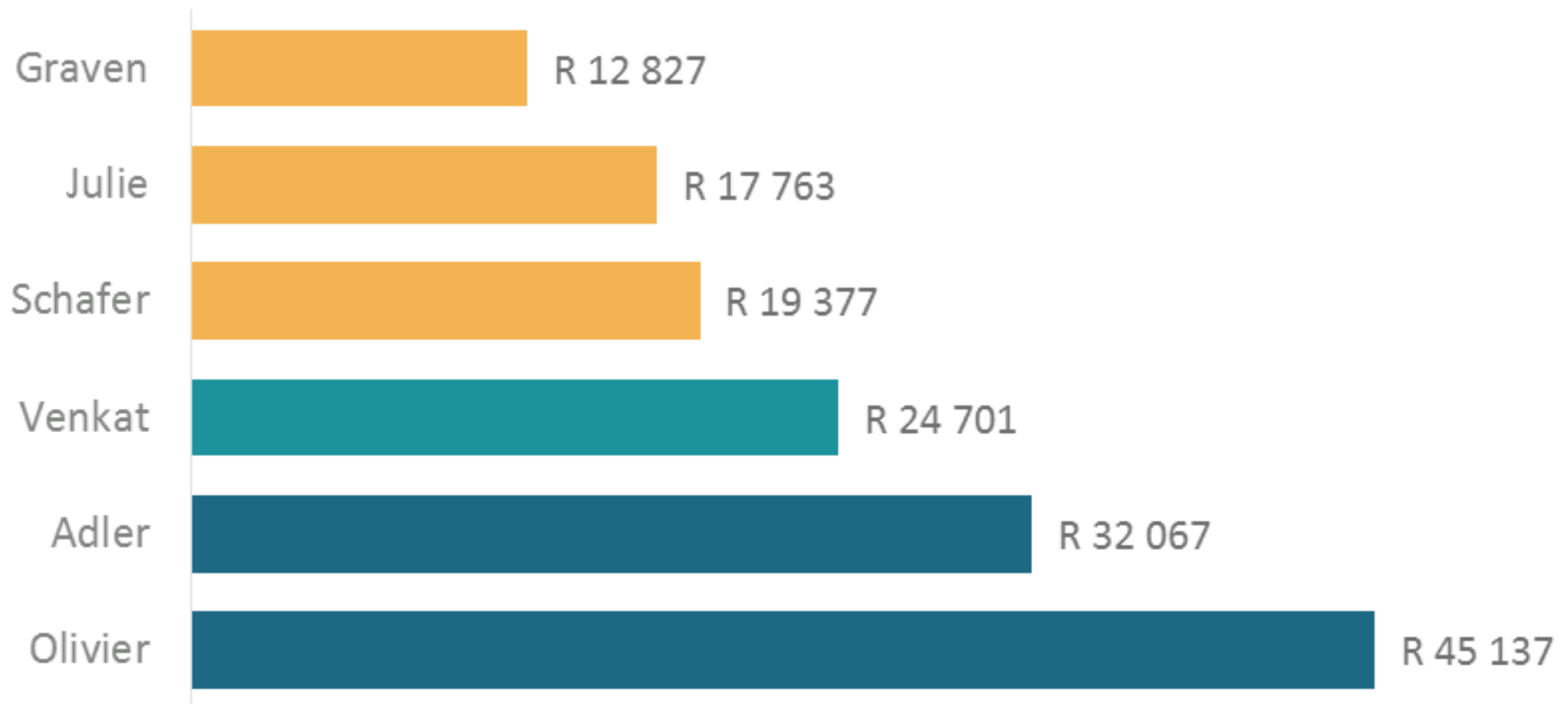
TABLE 6: COMPARATIVE AND SUMMARISED COSTS

