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AMESA 2021 SPECIAL INTEREST GROUPS (SIG) REPORTS

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Report compiled by Dr VG Govender (AMESA National Executive Member and AMESA 2021 National Organising Committee member) with input from SIG convenors

1. Contents

1. Introduction

Special Interest Groups or SIG for short has always been part of AMESA Congresses over the years. A Special Interest Group is defined or described as "a group of people drawn or acting together in support of a common interest or to voice a common concern".

SIGs are important in Mathematics Education as these are where academics and prospective researchers collaborate, investigate and research with a view to adding to the body of knowledge in Mathematics Education. SIGs may affect classroom implementation, in schools, universities and other institutions, directly or indirectly depending on the nature of Special Interest Group.

In our 2021 Congress, there were 4 such SIGs. These were:

- Academic Writing
- Problem Solving
- Ethnomathematics (including Indigenous Knowledge Systems: IKS)
- PrimTEd - Core Knowledge Standards for Teaching Geometry and Measurement

The convenors and attendance were as follows:

SIG	**Convener**	**Attendance**
Academic Writing	Faaiz Gierdien	24
Problem Solving	Manare Setati	70
Ethnomathematics (Including IKS)	Mosimege Mogege	80
PrimTEd - Core Knowledge Standards for Teaching Geometry and Measurement	Gary Powell	81
TOTAL		**255**

2. Academic Writing

Introduction:

The session was introduced by the convenor with the following guiding questions:

- What is academic writing? What is it not?
- What is 'academic' about academic writing?
- What is writing?

The convenor briefly outlined differences between Academic Writing (AW) **and** Language Editing (LE)

AW focuses on enhancing the quality of one's *argument.* Resulting questions:

- What is an argument?
- How can you detect the argument from the title of a paper?
- How can you construct research question from the title of paper?

LE is an extensive review of all aspects of grammar (structural use of words, clauses, and phrases; subject–verb agreement; proper use of singular and plural nouns; etc.), parallelisms, tense, conjugations, spelling and punctuation* **(added in)**

Current developments in the SIG in the South African Mathematics Education Community

This was the first time for the current convenor of the SIG. However, fromprevious Congresses, there were discussions on peer review processes when submitting an article to the *Pythagoras* Journal.

Key matters discussed by Convenor (School/teacher education sector)

The convenor used the following article to means to explicate the usual headings (*introduction, problem statement, research question, data collection strategies, analysis, discussion, conclusion/implications*) one finds in a published article:

> *The integration of semiotic resources and modalities in the teaching of geometry in a Grade 9 class in a South African high school: The four cases of congruency*
>
> http://www.sajournalofeducation.co.za/index.php/saje/article/view/1682/969

Questions posed by audience (and possible responses)

- How do I write a conceptual or theoretical paper?
- How do I narrow down my literature review?
- What guides my literature search & review?

These questions formed part of a general discussion on Academic writing

Building capacity in the SIG

On a continuous basis the SIG can be a forum where convenors can discuss and explicate questions that attendees have. These questions can be posted a week ahead of time so that the convenor presenter can respond to them during the actual session. Alternately, and more fruitfully, the SIG can go virtual and be active platform throughout the year.

Research opportunities in the SIG

The following matters were discussed:

- What are ways of discussing the nuances and varieties of mathematics that are 'out there'? For example,
    - in schools?
    - In higher education?
    - In the workplace?
    - In high-stakes assessment/examinations?
- What are relations between these varieties of mathematics?
- A related question, what happens when mathematics 'goes to school'?
- How does it become configured in the operative curriculum one finds in a school, teachers' worksite?

3. Problem Solving

The Special Interest Group (hereafter referred to as SIG) discussion session intended to focus on the following:

- Current developments in the SIG in the South African Mathematics Education Community
- Key matters discussed by Convenor (School/teacher education sector)
- Questions posed by audience (and possible responses)
- Building capacity in the SIG
- Research opportunities in the SIG

The Convenor decided to focus of the AMESA 2021 Online Congress Problem Solving SIG discussion on Maths Challenge. The Convenor is however, aware that Maths Challenge is not necessarily Problem Solving, but Problem Solving is a vehicle through which Maths Challenge competition learner performance can be improved.

Current developments

Two AMESA members directly involved in the Maths Challenge operations and support of the Maths Challenge, Patrick Rasehwete (SAMF – Project Manager) and Alwyn Olivier (SAMC Academic Convener) presented on current matters about the Maths Challenge for learners' and the Problem-Solving course for teachers' current state of affairs as follows:

Maths Challenge for Learners:

Patrick gave an outline of a detailed number of Maths Challenge participants by province and quintile for 2021 in comparison to the past 2 years. The concern raised in the presentation was that most learners participating are from quintile 5 schools even if the competition is free for the first 100 participants in quintile 1 & 2 schools. This concern was intended to be a matter of discussion for the way forward (i.e. how can the number of participants be improved for future competitions).

