20th SAASTEC Conference

BOOK OF ABSTRACTS & PAPERS

Theme: Making Madiba Proud
# 20th SAASTEC Conference

Hosted by Vuwani Science Resource Centre, University of Venda  
26 – 29 November 2018

Conference Venue  
Porche-Villa and Conference Centre  
Thohoyandou, Block J (Muledane) On the main road to Tswinga

## Programme

**Theme : Making Madiba Proud**

> “And as we let our own light shine, we unconsciously give other people permission to do the same.”
> ~ Nelson Mandela

### Monday 26th November 2018

> “Do not look the other way; do not hesitate. Recognise that the world is hungry for action, not words. Act with courage and vision.”
> ~ Nelson Mandela

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>08:30-13:00</td>
<td>SAATA Workshop (venue to be decided)</td>
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<tr>
<td>14:30-20:00</td>
<td>Workshops, Registration and Icebreaker @ Vuwani Science Resource Centre (delegates will be transported).</td>
</tr>
</tbody>
</table>
| 15:00-17:30| Choice of 3 Workshops  
(Pre-booking compulsory – please visit the website to book your workshop [https://saastec.co.za/conference](https://saastec.co.za/conference))   |

#### 12:30-17:30

- **Exhibit Building**  
  (by Stuart Hopwood & team - Sci-Bono Discovery Centre)  
  Exhibit building workshop where each participant will leave with a function working exhibit  
  (Provided that it meets the minimum standard)  
  Exhibit made will be the Chaotic Magnetic Pendulum.  
  *(Capacity : 15)*  
  5 hrs

- **Career Development Services - the implementation of Career Kiosks in the science centres.**  
  Mr D Fothane and Mabasa Thembani, Depart of Higher Education & Training Career Development Services  
  *(Capacity 30)*  
  5 hrs

- **Early Childhood Development (ECD)**  
  (by Shemone Bokary - ArcelorMittal Saldanha)  
  Interactive ECD workshop on the life cycle of the butterfly. Participants will take part in an exploratory tour on how to introduce scientific concepts to ECD learners in a play based manner. The workshop will have a strong focus on skills development focusing on things like observation and investigation. Prioritizing visual perception development in young learners. Each participant will leave with DIY teaching aids that they can use as part of their ECD programs.  
  *(Capacity : 30)*  
  2.5 hrs

- **Easy Writing Workshop**  
  (by Ginny Stone - SAASTEC / Writer)  
  Are you regularly contributing to the Khoroni or your local newspaper? If so, this workshop is not for you! If not, come and discover an easy way to elevate your science centre’s profile in your community and on a broader scale.  
  *(Capacity : unlimited)*  
  2.5 hrs
"There is no passion to be found playing small - in settling for a life that is less than the one you are capable of living.”
~ Nelson Mandela