	Adler	Schäfer	Olivier	Graven	Venkat	Julie	Total
Research	R 4 168 446	R 4 081 372	R 2 309 800	R 3 696 050	R 2 338 491	R 2 352 900	
Development - Core	R 3 718 042	R 2 503 350	R 6 003 200	R 2 771 800	R 4 607 867	R 3 112 205	
Development - Other activities	R 471 508	R 396 710	R 1 105 600	R 1 817 900	R 441 702	R 630 375	
Leadership	R 1 132 277	R 750 905	R 718 200	R 415 500	R 983 948	R 665 751	
Administration	R 1 578 892	R 2 267 663	R 922 200	R 1 184 750	R 2 117 822	R 663 669	
Total	R 11 069 165	R 10 000 000	R 11 059 000	R 9 886 000	R 10 489 830	R 7 424 899	R 59 928 894
Additional NRF funding*	R 1 897 000						R 1 897 000
Leveraged amount	R 6 128 000	R 1 316 000	R 31 273 500	R 2 914 962	R 3 178 000	R 2 887 850	R 47 698 312
Pro-rated administration (Tshikululu and NRF)**	R 385 372.00	R 385 372.00	R 385 372.00	R 385 372.00	R 385 372.00	R 385 372.00	R 2 312 232
Evaluation (2011-2016)							R 6 109 887
Total Individual Maths Chairs costs (2011-2016)	R 28 651 702	R 21 701 372	R 53 776 872	R 23 072 334	R 24 543 032	R 18 123 021	
Total Maths Chairs Programme costs (2011-2016)							R 117 946 325

*Prof Adler's additional NRF funding due to her Chair rating of A2

** Estimated average amount of admin costs per chair per annum.

Cost per Educator (cumulative)



7.5. TERMINOLOGY

NRF RATING PROCESS¹⁶

The NRF rating system is a key driver in the NRF's aim to build a globally competitive science system in South Africa. It is a valuable tool for benchmarking the quality of South African researchers against the best in the world. NRF ratings are allocated based on a researcher's recent research outputs and impact as perceived by international peer reviewers. The rating system encourages researchers to publish high quality outputs in high impact journals/outlets. Rated researchers as supervisors will impart cutting-edge skills to the next generation of researchers.

The rating of individuals is based primarily on the quality and impact of their research outputs over the past eight years, taking into consideration the evaluation made by local and international peers. It identifies researchers who count among the leaders in their fields of expertise and gives recognition to those who constantly produce high quality research outputs. Several South African universities use the outcomes of the NRF evaluation and rating process to position themselves as research-intensive institutions, while others provide incentives for their staff members to acquire and maintain a rating and give special recognition to top-rated researchers.

A successful rating allows one the option of applying for incentive funding from the NRF, the amount of which is directly proportional to the researcher's rating.

The rating is used as a national indicator of excellence and is to the advantage of your faculty and the University in terms of benchmarking.

Apart from providing access to NRF funds, rating may assist in leveraging outside funding.

The rating process is coordinated by members of academia who are represented in the following committees:

- 22 Specialist Committees coordinated by a Convener
- The Executive Evaluation Committee
- The Appeals Committee

The ratings that are awarded fall within the following categories:

- A – Leading international researchers
- B – Internationally acclaimed researchers
- C – Established researchers
- P – Prestigious Awards
- Y – Promising young researchers

¹⁶ Downloaded September 9, 2014 from <http://www.nrf.ac.za/rating>

The descriptors and requirements of these categories are outlined in the Table below.

