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A História e o Desenvolvimento da Pesquisa e Atividades em Etnomatemática na África do Sul

The History and Development of Ethnomathematics Research and Activities in South Africa

Historia y desarrollo de la investigación y las actividades etnomatemáticas en Sudáfrica

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Resumo

A história e o desenvolvimento da pesquisa e atividades em Etnomatemáticas na África do Sul remontam a 1995, quando o primeiro projeto de pesquisa etnomatemática foi realizado. Após esse projeto de pesquisa seminal, projetos de pesquisa em Etnomatemática foram realizados por pesquisadores e estudantes de pós-graduação em diferentes universidades. Esforços para avançar a pesquisa em Etnomatemática também foram realizados sob os auspícios da *Association for Mathematics Education of South Africa*. Este artigo relata esses desenvolvimentos em Etnomatemática, destacando o progresso feito e os desafios vivenciados. O artigo conclui indicando o que precisa ser feito para melhorar e avançar o interesse e as atividades de pesquisa em Etnomatemática na África do Sul.

Palavras-chave: Etnomatemática, Currículo de Matemática, Sistemas de Conhecimento Indígenas, Professores em Formação, Educação Matemática

Abstract

The history and development of ethnomathematics research and activities in South Africa dates back to 1995 when the first ethnomathematics research project was undertaken. Following this seminal research project, ethnomathematics research projects have been undertaken by researchers and postgraduate students at different universities. Efforts to advance ethnomathematics research have also been undertaken under the auspices of the Association for Mathematics Education of South Africa. This Paper reports on these developments in ethnomathematics, highlighting the progress made and the challenges experienced. The Paper concludes by indicating what needs to be done to improve and advance ethnomathematical research interest and activities in South Africa.

Keywords: Ethnomathematics, Mathematics Curriculum, Indigenous Knowledge Systems, Pre-service Teachers, Mathematics Education

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Resumen

La historia y el desarrollo de la investigación y las actividades etnomatemáticas en Sudáfrica se remontan a 1995, cuando se llevó a cabo el primer proyecto de investigación etnomatemática. Después de este proyecto de investigación fundamental, investigadores y estudiantes de posgrado de diferentes universidades llevaron a cabo proyectos de investigación en Etnomatemática. También se han realizado esfuerzos para promover la investigación en etnomatemáticas bajo los auspicios de la Asociación para la Educación Matemática de Sudáfrica. Este artículo informa sobre estos desarrollos en Etnomatemáticas, destacando los avances realizados y los desafíos experimentados. El artículo concluye indicando lo que se necesita hacer para mejorar y promover el interés y las actividades de investigación en etnomatemáticas en Sudáfrica.

Palabras clave: Etnomatemáticas, Currículo de Matemáticas, Sistemas de Conocimiento Indígenas, Professores en Formación, Educación Matemática

The Beginning of Research in Ethnomathematics

The focus of research on ethnomathematics in South Africa started in 1995 when the first Ethnomathematics Research Project was conducted under the leadership of Prof Paul Laridon at Wits University. Laridon invited a number of mathematics education researchers and postgraduate students to participate in this seminal project on 'The place of Ethnomathematics in the Secondary School Mathematics Curriculum in South Africa'. He had applied to the Foundation for Research Development (FRD), the Science Council responsible for development and support of research in South Africa which is currently known as the National Research Foundation (NRF) and obtained funding for the Project. Among those he invited to participate in this Ethnomathematics Research Project were Allison Kitto, Lesedi Rakgokong, Mogege Mosimege, Tusca Matlejoane, Collin Purkey, and other mathematics education researchers and postgraduate students in mathematics education at various institutions of higher learning in South Africa.