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Delegate</th>
<th>Mins</th>
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<tbody>
<tr>
<td>08:00</td>
<td>Registration at Conference Venue</td>
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<tr>
<td>09:00</td>
<td>Opening Session (Chair : Mondli Mnguni)</td>
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<tr>
<td>09:00-09:10</td>
<td>Welcome by SAISTEC Chair : Thami Mphokela</td>
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<tr>
<td>09:20-09:25</td>
<td>Introduction to the DST</td>
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<tr>
<td>09:25-09:45</td>
<td>Methodologies for determining participation in science centres</td>
<td>Livhuwani Masevhe, DST</td>
<td>20</td>
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<tr>
<td>09:45-10:00</td>
<td>Questions from the audience</td>
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<tr>
<td>10:10-10:30</td>
<td>Tea</td>
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<tr>
<td>10:30-12:00</td>
<td>Session 1 (Chair : Disampras Mathebe)</td>
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<tr>
<td>10:30-10:45</td>
<td>Science Centre Marketing - How do we communicate our value?</td>
<td>Sandle Rikhotso, University of Limpopo Science Centre</td>
<td>15</td>
</tr>
<tr>
<td>10:45-11:10</td>
<td>Establishing collaborations with society that would make Madiba proud</td>
<td>Tshepiso Maroga &amp; Mathipa Sebatsiwa, Sci-Enza, University of Pretoria</td>
<td>15</td>
</tr>
<tr>
<td>11:00-11:15</td>
<td>Performativity in science engagement: papering over cracks.</td>
<td>Tsepo Majake, Scholarly Publishing Unit, ASSAf</td>
<td>15</td>
</tr>
<tr>
<td>11:15-11:25</td>
<td>Questions from the audience</td>
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<td>10</td>
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<tr>
<td>11:30-13:00</td>
<td>Session 2 (Chair : Nadine Nortier)</td>
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<tr>
<td>11:30-11:45</td>
<td>Ten year review of Sci-Enza NYS volunteer programme</td>
<td>Puleng Tsie, Sci-Enza, University of Pretoria</td>
<td>15</td>
</tr>
<tr>
<td>11:45-12:00</td>
<td>National Science Week – Impact Studies</td>
<td>Bafedile Kgwidi, Gugulethu Mtsweni &amp; Joyce Khnou, SAASTA</td>
<td>15</td>
</tr>
<tr>
<td>12:00-12:15</td>
<td>Five Amazing ways we are making Madiba Proud</td>
<td>Thandamanz Mtsweni, SAASTA</td>
<td>15</td>
</tr>
<tr>
<td>12:15-12:30</td>
<td>Science engagement within Responsible Research an Innovation</td>
<td>Shadrack Mkansi, SAASTA</td>
<td>15</td>
</tr>
<tr>
<td>12:30-12:45</td>
<td>The Tragedy of the Commons</td>
<td>Ulrich Oberprieler, National Zoological Gardens</td>
<td>15</td>
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<tr>
<td>12:45-13:00</td>
<td>Panel discussion, with questions from the audience</td>
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<tr>
<td>13:00-14:00</td>
<td>Lunch</td>
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<tr>
<td>14:00-16:15</td>
<td>Session 3.1 (Chair : Thami Mphokela)</td>
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<tr>
<td>14:00-14:15</td>
<td>Science and Story Telling</td>
<td>Ginny Stone</td>
<td>15</td>
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<tr>
<td>14:15-14:30</td>
<td>Creating intergenerational Learning and Innovation spaces in selected communities: A collaborative between the elders, schools, Dzomo la Mupo (CBO) and a University in Venda</td>
<td>Mphatheleni Makaulele and Vhonani Netshandama, University of Venda</td>
<td>15</td>
</tr>
<tr>
<td>14:30-14:45</td>
<td>What Christoph Meyer Maths &amp; Science Centre has achieved that could have made Tata Madiba proud</td>
<td>Dorothy Miambbo, Christoph Meyer Maths &amp; Science Centre</td>
<td>15</td>
</tr>
<tr>
<td>14:45-14:55</td>
<td>Mandela day with the kids</td>
<td>SS Sibya &amp; S Bukhosini, Esithile Science Discovery Centre, Velabusha, KwaNgwanase</td>
<td>10</td>
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<tr>
<td>Time</td>
<td>Session</td>
<td>Speaker/Institution</td>
<td>Duration</td>
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<tr>
<td>14:55-15:10</td>
<td>Stimulating Science through Fun films</td>
<td>Diloshni Chetty, UNIZULU Science Centre</td>
<td>15</td>
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<tr>
<td>15:10-15:15</td>
<td>LEG STRETCH</td>
<td></td>
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<tr>
<td>15:15-15:30</td>
<td>The importance of using Science language in teaching Science subjects</td>
<td>Tracy Singo MSc, Assessor, Facilitator</td>
<td>15</td>
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<tr>
<td>15:30-15:40</td>
<td>Curbing demotivation</td>
<td>Busisiwe Hadebe and Matoboane Maphefo, Sci-Enza, University of Pretoria</td>
<td>10</td>
</tr>
<tr>
<td>15:40-15:55</td>
<td>Making everyday a Mandela Day</td>
<td>Phinah Manamela, ArcelorMittal Science Centre- Newcastle</td>
<td>15</td>
</tr>
<tr>
<td>15:55-16:10</td>
<td>Science shows: to theme or not to theme</td>
<td>Umr Chippendale, Cape Town Science Centre</td>
<td>15</td>
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<tr>
<td>16:10-16:25</td>
<td>RHI-Tracker</td>
<td>Gumede Thandoh BS, BSG Centre</td>
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<tr>
<td>16:25-16:40</td>
<td>Panel discussion, with questions from the audience</td>
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**PARALLEL SESSION B**