Category	Definition	Sub-category	Description
A	Researchers who are unequivocally recognised by their peers as leading international scholars in their field for the high quality and impact of their recent research outputs.	A1	A researcher in this group is recognised by all reviewers as a leading scholar in his/her field internationally for the high quality and wide impact (i.e. beyond a narrow field of specialisation) of his/her recent research outputs.
		A2	A researcher in this group is recognised by the overwhelming majority of reviewers as a leading scholar in his/her field internationally for the high quality and impact (either wide or confined) of his/her recent research outputs.
B	Researchers who enjoy considerable international recognition by their peers for the high quality and impact of their recent research outputs.	B1	All reviewers are firmly convinced that the applicant enjoys considerable international recognition for the high quality and impact of his/her recent research outputs, with some of them indicating that he/she is a leading international scholar in the field.
		B2	All or the overwhelming majority of reviewers are firmly convinced that the applicant enjoys considerable international recognition for the high quality and impact of his/her recent research outputs.
		B3	Most of the reviewers are convinced that the applicant enjoys considerable international recognition for the high quality and impact of his/her recent research outputs.
C	Established researchers with a sustained recent record of productivity in the field who are recognised by their peers as having: <ul style="list-style-type: none"> produced a body of quality work, the core of which has coherence and attests to ongoing engagement with the field demonstrated the ability to conceptualise problems and apply research methods to investigating them. 	C1	All of the reviewers are firmly convinced that the applicant is an established researcher as described with some reviewers indicating that he/she already enjoys considerable international recognition on the basis of his/her high quality recent research outputs.
		C2	All of the reviewers are firmly convinced that the applicant is an established researcher as described. The applicant may, but need not, enjoy some international recognition for the quality and impact of his/her recent research outputs.
		C3	Most of the reviewers concur that the applicant is an established researcher (as described).
P	Young researchers (normally younger than 35 years of age), who have held the doctorate or equivalent qualification for less than five years at the time of application and who, on the basis of exceptional potential demonstrated in their published doctoral work and/or their research outputs in their early post-doctoral careers are considered likely to become future international leaders in their field.		Researchers in this group are recognised by all or the overwhelming majority of reviewers as having demonstrated the potential of becoming future international leaders in their field on the basis of exceptional research performance and output from their doctoral and/or early post-doctoral research careers.

Y	Young researchers (40 years or younger), who have held the doctorate or equivalent qualification for less than five years at the time of application, and who are recognised as having the potential to establish themselves as researchers within a five-year period after evaluation, based on their performance and productivity of quality research outputs during their doctoral studies and/or early post-doctoral careers.	Y1	A young researcher (within 5 years from PhD) who is recognised by all reviewers as having the potential (demonstrated by research products) to establish him/herself as a researcher with some of them indicating that he/she has the potential to become a future leader in his/her field. OR A young researcher (within 5 years from PhD) who is recognised by all or the overwhelming majority of reviewers as having the potential to establish him/herself as a researcher of considerable international standing on the basis of the quality and impact of his/her recent research outputs.
		Y2	A researcher in this group is recognised by all or the overwhelming majority of reviewers as having the potential to establish himself/herself as a researcher (demonstrated by recent research products).

NRF DEFINITION OF RESEARCH¹⁷

For purposes of the NRF, research is original investigation undertaken to gain knowledge and/or enhance understanding.

Research specifically includes:

- ✓ The creation and development of the intellectual infrastructure of subjects and disciplines (e.g. through dictionaries, scholarly editions, catalogues and contributions to major research databases).
- ✓ The invention or generation of ideas, images, performances and artefacts where these manifestly embody new or substantially developed insights;
- ✓ Building on existing knowledge to produce new or substantially improved materials, devices, products, policies or processes.

It specifically excludes:

- ✓ Routine testing and analysis of materials, components, instruments and processes, as distinct from the development of new analytical techniques.
- ✓ The development of teaching materials and teaching practices that do not embody substantial original enquiry.

¹⁷ Downloaded September 9, 2014 from <http://www.nrf.ac.za/rating>

THE SOUTH AFRICAN RESEARCH CHAIRS INITIATIVE (SARCHI)¹⁸

The South African Research Chairs Initiative (SARChI) was established in 2006 by the Department of Science and Technology (DST) and the National Research Foundation (NRF). It is designed to attract and retain excellence in research and innovation at South African public universities through the establishment of Research Chairs at public universities in South Africa with a long-term investment trajectory of up to fifteen years.

The main goal of the Research Chairs initiative is to strengthen and improve research and innovation capacity of public universities for producing high quality postgraduate students and research and innovation outputs. The key objectives of SARChI are to:

- Expand the scientific research and innovation capacity of South Africa;
- Improve South Africa's international research and innovation competitiveness while responding to social and economic challenges of the country;
- Attract and retain excellent researchers and scientists;
- Increase the production of masters and doctoral graduates; and
- Create research career pathways for young and mid-career researchers, with a strong research, innovation and human capital development output trajectory.

The instrument is designed to bring new research leadership capacity into public universities, while at the same time retaining those that are already at the universities. To this effect a 60/40 target for external vs internal candidates was set to encourage recruitment from outside South African universities, i.e., from industry and abroad, including African scholars and South Africans in the diaspora.

