FROM **HOPE** TO **ACTION** THROUGH **KNOWLEDGE**

The Renaissance of the
University of the Western Cape

2001 – 2014

Editors

Ramesh Bharuthram
and Larry Pokpas

Faculty of Education

19

Impact of Visionary Leadership on the Growth and Development of the School of Science and Mathematics Education

*Emeritus Professor Meshach Ogunniyi**

*Professor Cyril Julie***

School of Science and Mathematics Education

**UNESCO Chair in Science and Mathematics Education, 1995-2000*

***FirstRand Foundation – DST/NRF SARCHI Research Chair in Mathematics Education*

Introduction

Through the leadership of the late Merlin Mehl (Department of Physics, UWC), passionately supported by the late Cecil Leonard (Department of Zoology, UWC) and the late Jan Persens (Department of Mathematics, UWC), John Volmink (Peninsula Technikon – now the Cape Peninsula University of Technology) and Cyril Julie of the Bellville College of Education, the forerunner of the School of Science and Mathematics Education, the Goldfields Resource Centre (GFRC), the forerunner of the School of Science and Mathematics Education, was established at UWC in the mid-1980s. GFRC was housed in the Science Faculty of UWC. The focus of the GFRC research and development was on cognitive acceleration in Science and Mathematics learning inspired by the work of Adey and Shayer of King's College of the University of London (see, for example, Adey & Shayer, 1994). Further impetus for the cognitive science approach to science and mathematics learning came from the work of Feuerstein's instrumental enrichment (Feuerstein, 1979). A generic course-based master's programme, which was academically housed in the Faculty of Education of the University, based on cognitive science was instituted by the GFRC. In addition to its academic endeavours, GFRC also had outreach programmes for high school science and mathematics learners. These outreach programmes were mostly computer-based, since UWC

FROM HOPE TO ACTION THROUGH KNOWLEDGE

was one of the few centres outside the USA that had a Programmed Logic for Automated Teaching Operations (PLATO) system running on a control data platform. Later a mobile unit was equipped with a fully operational PLATO system to serve learners in peri-urban and rural areas in the Western Cape. GFRC worked closely with the University to establish one of the first academic development units in the country to address the issue of underprepared first-entry university students.

Parallel to the activities of the GFRC, the academics involved in science and mathematics education in the Faculty of Education focused on academic and outreach work specifically related to schools in the disadvantaged areas in the Cape Peninsula. This was sometimes done in collaboration with academics from the Mathematics and Physics departments. Notably, the late Brian Gray focused on the preparation of learners for science competitions, which entailed completing various science-related projects for participation, firstly, in the university-based science competition, and then following an evaluation and selection of promising projects, for entry in the national competition. Academics of the Faculty of Science served as adjudicators for the university-based competitions. For Mathematics Education, academics from the Faculty of Education and the Mathematics Department in the Faculty of Natural Sciences engaged more with the socio-political issues of the turbulent late 1980s.

Regarding involvement in the socio-political issues, the Mathematics Education collective of UWC academics played leadership roles in the Mathematics Commission of the People's Education Movement, which had its headquarters at UWC. One of its major achievements was unifying different racially-based organisations for Mathematics Education in the country to form the Association for Mathematics Education of South Africa (AMESA). The Mathematics Commission also introduced Ethnomathematics to the South African mathematics community. This was done through a conference at which the well-known scholar in Ethnomathematics, the late Paulus Gerdes from Mozambique was the invited keynote speaker. Ethnomathematics was one of the first forays in South Africa into indigenous knowledge systems, albeit that it focused on the mathematisation of the production practices of ordinary people. For example, one doctoral study focused on the mathematics inherent in the indigenous Southern African games of Malepa and Morabaraba, while a master's thesis dealt with mathematics involved in the construction of the bow and arrow by the Khoisan people. A final significant event organised by the Mathematics Commission was the Second Political Dimensions of

Impact of Visionary Leadership on the Growth and Development of the SSME

Mathematics Education (PDME) Conference (see Julie, Angelis & Davis, 1993). It is no exaggeration to state that following the PDME Conference, many of the current prominent scholars in mathematics education in South Africa fostered enduring research collaborations with scholars in the field from other countries who attended the conference.