**Session 3.2 (Chair: Shadrack Mahapa)**

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<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Speaker/Institution</th>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td>14:00-14:15</td>
<td>The depiction of Vuwani Science Resource Centre learner's support program from the year 2000 until 2018</td>
<td>H Siaruli, SM Mathebe, Vuwani Science Resource Centre TS Mulauzdi and NIE Maluta Department Physics UniVEn</td>
<td>15</td>
</tr>
<tr>
<td>14:15-14:30</td>
<td>Understanding the use of pre- and post-tests in the grade 8 and 9 Natural Sciences teachers in Mpumalanga province</td>
<td>Maria Catherine Kekana, Sipho Nhlanhla Dlamini, MST Academy</td>
<td>15</td>
</tr>
<tr>
<td>14:30-14:45</td>
<td>Impact of e-Learning on academic performance: A case study of Grade 12 Physical Sciences learners in secondary schools</td>
<td>Ngoako Norman Moshokoa, Palabora Foundation</td>
<td>15</td>
</tr>
<tr>
<td>14:45-14:55</td>
<td>What South Africa needs to do to improve mathematics and science?</td>
<td>Xolani Cosmos Thikazi, Arcelor Mittal Science Centre Sebokeng</td>
<td>10</td>
</tr>
<tr>
<td>14:55-15:10</td>
<td>Be the change you want to see</td>
<td>Patrick Zondo, Siphesihle Bukhosini, Themba Ngubane, Isibusiso Esihle Science Discovery Centre</td>
<td>15</td>
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<tr>
<td>15:10-15:15</td>
<td>LEG STRETCH</td>
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<tr>
<td>15:15-15:30</td>
<td>Teach me in my language and I will understand</td>
<td>Silindile Mthembu, Unizulu Science Centre</td>
<td>15</td>
</tr>
<tr>
<td>15:30-15:45</td>
<td>Hope for the future</td>
<td>Nonhle Magudulela, ArcelorMittal Science Centre-Newcastle</td>
<td>15</td>
</tr>
<tr>
<td>15:45-16:00</td>
<td>Redefining Education</td>
<td>Zandile Nkopo, North West University Science Centre</td>
<td>15</td>
</tr>
<tr>
<td>16:00-16:15</td>
<td>The enhancement of mathematics and science education through innovative approaches – The case of the University of Johannesburg Soweto Science Centre</td>
<td>Patrick Monama, UJ, Soweto Science Centre</td>
<td>15</td>
</tr>
<tr>
<td>16:15-16:30</td>
<td>Science Centres and Youth Development</td>
<td>Alfred Hanyane, Sci-Bono Discovery Centre</td>
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<tr>
<td>16:30-16:45</td>
<td>Panel discussion, with questions from the audience</td>
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<tr>
<td>16:45-17:30</td>
<td>POSTER SESSION - see <a href="#">poster presentations</a></td>
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<tr>
<td>18:00-</td>
<td>Free evening</td>
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Wednesday 28th November 2018

“Education is the most powerful weapon which you can use to change the world.”
~ Nelson Mandela