Research Chairs are established at the Tier 1 or Tier 2 level based on the candidate's research track record and standing and postgraduate student and postdoctoral fellow training track record. Tier 1 Chairs are for established researchers that are recognised internationally as a leader in their field and/or have received international recognition for their research contributions. Tier 2 Chairs are for established researchers, with a potential to achieve international recognition for their research contributions in the next five to ten years. Candidates from abroad that are willing to spend at least 50% of their time at a South African host university are eligible for consideration at the Tier 1 level. However, international candidates appointed at the Tier 2 level are required to reside full-time in South Africa for the duration of the Research Chair award.

Research Chairs are held by a university in partnership with a public research institution such as: another university, a science council, a national research facility or an academic health complex. Since inception, 150 Research Chairs were awarded to 21 public universities across the country in open and directed categories; priority research areas; science and technology for poverty alleviation; innovation, engineering and technology development; and within the national science and technology missions.

¹⁸ Downloaded September 9, 2014 <http://www.nrf.ac.za/division/rcce/instruments/research-chairs>

WHAT MAKES A GOOD PPP?¹⁹

1. Definition of a PPP
 - a. A PPP is a written contract between a government institution and a private party wherein
 - i. The private party undertakes a governmental function for and on behalf of the government (usually involving building new infrastructure), or
 - ii. The private party uses government land for its (the private party's) commercial purposes and
 - b. Where the private party receives a benefit for so doing by way of payment from the governmental institution, the users of the property, or both.
2. Examples:
 - a. In Nelspruit, a private party provides complete water services for the municipality (treats and distributes potable water and collects, treats and discharges treated wastewater)
 - i. In addition, the private party invoices customers and collects the payments, as to which it retains a fee, the remainder going to the municipality
 - ii. The private party also undertakes all customer relations activities for the municipality in terms of water services
 - b. The National Department of Transport is the main governmental institution operating a transversal fleet management PPP with a private sector fleet management company.
 - i. By transversal it is meant that other national departments can join in the fleet management PPP. Many other department have, including the Presidency
 - ii. *In this PPP the private party finances the purchase of the automobiles, maintains them, and makes them available to authorised public sector employees for a fee which is paid to the private party on a monthly basis.*
 - c. The Gautrain is a PPP whereby the private party (Bombela) partially financed, designed, constructed and operates the Gautrain, charging and collecting fees from the users thereof. Gauteng province and the National Department of Transport have "guaranteed" a minimum fee paid to Bombela if the passenger revenues collected fall below a certain level.
 - d. Many national departments here in Pretoria have offices in bespoke office accommodation provided to them under PPPs whereby the private party has financed, designed, built and operated and maintained the office building to specifications, for which it is paid a fee determined by contract, on a monthly basis.
3. So, what makes a good PPP for a "traditional" PPP is –
 - a. **A government function that can be undertaken by the private sector**

¹⁹ James Aiello: Senior Project Advisor: PPP Unit, National Treasury

- b. A private sector that has access to private funding to build the infrastructure needed to undertake the government function and the expertise to do so**
 - c. The governmental entity undertakes to annually budget to pay the PPP fees (actually, National Treasury makes sure they do budget appropriately after a PPP agreement is signed)
- 4. A good PPP for private sector use of government land for its own commercial purposes –
 - a. Government has land that is not needed to provide a necessary service; and**
 - b. The private sector wants to develop that land and build revenue-generating enterprises on it.**
- 5. Further information may be found at www.PPP.gov.za, and www.Treasury.gov.za/

7.6. THE SUSTAINABILITY FRAMEWORK

Understanding Sustainability, adapted from <https://sustaintool.org>

The Sustainability Framework identifies a small set of organizational and contextual domains that can help build the capacity for maintaining a program. Capacity for sustainability is defined as the ability to maintain programming and its benefits over time.

The eight key domains that can influence a program's capacity for sustainability are described below:



Environmental Support

We define Environmental Support as:

having a supportive internal and external climate for your program.

Why does Environmental Support matter?

No matter the level at which your program operates, the overall economic and political climate will affect your ability to get things done. State-level programs are significantly influenced by the governor, appointed agency leaders, the structure and traditions of public agencies, and the legislature. Community-level programs are more influenced by local councils and boards. Programs are also influenced by internal organizational politics and leadership.