Of importance for the topic of this Chapter, Brian O'Connell was also involved in the deliberations pertaining to issues around People's Education. Prof Julie vividly recalls a meeting of the Northern Suburbs branch of the Western Cape Teachers' Union (WECTU), of which a lecturer of the Department of Mathematics of UWC was the chairperson, that was held at O'Connell's private residence in the Strand. Already at these meetings O'Connell displayed non-meretricious leadership by raising cautions about the challenges to be faced by school education once liberation was achieved.

Although GFRC dealt with Science and Mathematics Education, its focus was more multidisciplinary, whilst there were parallel dedicated initiatives in Mathematics and Science Education in the Faculty of Education and in the Departments of Physics and Biology in the Faculty of Natural Sciences. Confident that it could successfully bid for a UNESCO Chair in Science and Mathematics Education based on its strengths in these fields, the University constituted a committee, led by Prof Jan Persens, to develop a proposal for a Chair to be assigned to UWC. The proposal was successful and a UNESCO Chair in Science and Mathematics Education was awarded to UWC.

Establishment of the School of Science and Mathematics Education (SSME)

Developments in the 1990s leading to the eventual dismantling of apartheid and the achievement of majority rule in a democratic dispensation in South Africa, followed by the re-organisation of the higher education sector had serious implications for UWC. One of the more serious implications addressing was the financial distress the University suffered. As a result, many of the GFRC staff also suffered the brunt of retrenchments which were implemented by UWC to address its precarious financial situation. Therefore, it did not make much economic sense for the same institution to embark on another venture like the proposed School of Science and Mathematics Education (SSME) when the existing Resource Centre for Science and Mathematics Education (RCSME), which it was meant to replace, was in deep financial debt. Despite the prevailing financial

FROM HOPE TO ACTION THROUGH KNOWLEDGE

situation, however, the University was determined to start the new School as it realised the importance of such a school to address the low level of preparedness of high school learners for tertiary-level studies in these and related disciplines. An outflow of the UNESCO award was the setting up of a dedicated entity, housed in the Faculty of Education, comprising all initiatives in Science and Mathematics Education. Consequently, the School of Science and Mathematics Education (SSME) was established and Prof Meshach Ogunniyi was appointed as the UNESCO Chair in 1994. SSME was conceptualised by the University to further foster the existing scholarly and outreach initiatives in Science and Mathematics Education. When the Institution's financial position improved in the later years, a fraction of the retrenched staff returned to UWC to join SSME.

Drawing on Achebe's (1987) work, in 2001 Brian O'Connell entered an institution with a 'bruised heart' and set himself the task to 're-establish vital inner links' with and between a fairly disillusioned and divided University community. This he did by not aligning to 'any little caucus, no matter how talented', but emphasised the need for us to go forward as a collective with a shared vision on the future of UWC. From SSME's perspective, given O'Connell's emphasis on excellence and societal impact in his strategic vision for UWC, the ongoing activities of the School were not disrupted despite the many challenges. This approach was very different from the usual practice at many higher education institutions where, in the midst of financial challenges, entities such as centres, units and schools are subjected to reviews, leading to re-organisation and in some cases even closure.

Early work of the SSME

The existing coursework master's programme in Mathematics Education (CMPME) driven by Prof Julie and the generic Master of Science and Mathematics Education continued till the early days of SSME. The CMPME graduated 10 students. However, students who enrolled in the Science Education segment were made to take additional Science and Science Education courses under SSME and 6 of them completed their master's degrees in the late 1990s; one of them was a staff member in the Outreach Programme, another a staff member at Peninsula Technikon and the other became a member of staff during this period. Similarly, 5 international students (3 master's and 2 doctoral) completed their studies at UWC in the late 1990s. These students came from far afield as Kenya, Botswana and Eritrea. They were soon followed by students from other African

Impact of Visionary Leadership on the Growth and Development of the SSME

countries. Across GFRC and the Department of Didactics two doctoral candidates successfully completed their degrees. One of them was one of the first African women in South Africa to be awarded a doctoral degree in Mathematics Education. The Primary Mathematics Project, led by Lynne Rossouw, continued in SSME. The Realistic Mathematics Education in South Africa (REMESA), a collaboration with the world-renowned Freudenthal Institute of Utrecht University, also continued and one of the GFRC staff members was redeployed to this project. Julie and Gierdien (2019) describe the impact this project had on school mathematics in South Africa.