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<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>08:00</td>
<td>Registration at Conference Venue</td>
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<tr>
<td>08:40</td>
<td>Session 4 (Chair : Eric Maluta)</td>
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<tr>
<td>08:40-08:55</td>
<td>Making Madiba proud through affording an informed decision making using career guidance.</td>
<td>Solly Simelane, Anglo-American Science Centre</td>
<td>15</td>
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<tr>
<td>08:55-09:10</td>
<td>The NSTF Share ’n Dare Programme.</td>
<td>Fulu Gelebe, National Science and Technology Forum (NSTF)</td>
<td>15</td>
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<tr>
<td>09:10-09:25</td>
<td>DigiGirlz are everywhere.</td>
<td>Nomusa Keninda , Mpumalanga ICT Club</td>
<td>15</td>
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<tr>
<td>09:25-09:45</td>
<td>Career Development Services Training.</td>
<td>Thembani Mabasa and Ditupa Fothane, Dept. of Higher Education &amp; Training Career Develop. Services</td>
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<tr>
<td>09:45-10:00</td>
<td>Questions to the Panel</td>
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<td>10:00-10:05</td>
<td>Housekeeping</td>
<td></td>
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<tr>
<td>10:05-10:30</td>
<td>Tea &amp; Poster Session</td>
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<td>10:30</td>
<td>Session 5 (Chair : Daniel Motsapi)</td>
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<td>10:30-10:45</td>
<td>Empowering our Youth through Financial Education</td>
<td>Old Mutual</td>
<td>15</td>
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<tr>
<td>10:45-11:00</td>
<td>SKA Science Centre in Carnarvon</td>
<td>Takalani Nemaungani Astronomy (SKA, AVN, SALT, HartRAO,etc)</td>
<td>15</td>
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<tr>
<td>10:45-11:10</td>
<td>Questions to the Panel</td>
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<tr>
<td>11:15</td>
<td>PARALELL SESSION A (Chair : Akash Dusrath)</td>
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<tr>
<td>11:15-11:30</td>
<td>Building Hope in Learners through collaborative Outreach</td>
<td>Norman Pillay, Sci-Bono Discovery Centre</td>
<td>15</td>
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<tr>
<td>11:30-11:40</td>
<td>Science on the move with Joburg City Parks and Zoo</td>
<td>Molie Moonyane, Johannesburg City Parks and Zoo</td>
<td>10</td>
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<tr>
<td>11:40-12:50</td>
<td>Is my outreach really reaching out?</td>
<td>Daniel Motsapi, ArcelorMittal Science Centre</td>
<td>15</td>
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<td>11:50</td>
<td>Public open spaces as interactive STEMi and Sustainability Learning</td>
<td>Sinah Magolo, Johannesburg City Parks and Zoo</td>
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<tr>
<td>12:00-12:15</td>
<td>Centres: The Case of Johannesburg City Parks and Zoo</td>
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<tr>
<td>12:00</td>
<td>When It’s Time To Say Goodbye – Letting go of a project</td>
<td>Meeloni Tanna, Sci-Enza, University of Pretoria</td>
<td>15</td>
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<tr>
<td>12:15</td>
<td>Inspiring Beacons of Hope for Our Future</td>
<td>Nadine Nortier, Incubeko Youth and Science Centre</td>
<td>15</td>
</tr>
<tr>
<td>12:30-12:45</td>
<td>Oops they’ve done it again - Umjikelezo We-Science - The saga continues...</td>
<td>Stephen Ashworth, Henri Benson, Nokwanda Cele, Celiwe Chauca, Kesigan Govender, Busiwe Gumede, Theshine Naidoo, Tanja Reinhardt, Charles Thethwayo and the Umjikelezo We-Science team</td>
<td>15</td>
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<tr>
<td>12:45-13:00</td>
<td>Questions &amp; Panel Discussion</td>
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<td>10</td>
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<tr>
<td>Time</td>
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<td>Speaker(s)</td>
<td>Mins</td>
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<tr>
<td>11:15-11:30</td>
<td>Piloting the Process of Evaluating Interactive Exhibits within the Science Centre Environment</td>
<td>Shadrack Mahapa and Silindokuhle Mbonane, Sci-Bono</td>
<td>15</td>
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<tr>
<td>11:30-11:45</td>
<td>How to monitor the learning progress of Science Centre visitors</td>
<td>Michael Wolf, Formula D interactive</td>
<td>15</td>
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<tr>
<td>11:45-12:00</td>
<td>Enhancing Critical thinking through Gardening for Wildlife</td>
<td>Armstrong Mashakeni, National Zoological Gardens</td>
<td>15</td>
</tr>
<tr>
<td>12:00-12:15</td>
<td>How is Uranium Related to Energy</td>
<td>Gilbert Lekwe, Nesca</td>
<td>15</td>
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<tr>
<td>12:15-12:30</td>
<td>Minerals for South Africa but its wealth for the other continents</td>
<td>Joseph Sibiya, Mondi Science, Career Guidance Centre</td>
<td>15</td>
</tr>
<tr>
<td>12:30-12:45</td>
<td>UK M Sc and RSA UCT Graduated Scientists for German Branded EnerKey R&amp;D PhD Thesis Collection of African Indigenous Knowledge Systems for Biodiversity Economy and Enterprises Development with Public Enterprises SOEs, Dst Agencies and SAASTEC Members</td>
<td>Gcinimuzi Jeremia Mafereka AFRIKA, GWoT</td>
<td>15</td>
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<tr>
<td>12:45-13:00</td>
<td>Questions &amp; Panel Discussion</td>
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<tr>
<td>13:00-14:00</td>
<td>Lunch</td>
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<tr>
<td>14:00-15:30</td>
<td>SAASTEC AGM (Voting year)</td>
<td>All</td>
<td>90</td>
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<tr>
<td>16:00-22:30</td>
<td>Afternoon / Evening Function @ Kalahari Waterfront (Nandoni Ha Budeli, Vhembe District)</td>
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Thursday 29th November 2018

“If you talk to a man in a language he understands, that goes to his head.
If you talk to him in his language, that goes to his heart.”
~ Nelson Mandela

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<th>Time</th>
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<tbody>
<tr>
<td>08:30-08:25</td>
<td>Session 7.1 (Chair : Puleng Tsie)</td>
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<tr>
<td>08:30-08:45</td>
<td>Shaping the future for the disadvantaged through Mechatronics.</td>
<td>Phathutshedzo Malivha, Sci-Bono Discovery Centre</td>
<td>15</td>
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<tr>
<td>08:45-09:00</td>
<td>A taste of the future: 3D printing technology as innovation tool to supplement teaching and learning of STEM.</td>
<td>Mncedi Rani, FOSST</td>
<td>15</td>
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<tr>
<td>09:00-09:15</td>
<td>ICT infrastructures in the Vhembe District Secondary Schools</td>
<td>Rodney Ramaru Rothiwa, University of Venda</td>
<td>15</td>
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<tr>
<td>09:15-09:30</td>
<td>Using Technology to Enhance Learning.</td>
<td>Themba Zwane, Mondi Science, Career Guidance &amp; FET Skills Centre</td>
<td>15</td>
</tr>
<tr>
<td>09:30-09:40</td>
<td>Encouraging Diversity and Social Inclusion: Piloting the possibility of developing a Blueprint for science centres</td>
<td>Mr. X Nameka, Sci-Bono Discovery Centre</td>
<td>15</td>
</tr>
<tr>
<td>09:40-09:55</td>
<td>Advancements of the Public Engagement with Astronomy through Project Management.</td>
<td>Niskelelo Malinga, UniZulu Science Centre</td>
<td>15</td>
</tr>
<tr>
<td>09:55-10:10</td>
<td>The World and Beyond.</td>
<td>Sithembile Meweli, Siphelele Bukhosini, Isibusiso Esihle Science Discovery Centre</td>
<td>15</td>
</tr>
<tr>
<td>10:10-10:25</td>
<td>Questions to the Panel</td>
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<td>15</td>
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PARALLEL SESSION B