Alwyn presented about the nature of SAMF/AMESA Problem Solving workshops that are intended to improve teacher engagements with learners that will improve on Maths Challenge competition learner performance and mathematics in general. The purpose of this presentation was to encourage teachers to register for this workshop when such opportunities arise in their respective regions (provinces).

Due to time constraints, the SAMO for grades 8 – 11 was not covered in the meeting

Key matters discussed by Convenor

The convenor requested participants to reflect on the presentations to chat a way forward that would improve on the participation (Maths Challenge) of more schools or all learners in the country with the view of their experiences school in the schools/institutions that they work in.

Questions posed

How to we keep each other updated of the activities?

Response:

It was agreed that a WhatsApp group be formed and have it updated from time to time to ensure that members are aware of the Maths Challenge developments (i.e. both workshops and registration for competition.

Building capacity

While participants did not discuss this item, it is the opinion of the Convenor that funding needs to be source to facilitate the fast tracking of the number of teachers trained in the Problem Solving Course as this will ensure that teachers and other stakeholders are aware of what it takes to engage learners in “doing mathematics”.

Research Opportunities

No research opportunities were explored due to time constraints

4. Ethnomathematics (including Indigenous Knowledge Systems)

Introductions

The Chair introduced himself **and then sketched the background to the SIG (Ethnomathematics) which were:**

- His Plenary Address at the AMESA Congress in Nelspruit in 2016
- The Panel Discussion and the SIG activities at the AMESA Congress at the University of KwaZulu-Natal in Durban in 2019

Current developments in the SIG in the South African Mathematics Education Community:

In view of the fact there are no specific current activities directly related to Ethnomathematics SIG in AMESA that I am aware of, the convenor referred to individual studies that have been undertaken by different students at different South African Universities over the past 20 years, including the latest studies in Ethnomathematics that have been published

Key matters discussed by Convenor (School/teacher education sector):

In addition to the various Research Activities referred to above, this Section also referred to International Developments in Ethnomathematics. These are:

- The Ethnomathematics Topic Study Group (TSG 35) at the International Congress on Mathematical Education (ICME) and the kinds of questions that guide the participants in the TSG; These questions can serve as a basis for Ethnomathematical Activities in the Schools
- The various International Conferences on Ethnomathematics that have taken place since the first Conference in 1998 and how these Conferences have focused an Ethnomathematics Research Activities in the different countries
- The work of Professor Ubiratan D'Ambrosio (Brazil) and Professor Paulus Gerdes (Mozambique) and their influence on Ethnomathematical Research

Questions posed by audience (and possible responses): Some of the questions that were asked by the participants are:

- Why is there very little reference in the CAPS Documents about the importance and inclusion of Ethnomathematics and IKS?
- It is not always easy to relate cultural activities in the teaching of mathematics. What ideas I could share on this?
- Suggestions on how to integrate ethnomathematical approaches in the teaching and learning of mathematics

Building capacity in the SIG:

In relation to the studies referred to in Section 2 above, the convenor referred to South African Universities that have registered students in postgraduate Studies (Masters and Doctoral) and also indicated some of the supervisors who have been involved in the supervision of such in the past and currently. AMESA members who are interested in such studies can follow up on these Universities and Supervisors for related research activities

Research opportunities in the SIG:

As part of the way forward, the convenor suggested the following to the participants:

- Those who are interested in Ethnomathematical Activities and advancing the work of the Ethnomathematics SIG should send the convenor an e-mail: mosimegemd@ufs.ac.za
- To compile a record of the discussion at this SIG Meeting and submit them to the AMESA National Committee
- By December 2021 to finalize the plans for the Ethnomathematics SIG at the AMESA Congress in 2022

5. Prim- Ted Core Knowledge Standards for Teaching Geometry and Measurement

Gary Powell chaired the meeting and made the presentation for the session.

He explained that the intent of the PrimTEd Project was to develop a guideline for the training of pre-service teachers in higher education institutes. In this case, for the teaching of geometry and measurement.

Team Members

He mentioned the members of the working group. They were as follows:

Member	Institute
Prof Rajendran Govender (Leader)	UWC
Prof Bheki Khuzwayo	UWC
Dr Marius Simons	UWC
Mr Gary Powell	UCT
Mr Kaashief Hassan	UCT
Dr Duncan Mhakure	UCT
Dr Stanley Adendorff	CPUT
Ms Zonia Jooste	CPUT
Prof Mogege Mosimege	UFS
Prof Vimolan Mudaly	UKZN
Dr L Kalobo	CUT
Mr J Thomas	Sol Plaatjie
Mr R Bappoo	Sol Plaatjie
Dr Eurika J van Vuuren	UMP
Ms Nokwanda Mbusi	UMP
Mr Emmanuel Libusha	UJ
Ms Maria Weitz	WITS
Dr VG Govender	ECED
Prof Samuel Otten	Missouri (Guest)
Prof Michael De Villiers	SU (ret.)