Prior to the establishment of SSME, UWC was fortunate to have set up a strong collaborative programme in mathematics education between the University and two universities in Norway (Universities of Bergen and Agder University College in Kristiansand). The University of Zimbabwe and the Pedagogical University of Mozambique were the other Southern African universities involved in the multi-country collaboration. The programme focused on capacity building in research in mathematics education for primarily academics from higher education institutions through offering research and development support for academics to pursue doctoral degrees at UWC. Initial negotiations and the development of a project proposal to be submitted to the Norwegian Agency for Development Co-operation Agency (NORAD) started in 1993. The proposal for a Post-Graduate Programme in Mathematics Education was accepted for funding under the Norwegian Council for Higher Education's Programme for Development Research and Education (NUFU) started in 1996. Eight students were recruited into the programme: 2 from Mozambique, 4 from South Africa and 2 from Zimbabwe. All students – except the one from Zimbabwe who terminated his studies for personal reasons – successfully completed their doctoral degrees. Amongst those who graduated from the project was the first female academic in Mozambique to obtain a doctoral degree in Mathematics Education. A reflection on the modalities and the issues confronted in this project are reported in Julie, Mikalsen and Persens (2005).

The tempo of academic collaboration was greatly expanded under the UNESCO/UNITWIN institutions in Southern Africa namely, UWC, Eduardo Mondlane Universidade, Mozambique, University of Namibia and the University of Zimbabwe. The programme was later extended to the Universidade Pedagogica, Mozambique at the request of the late Paul Gerdes, the Rector of that University. As the Director of the UNESCO/UNITWIN, Prof Oggunniyi ran research capacity-building workshops in all

FROM HOPE TO ACTION THROUGH KNOWLEDGE

these five institutions twice a year. In addition to staff members of those institutions undertaking their doctoral and postdoctoral studies at UWC they also undertook joint publications with UWC staff and participated in several research collaborative activities. One of the postdoctoral students in Science Education, Dr Emelia Nhalevilo developed a strong research programme in Science and Indigenous Knowledge and subsequently became a professor at the Universidade Pedagógica, Mozambique. Recently, she was appointed as Rector of the Universidade Pungue in Mozambique.

SSME and alignment with the imperatives of the UNESCO Chair

The appointment of UNESCO Chair Prof Ogunniyi in 1994 provided UWC an opportunity to strengthen its programmes in science education as he arrived with strong knowledge and expertise in cultural studies and in science education, including indigenous knowledge systems (IKS), which is so relevant to the African continent, given the suppressive impact of colonisation. As indicated earlier, there were strong national and collaborative research initiatives and outreach programmes at the University in Science and Mathematics Education. A primary task for the Chair since his assumption of duty in 1995 has been to integrate his vision and goals with the ongoing activities. In pursuance of this aim he spearheaded the development of new courses (later modules) consistent with worldwide practice in the fields of science and mathematics education. For example, the new courses were based not on the so-called cognitive acceleration models of the 1970s and early 1980s, based largely on the Piagetian personal constructivist view of learning, but on the Vygostkian and neo-Vygostkian socio-constructivist and critical constructivist models of learning. They also draw on Bandura's notion of sociocultural and agentic view of learning.

Another major challenge was the unavailability of funds. Although some staff members had successfully raised funding from the Foundation for Research Development (the forerunner of the National Research Foundation (NRF)) for research projects in Science and Mathematics Education, the funding from the private sector dried up due to the sector having reprioritised projects they would fund in line with the dictates of the newly liberated South Africa. A further aspect in the funding realm was that UNESCO did not fund the UNESCO Chair at a level that UWC expected. This did not deter the UNESCO Chair and, with the members of SSME, they set about to conceptualise what SSME as an UNESCO/

Impact of Visionary Leadership on the Growth and Development of the SSME

UNITWIN Centre of Excellence should look like by harnessing the potential of staff as well as galvanising the activities of the School. Through a series of strategic meetings, a programme of action was developed to set up the modalities for implementing various tasks such as:

- o Drafting the different, where needed, modules for the Honours, the Structured master's programme in Science and Mathematics Education with four modules related to quantitative and qualitative research methods, the history, philosophy of science and socio-political issues in Science and Mathematics Education for students from both disciplines and four modules specific to the two disciplines;
- o Organising Friday seminars and Saturday research workshops and editing the outcomes of the Seminar Series titled "The Pursuit of Excellence in Science and Mathematics Education";
- o Setting up an editorial board consisting of experienced reviewers from different parts of the world to review the presentations in the seminars and workshops. The Seminar Series was the forerunner of the *African Journal of Science, Mathematics and Technology Education*, of which Prof Ogunniyi was the founding editor; and
- o Planning the first International Conference on Public Understanding of Science and Technology (PUST) in Southern Africa, which was held in Cape Town in December 1996 (Ogunniyi, 1998).

As part of the strategy to make the School visible on national and international platforms, the first conference on "Promoting Public Understanding of Science and Technology (PUST) in Southern Africa" was organised. The conference was well attended, including eminent scholars from many African countries as well as other parts of the world. Through this conference SSME at UWC had started to expand its footprint. Notable among the keynote speakers and discussants at this conference were internationally renowned scientists and science educators from Oxford University, the University of Bristol, University of Oslo, the University of Leeds, the University of Manitoba, Canada, the Vrije Universiteit Amsterdam, the University of Natal and the University of Malawi.

During this phase of SSME's life, not surprisingly, the executive committee of the Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE) nominated and appointed Ogunniyi in 1996 as the founding editor of the association's proposed journal, which was later known as the *African Journal of Mathematics, Science and Technology Education* (AJMSTE), which was accredited by

FROM **HOPE** TO **ACTION** THROUGH **KNOWLEDGE**

the Department of Higher Education and Training in 2001, and is currently published by the Routledge Taylor and Francis Group. Since its inception in 1997, the journal has had six editors and now has the highest impact factor in the field of MSTE in Africa.

SSME as an integrated entity

The University was now in a period driven by its new rallying slogan *A Place of Quality, a Place to Grow* moving forward in time from “the intellectual home for the left” as declared in 1987 by the then Rector and Vice-Chancellor, Prof Jakes Gerwel. Brian O’Connell extended the first slogan to *A Place of Quality, a Place to Grow, from Hope to Action through Knowledge*. This fitted well with the aspirations of SSME. It continued the work of the Primary Mathematics Project by offering university-accredited qualifications in Science and Mathematics Education to practising teachers in the Western and Northern Cape. A similar qualification for Mathematical Literacy for out-of-field teachers – teachers teaching Mathematical Literacy, but qualified to teach subjects other than Mathematics – in the Western Cape. The offerings resulted from successful bids for tenders put out by the two provincial departments.

In order to give expression to SSME as a unified collaborative entity, an application was submitted to NORAD for an expanded capacity-building project of academics from universities in Sub-Saharan Africa to follow doctoral studies. This project was named the GRAduate Studies in Science, Mathematics And Technology Education (GRASSMATE) project. GRASSMATE was selected for funding by NORAD. We believe the success of its forerunner, the Post-Graduate Programme in Mathematics Education, contributed in no small way to this positive outcome. As is evident from the project title, the fields of study were expanded to include Science and Technology Education with Mathematics Education. The number of countries participating in this project was expanded from 3 to 10: Ghana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Uganda and Zimbabwe. The membership was expanded to include more participants from both Norway and Sub-Saharan Africa to strengthen the supervisory capacity needed for the expanded fields of study. On the Norwegian side, science educators from the universities of Bergen and Oslo were added. Within Southern Africa, science educators from Uganda and Zimbabwe and, in addition to the science and mathematics educators from UWC, a curriculum studies specialist from UWC formed

Impact of Visionary Leadership on the Growth and Development of the SSME

the expanded supervisory team. Twenty-two students were selected for the project. After the first five years, based on its satisfactory progress, GRASSMATE was supported for a further 5-year cycle. A further 6 students were added and by 2017 all students, barring one who withdrew, graduated with their doctoral degrees.