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<th>Time</th>
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<tbody>
<tr>
<td>08:30-08:30</td>
<td>Session 7.2 (Chair : Ulrich Oberprieler)</td>
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<tr>
<td>08:30-08:45</td>
<td>Learning without limits (Engaging rural primary schools in science and technology).</td>
<td>Brian Ndavha, Giyani Science Centre</td>
<td>15</td>
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<tr>
<td>08:45-09:00</td>
<td>A call to recognize the importance of play based- learning in our science centres.</td>
<td>Innocentia Mabuza, Sci-Bono Discovery Centre</td>
<td>10</td>
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<tr>
<td>09:00-09:15</td>
<td>The Future is here: Industry 4.0</td>
<td>Akash Dusrath, Cape Town Science Centre</td>
<td>15</td>
</tr>
<tr>
<td>09:15-09:30</td>
<td>An Ignited Curiosity in Science, Then What? Taking a Talent Tracking Approach.</td>
<td>Raven Motsewabangwe, Inkcubeko Youth and Science Centre</td>
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</tr>
<tr>
<td>Time</td>
<td>Session</td>
<td>Presenter/Panelists</td>
<td>Venue/Location</td>
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<td>Robotics in STEMI Education.</td>
<td>Mzwandile Maphanga, ArcelorMittal Science Centre</td>
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<td>Thabang More and Shoneez Parsons, Sci-Enza, Univ. of Pretoria</td>
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**POSTER PRESENTATIONS**

(Prizes will be awarded for the best posters)

1. **The Great South African Invention: Post democracy.** Happy Vilakazi and Njabulo Duma, SAASTA
2. **Adding value.** Vuyolwethu Ngalo, Nelson Mandela Bay Science Centre
3. **The Importance of being an Entrepreneur.** Martins Mpotu, ArcelorMittal Science Centre (Sebokeng)
4. **Applications of Telecommunications in the 21st Century Science Centres to enhance Public Communication and Bridge the Barriers in Learning.** Zibusiso Nyoni, Sci-Bono Discovery Centre
5. **Greatest Discoveries made from simple observations.** Themba Ngubane, Siphelele Bukhosi, Isibusiso Esihle Science Centre
6. **Mathematics is an art, let learners be creative.** Daniel Motlapa, Khuliso Makungo, ArcelorMittal Science Centre
7. **Impacting communities through education.** Sci-Bono Outreach Team
8. **Making Mandela Proud by providing an inclusive Science, Technology, Engineering and Mathematics (STEM) learning to all.** Fulufhelo Khomola & Mary-Ann Makama, Sci-Bono Discovery Centre
9. **Knowledge sharing for capacity building.** Sakhiile Masango, ArcelorMittal Science Centre Newcastle
10. **Education is the only tool that we can use to transform the world.** Mangaliso Mathebula, Mondi Science, Career Guidance & FET Skills Centre
11. **The use of absorption metals to enhance photo catalytic applications.** Nqobile Sibeko, Mondi Science, Career Guidance & FET Skills Centre
12. **Science centres as learning centres: Lessons from the grassroots.** Vhonani Netshandama, University of Venda
13. **The Fourth Industrial Revolution: issues and implications for career research and practice.** Phe Sekele, Sci-Bono Discovery Centre
14. **Can Nano-materials be used to reduce CO\(_2\) emissions?** Sakhiile Nshangase, Mondi Science, Career Guidance & FET Skills Centre
15. **Hydrogen Storage for Stationary and utility Vehicles.** Suprice Mnisi, Mondi Science, Career Guidance & FET Skills Centre
16. **The Influence of Learners' Perceptions on Mathematics Performance: A Case of the Soweto Science Centre Learner Intervention Program Hosted by the University of Johannesburg in Gauteng, South Africa.** GKE Mosina, DSipuka, NMacheke, M January, S Nhlapo, Faculty of Science, Soweto SC, University of Johannesburg,
17. **Recycling of cell phones to save gorillas in the wild.** Boitumelo Moeketsi, National Zoological Garden of SA
18. **RHI—TRACKER.** Gumede Thandoh B, BSG Centre
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| 27  | Pathogenic Escherichia coli strains recovered from selected aquatic resources in the Eastern Cape, South Africa and its significance to public health. | Kingsley Ehi Ebornah, Martins Ajibade Adelisoye and Anthony Ifeanyi Okoh  
1 SAMRC Microbial Water Quality Monitoring Centre, Univ. of Fort Hare  
2 (AEMREG), Dept of Biochem & Microbiology, Univ. of Fort Hare |
| 28  | Making Science Fashionable                                            | R.M Ramohlale, N Mariba, K.E Mathebula, M.M Modiba, K.A.Molekoa, M.D. Ncha, Univ. Limpopo Science Centre |