Introducing the idea of 'big ideas"

In the face of a highly specific school curriculum, and perceived "compartmentalization" of topics to be taught, initial meetings of the working group decided to focus on "big ideas" in

teaching Geometry and Measurement.

Initial suggestions (first WG3 meeting) included:

- Spatial reasoning
- Invariance
- Properties
- Measurement
- Van Hiele Levels
- Transformations
- Visualization

Theoretically, interconnectivity of mathematical concepts is unified by "a few really big and important ideas", as opposed to "a lot of different rules and methods" (Boaler, 2019)

Also, according to Barclay and Barnes, (2013), "Big ideas" in teaching mathematics deepens teachers' subject knowledge and can promote the development of relevant pedagogies

Having considered several theories on teaching Geometry, and taking into account what is required to be taught in schools by the South African schools' curriculum, the working group finally settled on the following as "big ideas":

- Properties
- Measurement
- Transformations

This discussion focussed on *properties* as a big idea in teaching geometry

Properties as a "big idea"

In Geometry, we may assume that the properties of geometric elements make these elements to be what they are. In other words, if any element should lose, or change any of its properties, it will no longer be what it was. It will not remain invariant. It will be transformed.

This suggests that one of the most important underpinning ideas in the teaching and learning of geometry in school mathematics is those properties which define geometric elements to be what they are.

Further, properties are most likely those attributes which are initially perceived when any geometric object is observed. At least 11 components contribute to the understanding of geometric properties.

Knowledge of Geometrical Properties

The properties of geometric elements make those geometric elements what they are. Initial properties are most likely to be those attributes which are initially perceived when any geometric element is observed.

1. Describe lived space and objects use of the minimum information required to locate a point in space.
2. Can explain 0-D (point), 1-D (line), 2-D (shape), and 3-D (object)
3. Describe the location of the point
4. Understanding that lines can be defined in terms of their position, direction, and in relation to other lines
5. Knowing that angles are formed when lines intersect
6. Realising that 3-D objects can consist of flat and/or curved surfaces, and 2-D shapes can consist of straight and/or curved lines
7. Realising the 3-D objects and 2-D shapes can be deconstructed into other shapes and objects
8. Knowing that 3-D objects and 2-D shapes can be described, classified and named according to their properties
9. Knowing that polyhedrons and polygons can be constructed from, and deconstructed into points, lines, and (other) polygons
10. Understanding that some polyhedrons and polygons possess the properties of other polyhedrons and polygons, and can therefore be classified and named in more than one way
11. Accepting that polyhedrons and polygons can be accurately defined using necessary and sufficient properties

The presentation was followed by discussion on how these standards could be successfully implemented in HEIs. It was explained that the standards as presented are backed up by exemplars which would encourage further thought, investigation and understanding.

6. Concluding remarks

The attendance in the various SIGs and the contributions of convenors, members and teachers show the Special Interest Groups play an important role in highlighting the key role that AMESA plays in Mathematics Education in South Africa. In this regard the following holds true:

- There is a need to build capacity in **Academic Writing**. New or novice researchers should be encouraged to publish articles and papers in local and internationally recognised journals and conference proceedings. AMESA has recognised the need to develop their Academic writing skills, hence its inclusion as a Special Interest Group. The convenor has recommended that there should be regular interactions with new or novice researchers to assist them throughout the year.

- **Problem Solving** is an integral part of **Mathematics**. Teachers should ensure that problem-solving activities are incorporated into their lessons so learners are able to develop their "higher-order" thinking skills from an early age. In July 2021, a number of regional SAMC (South African Mathematics Challenge) coordinators and local facilitators participated in the second level problem- solving course organised by SAMF. However, there is a need for more learners to participate in the SAMC (grades 4 – 7) and the SAMO (South African Mathematics Olympiad) for grades 8 – 12 learners. In this regard AMESA has nominated members to assist in boosting numbers in these important problem-solving activities.
- South Africa is a non-racial, multi-ethnic, multi-cultural country. Thus, children are likely to take these attributes with them to school; teachers need to take an inclusive approach to planning their lessons. Thus, aspects of **Ethnomathematics and** IKS could feature in some of their lessons.
- In 2018 and 2019, AMESA was involved in the training of over 800 primary school mathematics teachers. In its reports to the Department of Basic Education, AMESA noted that despite progress made in the sector, primary school mathematics teachers still need support. This is especially so in Geometry and Measurement. **The Prim-Ted Core Knowledge Standards for Teaching Geometry and Measurement** was established to ensure that pre-service mathematics teachers have the requisite knowledge and content training during their under-graduate years. The committee have come up with well-designed materials which are being used in a number of universities. It is more than likely to have a positive impact on new primary school mathematics teachers entering the school system. We believe that these materials should be adapted for **use with in-service primary school teachers**.

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