During the lifespan of GRASSMATE more than 100 publications emanated in the form of peer-reviewed conference proceedings, refereed journal articles and book chapters. (see Mikalsen & Julie, n.d.) for a list of publications and other issues pertaining to GRASSMATE. Some of the GRASSMATE graduates are continuing as academics not only in their own countries but also in England and Australia. Others have moved into other senior management positions such as Deputy Vice-Chancellors at universities, advisors to ministries of education and a senior education officer at the Reserve Bank in South Africa. Interestingly, most are continuing to publish. Noteworthy in terms of the topic of this chapter was the work of the late Larry Kannemeyer. His work centred on dealing with tutorials during lectures for first-year mathematics students in an integrated manner (Kannemeyer, 2005). Brian O'Connell highly appreciated this work and personally expressed his appreciation to Kannemeyer for his work, which gained recognition beyond the confines of UWC. This is demonstrative of O'Connell's leadership in being sensitive to the achievements of all, regardless of how insignificant their work might be deemed to be by others. In honour of Kannemeyer's outstanding approach and qualities as a teacher, the University introduced the Vice-Chancellor's Annual Larry Kannemeyer Distinguished Teacher Award. Among the GRASSMATE students who graduated were 7 women, one of them being the first female from Namibia to achieve a doctoral degree in Mathematics Education. Taken together with Julie's doctoral student at Agder University, whose thesis dealt with the use of context in school mathematics, and who was the first woman from Albania to achieve a doctoral degree in Mathematics Education, SSME had fair success in capacitating women scholars in Mathematics Education through awarding the highest university qualification on offer by higher education institutions.

SSME has in no small way drawn inspiration from the visionary leadership of Prof O'Connell. As an astute educationist he hardly completed any of his speeches without reminding his audience of the apartheid past and the need to change the state of affairs in South Africa for the better. Nor could one ignore his insistence (together with the DVC Academic, Prof Ramesh Bharuthram) that UWC should produce high-quality

FROM HOPE TO ACTION THROUGH KNOWLEDGE

research and excellent graduates who could stand their ground and find their place in the national and global marketplace and in society at large. Their combined energy and passion motivated the leadership of SSME to take the School to even greater heights. Consequently, SSME has gained recognition nationally and internationally. The large research grants awarded to Prof Julie and Prof Ogunniyi by the NRF and others, as well as the two research awards accorded to Prof Ogunniyi by two international professional organisations in 2014 and 2015, respectively, are vivid examples of such recognition. Indeed, SSME has become the flagship of the Faculty of Education in terms of its research publications and throughput rate of master's and doctoral graduates, and in so doing has become a research centre of high repute worldwide in the fields of science and mathematics education.

SSME undertook other research projects during the period 1996-2014, of which the most successful, in addition to those already elaborated above, have been the following:

- o The Scientific and Technology Literacy Project (1996-2003);
- o Teachers and Learners' Scientific and Indigenous Knowledge of Nature Project (TSLIKON) – forerunner of SIKSP (1996-2003);
- o The Relevance of School Mathematics Education (ROSME) Project (2004-2014);
- o The Science and Indigenous Knowledge Systems Project (SIKSP) (2004-2014);
- o Applications and Modelling in School Mathematics Project (AMSMAP) (2000 and ongoing);
- o Conceptions of Scientific and Indigenous Worldviews Project (COSIWP) (1996 to date);
- o The South African-Mozambican Collaborative Programme on Research (2011-2013); and
- o Local Evidence-Driven Improvements in Mathematics Teaching and Learning Initiative (LEDIMTALI) Project (2011 and ongoing).

The main goal of the UNESCO/UNITWIN Scheme had been to create Centres of Excellence in the various disciplines, especially in the developing countries with a strong emphasis on collaboration and partnership. As indicated earlier, the School had the responsibility of spearheading research-capacity development in five Southern African institutions, namely, UWC, the University of Namibia, Eduardo Mondlane University, Mozambique, Universidade Pedagógica, Mozambique and the University

Impact of Visionary Leadership on the Growth and Development of the SSME

of Zimbabwe. In line with the aim of the Scheme, research capacity-building workshops were held twice a year in all these UNESCO/UNITWIN institutions. In addition, academics in these institutions were capacitated to complete their doctoral studies within the shortest time possible. The School has been a fertile ground for collaborative research networks straddling virtually all regions of the world – Africa, Asia, Australia, Canada, Europe, Latin America and the Middle East.