At the time I was a Lecturer of Mathematics Education and Science Education at the University of Limpopo. Prof Laridon therefore intentionally invited and involved a team of researchers from different parts of the country, which I believe benefitted the Research Project immensely as it brought a set of experiences from a broad variety of socio-cultural background and contexts. The involvement of the young scholars from various parts and Provinces of South Africa also planted the seed for the individual research projects on ethnomathematics by these scholars. As an example of the seed which was planted, I subsequently went on to study for a Doctoral Degree in Mathematics Education at the University of the Western Cape, with a focus on Ethnomathematics. Prof Laridon also went

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on, after this Ethnomathematics Project, to supervise three Doctoral studies on ethnomathematics at Wits University (Cherinda, 2002; Ismael, 2002; Mogari, 2002).

The Ethnomathematics Project investigated mathematical concepts in the following ethnomathematical activities:

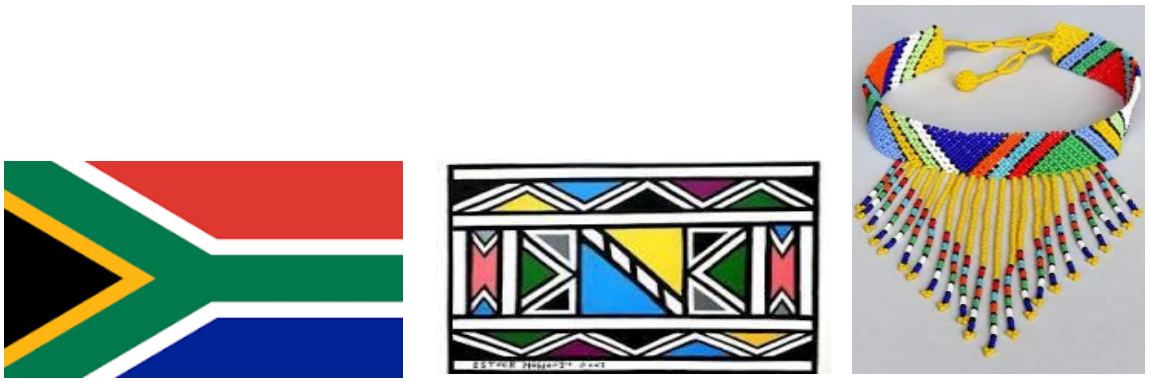
(i) The South African Flag

(ii) Mural Decorations (specifically the Ndebele Mural Decorations)

(iii) Beadwork

Figure 1 shows pictures of the three activities.

Figure 1: Pictures of three ethnomathematical activities



(i) (ii) (iii)

Source: Author's personal file

The Research project also investigated other activities not mentioned above which did not necessarily fit into the definitions of ethnomathematics as proposed by D'Ambrosio (1984, 1985, 1989) or Gerdes (1985, 1988, 1989, 1994). The activities did not also fit perfectly into Bishop's (1988) six fundamental activities that he contends are characteristic of every culture. The six activities are counting, locating, measuring, designing, playing and explaining. Indeed these six fundamental activities developed by Bishop are identifiable in various cultures. The Project was finalised and the Research Report submitted to the FRD in 1998 (Purkey, 1998).

Following the completion of this Ethnomathematics Research Project, a number of research activities and projects have been undertaken at South African universities on ethnomathematics or related to ethnomathematics. Some of these Projects have been

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undertaken by Masters and Doctoral students under the supervision of Mathematics Education staff at universities while others have been undertaken as Research Projects by the Mathematics Education staff. The Research Projects will be reported in the Sections below.