“The greatest glory in living lies not in never falling, but in rising every time we fall.”
~ Nelson Mandela

Please travel home safely!
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National Science Week – Impact studies
Bafedile Kgwadi, Gugulethu Mtsweni & Joyce Khunou, SAASTA

The White Paper on Science and Technology (1996) seeks to build an effective National System of Innovation (NSI) that advances both social and economic development priorities of the country. The process towards an effective and successful NSI depends on among others, the participation of all South Africans, which in turn requires a society that understands and values science, technology and innovation (STI). In this context, the Department of Science and Technology (DST) established a national campaign to promote public awareness of, and engagement with STI. The primary goal of this campaign is to promote science and technology literacy, as well as their pivotal role in addressing issues affecting people (i.e. promoting the power of STI).

Initiatives that are part of the DST’s campaign to promote public awareness of, and engagement with science, technology, and innovation (STI) include the annual National Science Week (NSW).

NSW is an annual countrywide celebration of science, technology, engineering, mathematics and innovation (STEMI) led and funded by the DST, where various stakeholders, role players and interest groups collectively conduct activities that promote general awareness of the value of STEMI to people’s daily lives. Through this project, learners, educators and the public (the community at large) are targeted in order to expose them to the appreciation, value and impact of science, technology, engineering and mathematics (STEM) in their lives.

The NSW project has been implemented since 2000 up to date. Science centres are one of the stakeholders that have been implementing this project. Many people have been exposed and benefitted from the project, just as Madiba would have wanted, and more can still be done to make their lives even better through these centres.

The impact that the project has made has now been done and will be shared with the audience.

The talk will among others, will cover the following:

- Objectives of the NSW,
- basics of monitoring and evaluation,
- the definition of impact studies
- what impact studies desired to achieve
- what studies have been looked at to measure the impact of the NSW on publics.
- the different categories of publics
- the result of what publics are saying about the NSW as well as
- challenges that exist and challenges experienced
- opportunities that can be used.
Science engagement within Responsible Research and Innovation
Shadrack Mkansi, SAASTA

Around the globe, the concept of Responsible Research and Innovation (RRI) is increasingly important in research governance and funding. How this interacts with science communication is therefore very interesting to explore.

This paper will outline a major role played by a Horizon2020 funded RRI project called NUCLEUS (New Understanding of Communication, Learning and Engagement in Universities and Scientific Institutions) involving 24 partners from Africa, Asia and Europe. It will further share the achievements made that gave birth to a new funded project called RRING involving 22 partners from 6 continents with SAASTA being the African partner.

We will explore what ‘responsible science communication’ means to people, particularly in different countries and cultures. How do science centres play a role? For example around the showcasing of cutting-edge research with significant societal impact or in influencing behaviours or policies?

It will also share the outcome of world cafes ran in two international conferences on a manifesto for Responsible Science Engagement.
The Department of Science and Technology (DST), through the South African Agency for Science and Technology Advancement (SAASTA), a business unit of the National Research Foundation (NRF), has been supporting the science centre programmes and development since 2009. The support is through a funding framework named Programmatic Support Grant Intervention (PSGI). This support dates back to 2004 when DST established the funding facility to benefit both established and developing science centres in the country. In the implementation of the Youth into Science Strategy (YiSS), DST identified science centres as one of the best infrastructures they could use to deliver on the objectives of YiSS. Science centres use this funding for either programme focussed infrastructure development for their centres, or developing and implementing non-curricular and curriculum support programmes for learners, educators, and the public. The programme is relevant as it responds to one of the strategic objectives of the NRF Strategic Objectives 2020, two priorities of the DST Strategic Plan 2015-2020, and the four goals of the DST Science Engagement Strategy. I will speak about the success of PSGI, and highlight the five amazing ways we are making Madiba proud.
Ten year review of Sci-Enza NYS volunteer programme
Puleng Tsie, Sci-Enza, University of Pretoria