SSME has continued its education of master's and doctoral students. Of the South African graduates, Mr Shafiek Dinie, Dr Cynthia Fakude and Prof Monde Mbekwa joined the staff of the School, as did Dr Keith Roy Langenhoven, who is Research Fellow. Moreover, several previous students of SSME now teach in higher education institutions across the continent, e.g. Botswana, Cameroon, Democratic Republic of Congo, Ghana, Eritrea, Kenya, Lesotho, Malawi, Mozambique, Namibia, Nigeria, Swaziland, Uganda and Zimbabwe, as well as other parts of the world including China and South Korea. Overall, some 72 master's and 25 doctoral graduates, as well as 9 postdoctoral fellows, were successfully supervised. The doctoral and postdoctoral students also produced publications in refereed conference proceedings, journals and books during this period. For instance, SSME produced the largest number of long papers at every annual conference of the Southern African Association for Research in Mathematics, Science and Technology Education between 2001 and 2014.

In line with O'Connell's steadfast position that UWC should not only be concerned with the production of quality research, but must take action for addressing the lot of the poor and marginalised, his passion for improvement of conditions in schools led to the appointment of the science educator Shaheed Harley. He focused on resourcing schools in the Western, Eastern and Northern Cape with science laboratories and offering in-service courses, on request from the provincial education departments, to practising teachers. This initiative was operated under the auspices of a separate unit – the Science Learning Centre for Africa (SLCA). By 2017, 57 laboratories had been constructed across the provinces. To show their interest and support for this initiative, whenever their diaries allowed, Prof Brian O'Connell and Prof Ramesh Bharuthram would personally attend the opening of these laboratories regardless of the distance from the University.

Conclusion

It is apposite to state that despite the initial hiccups and uncertainties that bedevilled the School, SSME is currently on a sound footing. The confidence of O'Connell and Bharuthram in SSME led them to facilitate the nomination and appointment of Prof Cyril Julie as the prestigious First Rand Foundation – DST/NRF SARCHI Research Chair in Mathematics Education in 2011. This move confirmed the Executive Management's strategic intent to establish SSME as a research niche area of the Faculty of Education.

The ongoing major projects such as the Dialogical Argumentation Instructional Method (DAIM) and LEDIMTALI, which focus on the continuous professional development of teachers to enhance achievements in school science and mathematics, would make O'Connell proud. These projects are squarely rooted in schools facing many challenges because of the low socio-economic status of the communities the schools are serving. O'Connell always had a passion for improving the educational outcomes of learners in these schools. During his tenure as Superintendent-General of the Western Cape Education Department he agitated for the unpopular reduction in salaries in order to staff schools adequately with teachers, instead of offering retrenchment packages to teachers to balance the books. It is therefore no coincidence that he was one of the lowest paid university Vice-Chancellors in the country. In his later years he had the vision of UWC being an example to the broader South African society, with the country operating and achieving success within the financial resources realistically available to the country rather than within a budget it hoped to have. Everyone, especially those in the upper echelons of society, according to him, had to buy-in and act to realise this vision, since it is in the interests of the greater public good, which O'Connell firmly believed. He in no small way led with this vision, since he was convinced that leaders must serve rather than be served.

In summary, SSME has undergone rapid scholarly advancement, especially during the period 2001 to 2014, from being a Resource Centre for Science and Mathematics Education to becoming the only UNESCO Centre of Excellence in Science and Mathematics Education in Africa, motivated and guided by the inspirational leadership of Prof Brian O'Connell. Today, SSME through its graduates, research publications and collaborations is held in high regard globally in the field of science, mathematics and technology education. Of course, such a meteoric rise of SSME could not have

Impact of Visionary Leadership on the Growth and Development of the SSME

happened through the efforts of the Vice-Chancellor alone. It occurred through the combined efforts, support and commitment of the Deputy Vice-Chancellors, (especially the then Deputy Vice-Chancellor Academic, Prof Ramesh Bharuthram), fellow Executive Management members, the Deans of the various Faculties, Heads of Academic Departments, the Directors of Schools, Centres, Institutes, Administrative and Support Divisions and indeed all staff of the various units in the University who embraced the vision expressed by Prof Brian O'Connell.