You can't necessarily handpick who is in the Director's chair or in political office, but they can have a big impact on your program. Whether they support your cause or support your opposition, decision makers deserve your attention. Work to get people of influence on your side, both within and outside of your organization. Often these decision makers control the money, and if you want some for your program, you will need them to know and like your program. In addition, champions can get policies passed that benefit your target population and help achieve your program goals.



Funding Stability

We define Funding Stability as:

Establishing a consistent financial base for your program.

Why does Funding Stability matter?

Planning for the sustainability of funding should be a strategic process that addresses the long-term needs of your program and adjusts to changing trends in economic and political cycles. Having a defined plan with an adaptive timeframe that maintains critical infrastructure is essential.

Funding highs and lows put stress on programs and make it difficult to provide consistent quality services. Valuable staff may leave or have to be laid off if funding shortfalls are

anticipated. Meanwhile, programs that rely on a single funding source are more vulnerable to funding cuts. For all these reasons, cultivating a stable and diverse funding base is essential for ongoing sustainability.



Partnerships

We define Partnerships as:

Cultivating connections between your program and its stakeholders.

Why do Partnerships matter?

Partners play an important role in sustainability in several ways:

- partners can be connectors to greater resources or expertise;
- partners can take over providing services if your program has to cut back; or
- partners can advocate on behalf of your cause.

Partners can also help rally the community around your program and its goals. They can range from business leaders and media representatives to organizations addressing similar issues and community members. When your program is threatened either politically or financially, your partners can be some of your greatest champions. Building awareness and capacity for sustainability requires a strategic approach and partnerships across sectors, including alliances between private and public organizations.



Organizational Capacity

We define Organizational Capacity as:

Having the internal support and resources needed to effectively manage your program.

Why does Organizational Capacity matter?

Organizational capacity encompasses a wide range of capabilities, knowledge, and resources. For example, having enough staff and strong leadership can make a big difference in accomplishing your program goals. Cultivating and strengthening your program's internal support can also increase your program's likelihood of long-term success.



Program Evaluation

We define Program Evaluation as:

Assessing your program to inform planning and document results.

Why does Program Evaluation matter?

Evaluating your program on an ongoing basis builds sustainability capacity in two key ways.

First, evaluation helps keep your program on track with its goals and outcomes. If evaluation data shows that an activity or strategy isn't working, you can correct your program's course to become more effective. Your evaluation or performance improvement measures can also influence strategic planning.

Second, collecting data about your program's successes and impact is a powerful tool for gaining support and funding. If your evaluation data shows that your program is making an important (or irreplaceable) impact, you can make a strong case for why your program needs to continue. Even in times of decreased funding, evaluation and monitoring data are key for the pursuit of new funding sources.



Program Adaptation

We define Program Adaptation as:

Taking actions that adapt your program to ensure its ongoing effectiveness.

Why does Program Adaptation matter?

Circumstances change and sometimes your program needs to also. The goal is not necessarily to sustain all of a program's components over time, but rather to sustain the most effective components and their benefits to your target group. This requires flexibility, adaptation to changing conditions, and mechanisms for quality improvement within your program. By using your evaluation data and the most current evidence-base, you can ensure that your program effectively uses resources and continues having an impact. As you adapt your program, make sure to keep up-to-date on best practices.



Communications

We define Communications as:

Strategic communication with stakeholders and the public about your program.

Why do Communications matter?

People need to know what your program does and why it's important. Communicating externally about your program's effectiveness helps the program gain greater visibility and builds support from stakeholders. Internally, evidence that a program works builds staff buy-in and support from organizational leaders. The more people know and care about your program and mission, the more likely they are to support your efforts to continue providing services in the long term.



Strategic Planning



We define Strategic Planning as:

Using processes that guide your program's directions, goals, and strategies.




Why does Strategic Planning matter?




Strategic planning is the glue that holds sustainability efforts together. Without a strategic direction and long-term goals, programs find themselves only reacting to day-to-day demands. Strategic planning combines elements of all of the sustainability domains into an outcome-oriented plan. Planning also ensures that the program is well aligned with the larger external and organizational environment.