The introduction of the NYS programme to the science centres in 2008 changed the landscape of science centre's operations drastically. This paper takes an in depth look at how the programme impacted Sci-Enza for the past decade. It illustrates the success, challenges and future recommendations for both science centres and the Department of Science and Technology.
The establishment of the Southern African Association of Science and Technology Centres has offered an essential platform to coordinate efforts in science communication, foster collaboration, share knowledge and best practices and to extend science communication efforts. This is an introspection article that will look at what the membership of this network means, what are the network's challenges and what opportunities the network should consider to explore and implement.
Building Hope in Learners through collaborative Outreach

Norman Pillay, Sci-Bono Discovery Centre

Many communities are plagued by socio-economic challenges that result in learners becoming disinterested and disillusioned with schooling. Science Centres are in a position to assist in rectifying the above challenge by partnering with Non Profit Organisations (NPOs) in the community. The NPOs working in communities are ideal partners because they would already have established relationships with the communities.

Science Centre activities can be both formal and informal with the main objective of generating an interest in Mathematics and Science. The activities could include STEM exhibits, interactive shows and career guidance talks involving conversations providing direction on subject choice and career paths, and highlight the dangers of social ills plaguing the society such as drug and/or alcohol abuse, rape and child abuse.

A collaborative Outreach programme, at schools can assist in improving academic achievement, generating interest in Maths & Science and provide career guidance.

This paper will demonstrate how the Sci-Bono Outreach Team aligns itself to “Making Mandela Proud”
Science on the move with Johburg City Parks and Zoo
Molie Moonyane, Johannesburg City Parks and Zoo

This paper showcases the positive impact of Johannesburg City Parks and Zoo (JCPZ) Mobile Science Laboratory, which caters programmes within the city of Johannesburg. JCPZ has physical structures in the form of environmental education centres which are not able to be accessed by all, especially marginalised and economically challenged residents of the City of Johannesburg including schools. Due to this, JCPZ through Department of Science and Technology received a sponsorship of a mobile science Lab which not only increased accessibility of our programmes but also tremendously increased the number of beneficiaries JCPZ reaches in a year e.g. from 30 000 to envisaged 80 000. Subsidy of City of Johannesburg (CoJ) is limited not covering all schools in Johannesburg but with the mobile science lab JCPZ can reach more.

Therefore, the intention of the paper is to illustrate the value of the mobile unit and how its programmes increase awareness of Science, Technology, Engineering, Maths and Innovation (STEMI) in communities and schools.

Science is often hard to do in a school setting. It requires a lot of prohibitively expensive equipment and reagents that schools cannot afford. Some progress in science education has been made in the US, according to the 2015 National Assessment of Educational Progress (NAEP)—known as “The Nation’s Report Card”—only one third of students have the skills they will need to be adequately prepared for college-level science classes and for a career in STEM (Jones AL and Stapleton MK (2017)).
Is my outreach really reaching out?
Daniel Motsapi, ArcelorMittal Science Centre, Sebokeng

Science Centre programmes normally focus on 3 things, Awareness, Career and STEM support. How often do these include Social Skills development? This paper is more focused on developing social soft skills for our audience; it explores possibilities of linking soft skills with social knowledge that can contribute to personal development as well.

Although the focus is on what ArcelorMittal Science Centre Sebokeng is offering to the community, it also aims to look at how other centres have done this type of work and if its impact reaches out to socio-economic development.
Public open spaces as interactive STEMI and Sustainability Learning Centers: The Case of Johannesburg City Parks and Zoo

Sinah Magolo Johannesburg City Parks and Zoo

Some schools especially those in marginalized communities lack basic resources such as laboratories for experimental and/or scientific learning. Educators use text books to teach scientific concepts in an imaginary way. In some communities, science centers are inaccessible as center visits have unaffordable financial implications. Science centers are also often unable to transport each and every school or community for center based learning programmes with only communities closer to the science center having an added advantage. However, there are natural resources that are not fully utilized but provide opportunities of a pop up science center.

Open spaces such as parks, botanical gardens, water bodies, nature reserves etc. not only provide ample opportunities for learning about biodiversity and conservation issues but can enhance STEMI learning in a way that is exciting and interactive. Thus, people’s connection to nature is a mediating factor in our emotional response towards, and future stewardship of, the natural environment. As a result, developing connections to nature is an essential tool in developing conscientious, informed citizens who will tackle the upcoming environmental challenges we face nationally and globally. This engagement is not limited to a focus on environmental projects but can be used to teach a range of other curricula aligned educational programmes such as STEMI. This paper shares how JCPZ use the range of learning and engagement opportunities provided by open spaces for STEMI education and learning.
Oops they’ve done it again - Umjikelezo We-Science - The saga continues...