Ethnomathematical Research and Indigenous Knowledge Systems

In 2004 the Department of Science and Technology (DST) published the Indigenous Knowledge Systems (IKS) Policy (Department of Science and Technology, 2004). The Preamble of the IKS Policy is stated as follows:

The government of the Republic of South Africa registers its commitment to the recognition, promotion, development, protection and affirmation of IKS. This Policy is the product of extensive consultation, scholarly reflection, debate and participation from a range of stakeholders. The participation of practitioners and holders of Indigenous Knowledge (IK) has been of critical importance. (Department of Science and Technology, 2004, p.6)

The IKS Policy is underpinned by the following Policy drivers:

(i) The affirmation of African cultural values in the face of globalisation – a clear imperative given the need to promote a positive African identity;

(ii) Practical measures for the development of services provided by IK holders and practitioners, with a particular focus on traditional medicine, but also including areas such as agriculture, indigenous languages and folklore;

(iii) Underpinning the contribution of indigenous knowledge to the economy – the role of indigenous knowledge in employment and wealth creation; and

(iv) Interfaces with other knowledge systems, for example indigenous knowledge is used together with modern biotechnology in the pharmaceutical and other sectors to increase the rate of innovation

Following the development and publication of the IKS Policy, other Government Departments in South Africa made an effort to include aspects of this Policy in their own Policies and activities. One of the Departments that has drawn some aspects from the IKS Policy is the Department of Basic Education (DBE), which is responsible for the education in the schools sector. The DBE developed the Curriculum and Assessment Policy Statements,

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the Policies that guide the content knowledge and assessment activities in the different school subjects.

The Curriculum and Assessment Policy Statement (CAPS) for mathematics for all the Phases (Foundation Phase (Grades 1-3), Intermediate Phase (Grades 4-6), Senior Phase (Grades 7-9), Further Education and Training Phase (Grades 10-12)) in South Africa identifies the following Principle which must be taken into account in the teaching and learning of mathematics: "Valuing Indigenous Knowledge Systems: Acknowledging the rich history and heritage of this country as important contributors to nurturing the values contained in the Constitution" (Department of Basic Education, 2011, p.8).

This Principle is important as it does not only call upon mathematics teachers to find ways to include ideas and concepts related to Indigenous Knowledge Systems (IKS) in mathematics classroom activities, but it equally challenges them to reflect on their own classroom practices and teaching strategies and be proactive to search for, identify and include ethnomathematics approaches and activities when they teach various mathematics topics and concepts.

This Principle also calls for a rethink and review of the Pre-service and In-service mathematics education curriculum to include IKS concepts in the training and preparation of mathematics teachers. A recent study found that the majority of mathematics education staff at different South African universities did not only exclude IKS concepts and activities in the training of mathematics teachers but some of them were not even aware of this Principle in the CAPS requirement for teaching school mathematics (Mosimege; Egara, 2024). More importantly, these Mathematics Educators were not preparing the Pre-service Student Teachers to integrate the IKS Principle into their teaching and learning activities in mathematics classrooms.

The Ethnomathematics Research Study Group and Activities at AMESA

The Association for Mathematics Education of South Africa (AMESA) is the professional association for those who are involved in Mathematics Education in South Africa. It brings together mathematics teachers and mathematics education researchers to discuss strategies and approaches in the teaching and learning of mathematics in South African Schools. AMESA was established in 1994, the same year in which South Africa

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became a democratic country. This means that the Association is as old as the country. AMESA holds annual conferences every year and this year (2024) the 29th Annual National Conference was held from 17 – 21 June at the Sol Plaatje University in Kimberley, Northern Cape Province,

AMESA has, since the introduction and focus of research activities in Ethnomathematics in South Africa, made efforts to promote and encourage work in ethnomathematics through the establishment of the IKS Special Interest Group under the auspices of the Association. The Special Interest group is the equivalent of the International Study Group on Ethnomathematics (ISGEm) in the South African context. The Special Interest Group has been in existence from around 2000. The AMESA Special Interest Groups (SIG) members or rather members of AMESA interested in ethnomathematical research are expected to meet during the Annual Conferences of the Association and discuss the work and research activities that have taken place throughout the year in schools and universities and make plans and activities related to the advancement of the work of the SIG.