7.7. Sustainability factors

Sustainability Factors ²⁰	Current Rating	Comments	
		Mid-term Evaluation (2014)	End-Term Evaluation (2016)
Enabling Environment		<p>The NRF through the SARChI process has the structure in place for the Maths Chairs. The NRF is in the process of learning how to work with the private sector (at times this has been a problem, for instance remembering to include FRF trustees in review processes or other decisions).</p> <p>The DST is committed to human capital development, but the back linkages to DBE and DHET on better teaching techniques and how to improve teaching and learning materials are very weak. Moreover, teachers outside the Chairs' programmes have limited access to the insights gained.</p>	<p>The NRF through the SARChI process has the structure in place for the Maths Chairs. However, after the five years, there has been limited buy-in of the development chairs model by the NRF or the DST.</p> <p>Linkages to DBE and DHET have marginally improved, but remain weak.</p>
Funding Stability		<p>The commitment expressed systematically by the DST and the NRF is heartening. This means that the FRF and AACF funding can continue to contribute to this institutionalisation and be a catalyst for further developments. The NRF is also seeking other ways to support the Maths Chair programmes such as supplementary grants for graduate students. Universities also benefit from the Chairs' activities. Five years, with the potential of another 5 years allows effective programme planning.</p>	<p>The DST and the NRF continue to express their commitment, meaning that the FRF and AACF funding can continue to contribute to this institutionalisation and be a catalyst for further developments.</p>

²⁰ Adapted from <https://sustaintool.org/> downloaded November 2014.

Leveraging Funds		The highest amount leveraged was by Prof Olivier; for every Rand of Maths Chair funding, an additional R2.25 funding was leveraged. The lowest amount leveraged was by Prof Julie with a ratio of R 0.10 for every Rand of Maths Chair funding.	In total, leveraged funds by all Chairs add up R 44,7 million. The highest amount leveraged was by Prof Olivier; for every Rand of Maths Chairs funding, an additional R 2.83 funding was leveraged. The lowest amount leveraged was by Prof Schäfer, with a ratio of R 0.13 for every Rand of Maths Chair funding.
Partnerships		While not a classic example of a Public Private Partnership (see Terminology section in Annex 7.5 for a full description of a PPP), this is an example where multiple partners are working together: the university sector, the private sector and government. However, as noted elsewhere, key stakeholders such as the DBE and DHET are not yet committed.	Relationships between stakeholders such as Tshikululu, NRF, DST and FRF have improved and are more collaborative. However, as noted elsewhere, key stakeholders such as the DBE and DHET are not yet committed.
Organisational Capacity		Each Chair has developed and led teams of researchers who have contributed their capabilities, knowledge, and resources to the programme. All have shown the capacity to lead and administer the unique model of research and development. This model has yielded research and developmental outputs and facilitated human capacity development through the outflow of research students working with the Chairs.	The Chairs continue to develop and lead teams of researchers, building new leaders in maths and numeracy education. In addition, the Chairs increased research outputs, generating important findings in their research areas.

Programme Evaluation		The current practice of separating the NRF review from the evaluation conducted of the development elements of the Maths Chairs programme is problematic, leading to a lack of alignment of incentives and awkward reporting cycles. The evaluation process led by Tshikululu is moving the maths chairs to better monitoring processes, but should be sustained.	There has been a transition, whereby Tshikululu and the NRF have agreed that the NRF will gradually take over the full evaluation responsibilities. If aligned with the M&E Plan being developed by Tshikululu (with NRF input), this will minimise reporting issues felt in the past.
Programme Adaptation		This type of programme has allowed rapid experimentation by the Chairs. Most of the Chairs adapted their projects to educator and learner needs as well as according to research conducted. (e.g. expansion to include Gr 8 and 9 educators)	All Chairs continued to adapt their projects throughout their five year chair.
Communications		Academic communications are strong, but to a limited audience. Advocacy skills and communications are weak. There is a need for multiple forms of communication, particularly to the funders and other audiences.	No communications and advocacy strategy has been put in place yet, meaning that key messages are not reaching audiences beyond the academic community.