References

- Achebe, C. (1987). *Anthills of the Savannah*. London: Penguin Books Limited.
- Adey, P. & Shayer, M. (1994). *Really raising standards: Cognitive intervention and academic achievement*. Florence, KY: Routledge.
- Feuerstein, R. (1979). *Instrumental Enrichment*. Baltimore, Maryland: University Park Press.
- Holtman, L., Julie, C., Mikalsen, O., Mtetwa, D. & Ogunniyi, M. (eds.). (2008). *Some development in science and mathematics in Sub-Saharan Africa: Access, relevance, learning, curriculum, research*. Cape Town: African Minds.
- Julie, C. & Gierdien, F. (2019). Reflections on Realistic Mathematics Education from a South African Perspective. In: M. van den Heuvel-Panhuizen (ed.), *International Reflections on the Netherlands Didactics of Mathematics – Visions on and Experiences with Realistic Mathematics Education*. Cham, Switzerland: Springer Open. pp. 71-81. https://doi.org/10.1007/978-3-030-20223-1_5
- Julie, C., Angelis, D. & Davis, Z. (eds.). (1993). *Proceedings of the Second PDME Conference: Curriculum Reconstruction for Society in Transition*. Cape Town: Maskew Miller Longman.
- Julie, C., Mikalsen, O. & Persens, J. (2005). The 'complex reality' of research capacity development in mathematics education in Southern African development community countries. *International Journal of Educational Development*, 25(6):591-601. <https://doi.org/10.1016/j.ijedudev.2004.11.020>
- Kannemeyer, L. (2005) Reference framework for describing and assessing students' understanding in first year calculus. *International Journal of Mathematical Education in Science and Technology*, 36(2-3):269-285. <https://doi.org/10.1080/0020739041233137004>
- Mikalsen, O. & Julie, C. (nd). *GRASSMATE: The story of a competence building in Southern Africa*. Bergen: University of Bergen. (This publication is available from Cyril Julie and it is in the process of being digitised for availability on the Internet.)
- Ogawa, M. (ed.). (1997). *Effects of traditional cosmology on science education: Report of an International Scientific Research Program (Joint Research) Project Number 08044003*. Ibaraki: Faculty of Education, Ibaraki University, Japan.
- Ogunniyi, M.B. (ed.). (1998). *Promoting public understanding of science and technology in Southern Africa*. Bellville: University of the Western Cape.
- Ogunniyi, M.B. (2000). UNITWIN/ UNESCO Chairs Program and Capacity Building in Science and Technology in Southern Africa. *Science Education*, 84:401-417. [https://doi.org/10.1002/\(SICI\)1098-237X\(200005\)84:3<401::AID-SCE5>3.0.CO;2-I](https://doi.org/10.1002/(SICI)1098-237X(200005)84:3<401::AID-SCE5>3.0.CO;2-I)
- Ogunniyi, M.B. (2007). Teachers' stances and practical arguments regarding a science-indigenous knowledge curriculum, paper 1. *International Journal of Science Education*, 29(8):963-985. <https://doi.org/10.1080/09500690600931020>

Impact of Visionary Leadership on the Growth and Development

Ogunniyi, M.B. (ed.). (2012). <i>Systematic review of South African-Mozambican Research on indigenous knowledge systems</i>. Proceedings of the First South African-Mozambican Systematic Review Workshop. Bellville: University of Western Cape. Ogunniyi, M.B. & Mushayikwa, E. (2015). Teacher education in South Africa: Issues and Challenges. In: B. Adegoke & A. Oni (eds.), <i>Teacher Education Systems in Africa in the Digital Era</i>. CODESRIA. https://doi.org/10.2307/j.ctvh8r00j.12	Otulaja, F.S. & Ogunniyi, M.B. (eds.). (2017). <i>The World of Science Education. Handbook of Research in Science Education in Sub-Saharan Africa</i>. Rotterdam: Sense Publishers. https://doi.org/10.1007/978-94-6351-089-9 Otulaja, F.S. & Ogunniyi, M.B. (2018). The science curriculum: What are the basics and are we teaching them? In: L. Brian & K. Tobin (eds.), <i>13 Questions: Reframing Education's Conversation: Science</i>. New York: Peter Lang Publishers.