The IKS Special Interest Group as part of AMESA has not been a success it was envisaged to be. Part of the challenge relates to the lack of continuous support throughout the year of such Interest Group and lack of appropriate structures to make it more sustainable. One of the reasons that teachers have mentioned affects their ability to integrate IKS (specifically ethnomathematics) into the teaching and learning of mathematics is the time allocated to the teaching of various mathematics topic and such mathematics topics are taught according to a specific timeframe outside of the real life context in which they exist. Even though the CAPS has referred to IKS as an important Principle, it has not provided examples of how this Principle can be integrated in the mathematics subject (and other subjects) content. As a result the extent of the integration of IKS in the school curriculum has been left to the efforts of teachers, most of whom have not been adequately trained nor exposed to such integration during their Pre-service training.

AMESA has also promoted ethnomathematical activities through Invitation of Plenary Speakers and Plenary Panels that specifically address ethnomathematical activities and IKS. Examples of such activities are:

- AMESA 2016 Conference: 27 June – 01 July 2016

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Venue: Tshwane University of Technology, Mbombela Campus, Mpumalanga Province

Plenary Address: Mogege Mosimege

Title of Plenary Address: Reclaiming our African Pride through the Integration of Ethnomathematical Studies in Mathematics Teaching and Learning

- AMESA 2019 Conference: 01-05 July 2019

  Venue: University of KwaZulu-Natal, Edgewood Campus, Pinetown, KwaZulu-Natal Province

  Plenary Panel: Renuka Vithal (Convener), Judit Moschkovich, Rajendran Govender, Mogege Mosimege

  Title of Plenary Panel Discussion: Developing Deep Mathematical Thinking through Mathematics Teaching using Indigenous Knowledge and Decolonisation

Ethnomathematics Research Studies undertaken by Postgraduate Students at South African Universities

A number of Masters and Doctoral studies in ethnomathematical have been undertaken under the supervision of Mathematics Educators at different South African Universities since the first Ethnomathematics Research Project by Laridon in 1995. The list indicated below is not exhaustive but a representation of what has been done. It includes both completed and current studies.

North-West University (Mafikeng and Potchefstroom Campuses)

1) Bhuda, M. T. (2019). The Role of Ethnomathematics in the Cultural Life of AmaNdebele Women at Ekosini Village in Mpumalanga Province. Unpublished Masters Dissertation, Mafikeng Campus, North-West University.
2) Mabotja, K. S. (2022). The Affordances of Ethnomathematical Perspectives in Pre-service Mathematics Teacher Education at Selected South African Universities. Unpublished Doctoral Thesis, Potchefstroom Campus, North-West University.
3) Mojekwu, E. O. (2022). An Exploration of the Affordances of Ethnomathematics: A Case Study in the North West Province. Unpublished Doctoral Thesis, Mafikeng Campus, North-West University.

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University of the Free State, Bloemfontein

1) Galawe, B. F. (2023). The Use of Indigenous Games in the Teaching of Geometric Patterns in Mathematics in the Intermediate Phase. Unpublished Masters Dissertation, University of the Free State.
2) Poo, F. M. (Current). An Exploration of Ethnomathematical Approaches in the Teaching and Learning of Grade 6 Geometry. Ongoing Doctoral Thesis.
3) Galawe, B. F. (Current). Investigating the Perspectives and Experiences of Educators and Learners regarding the Utilization of Ethnomathematical Approaches and Activities in the Teaching and Learning of Mathematics. Ongoing Doctoral Thesis.
4) Tafa, N. (Current). Integration of Ethnomathematical Practices in the Teaching and Learning of Geometry at Ordinary Level. Ongoing Doctoral Thesis.
5) Marema, I. J. (Current). An Exploration of Grade 11 Teachers' Perspectives on Using Ethnomathematical Approaches to Teach Euclidean Geometry. Ongoing Masters Dissertation.

University of the Western Cape, Cape Town

1) Mosimege, M D (2000). Exploration of the Games of Malepa and Morabaraba in South African Secondary School Mathematics Education. Unpublished Ph D Thesis, University of the Western Cape.

University of the Witwatersrand, Johannesburg

1) Cherinda, M. (2002). The use of a cultural activity in the teaching and learning of mathematics: exploring twill weaving with a weaving board in Mozambican classrooms. Unpublished Doctoral Thesis, University of the Witwatersrand.
2) Ismael, A. (2002) An Ethnomathematical Study of Tchadji – About a Mancala Type Boardgame played in Mozambique and possibilities for its use in Mathematics Education. Unpublished Doctoral Thesis, University of the Witwatersrand.
3) Mogari, D. (2002): An ethnomathematical approach to teaching and learning of some geometrical concepts. Unpublished Doctoral Thesis, University of the Witwatersrand.

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Ethnomathematics Research Studies Undertaken and Published by Mathematics Educators in South Africa

The Research Outputs listed below are a selection of some of the Ethnomathematical Research Projects that have been undertaken and published by Mathematics Educators in South Africa. Most of these Research Outputs come from the Projects that were funded by the National Research Foundation, the Science Council responsible for funding and supporting research in South Africa, while others were funded by the Research Offices of the universities where the Mathematics Educators are working.

1) Bhuda, M. T. and Marumo, P. (2021). The Ndebele Indigenous Games Pertinent to Primary School Mathematics Learning: Why Indigenous Games are a Vital Tool for Mathematics Teaching and Learning. *Gender and* Behaviour, 116-124.
2) Burnett, C. and Hollander, W. J. (2004). The South African Indigenous Games Project of 2001/2002. *South African Journal for Research in Sport, Physical Education and Recreation*, 26(1), 9-23.
3) Laridon, P., Mosimege, M., & Mogari, D. (2004). Ethnomathematics research in South Africa. In R. Vithal, J. Adler & C. Keitel (Eds.), *Researching mathematics education in South Africa*. XXX: HSRC Press.
4) Machaba, F. and Dlamini J. (2021). Ethnomathematics as a Fundamental Teaching Approach. In K Luneta (Ed). *Mathematics Teaching and Professional Learning in sub-Saharan Africa*, Research in Mathematics Education, 59-76.
5) Madimabe, M. P., Omodan, B. I. and Tsotetsi, C. T. (2022). Incorporation of Indigenous Knowledge in the Mathematical Geometry Discipline at a TVET College. *REDIMAT – Journal of Research in Mathematics Education*, 11(3).
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9) Mosimege, M. (2020). The Use of Indigenous Games in the Teaching and Learning of Mathematics. *Revemop*, 01-16.
10) Nkopodi, N. and Mosimege, M. (2009). Incorporating the Indigenous Game of Morabaraba in the Learning of Mathematics. *South African Journal of Education*, 29, 377-392.
11) Pitikoe, S. (2017). Basotho Herders Learn through Culture and Social Interaction. *Learning, Culture, and Social Interaction.*
12) Sunzuma, G. and Maharaj, A. (2019). Teacher-related Challenges Affecting the Integration of Ethnomathematics Approaches into the Teaching of Geometry. *EURASIA Journal of Mathematics, Science and Technology Education*, 15(9), 01-15.

Conclusion

Despite the efforts made to develop and advance ethnomathematical research and activities in South Africa, minimal progress has been made. The lack of progress may be attributed to the half-hearted commitment by the DBE as demonstrated by alluding to the inclusion of IKS in the CAPS documents and yet not providing explicit examples and assistance to make the integration a reality. The lack of progress may also be attributed to the lack of provision by the Universities on the curriculum for Pre-service student teachers. In order for research in ethnomathematics to grow to higher levels, the Government Departments responsible for the School curriculum (Department of Basic Education), the Government Department responsible for the Higher Education and Training sector (Department of Higher Education), and the Universities (both public and private universities) have to demonstrate their commitment through support of various activities and efforts made by the small number of South African school educators, South African Mathematics Educators at different universities to include ethnomathematics research in their classroom activities.

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