Stephen Ashworth, Henre Benson, Nokwanda Cele, Celiwe Chauca, Kesigan Govender, Busisiwe Gumede, Theshnie Naidoo, Tanja Reinhardt, Charles Thethwayo and the Umjikelezo We-Science team

Umjikelezo We-Science is the continuation of a joint project between CASME Science2Go, Durban Natural Science Museum (Go Wild), Kitchen Chemistry (University of East Anglia, UK), KZN Science Centre, STEC@UKZN Science 4U and the UNIZULU Science Centre.

The project aligns to the UNESCO and Sustainable Development Goals. It provides, on a small scale, quality education and reduced inequality, as we were visiting areas that are usually neglected in terms of science outreach. On a larger scale it demonstrates partnerships for the goal, as the Umjikelezo team again shows what one can achieve by working together.

In the past, there has been small scale collaboration amongst the participating organisations, but Umjikelezo We-Science fosters a real partnership with sharing organisation resources and manpower putting less pressure on the individual organisations.

In the presentation we will share our experiences with the second edition of Umjikelezo We-Science and highlight the growth of our programme. We have attracted additional stakeholder such as SASOL who donated a mobile lab to the project and Nautilus Engineering who sponsored an additional day.

Background

Umjikelezo We-Science is a collaboration among different institutions, namely the Centre for the Advancement of Science and Mathematics Education (CASME), Science2Go, the Durban Natural Science Museum (GO-WILD), the KZN Science Centre, the UKZN Science & Technology Education Centre (STEC@UKZN), the UNIZULU Science Centre and Kitchen Chemistry. The initial project started in 2017. Over 3 days Umjikelezo We Science visited schools in the Hammarsdale, Tongaat and Umbumbulu areas. We presented the project implementation (Umjikelezo We-Science project: A partnership to move outreach in KwaZulu-Natal to a new dimension) at the 19th SAASTEC Conference in Sebokeng.

The word Umjikelezo means circle in IsiZulu and draws on a cultural practice of church groups taking their message on the road to communities. In this spirit, Umjikelezo We-Science aims to take the message of Science to rural KwaZulu-Natal. One can view it as a mini traveling Science Festival.

The project is modelled after Dr Graham Walker’s Science Circus Africa, which is a pioneering science outreach project running in Southern Africa. The organisers aim to engage, inspire and promote Science, Technology, Engineering and Mathematics (STEM) throughout KZN using interactive exhibitions and dynamic science shows, to communities to which these science centres and their services are inaccessible.

Traditionally science centres and museums provide an “in-reach” service although the importance and necessity of “out-reach” is becoming increasingly recognised. KZN is home to one of the largest number of science centres, museums and other STEM public facilities in South Africa. The province was therefore uniquely placed to host this first-of-its-kind major collaboration, between local science centres, non-profit organisations and museums. The aim was to reach areas were learners are usually not exposed to science activities.
Implementation

As in 2017 we approached several organisations, e.g. SAASTA, for funding but were not able to secure any sponsorship for travelling to the schools. On the other hand we received a generous donation in form of a mobile science van through Sasol. The individual participating organisations therefore decided to self-fund and dedicate their time, human resources and outreach vehicles to the project. Kitchen Chemistry, through the University of East Anglia in the UK, funded the international flights for Dr Ashworth. A total of 25 staff members from the various organisations participated in the event. We therefore had to limit the number of days and travel distance (Fig.1). For a larger impact we agreed again to meet at a central place and then drive in convoy to the schools (Fig.2).

We had a few changes as compared to 2017. This year’s programme ran over 4 days instead of the 3 days in 2017. We also visited a school in the iLembe district, outside the border of the EThekwini area. And for the first time we visited a primary school. Experience from the previous year also showed that lunch and enough to drink is very important for the team spirit. The lunch on the first day was sponsored by Sasol. For the other days UKZN, Durban Natural Science Museum and Casme stepped in to sponsor lunch for the 25 team members.

Umjikelezo We-Science Programme Highlights

The Umjikelezo We-Science tour 2018 was marked with excitement, rewards and challenges. One of the highlights was the handover of the Sasol-Casme-Umjikelezo WeScience mobile lab at the Charles Hlengwa High School, a public state secondary school in Illovo on the first day (Fig.3). The Sasol-Casme-Umjikelezo We-Science van is the reward for last year’s Umjikelezo We-Science tour. Sasol recognised the value of the Umjikelezo We-Science collaboration in Science outreach and donated it to the project. The van is equipped with science experiments and will go out to schools to run CAPS related activities. Even though dedicated to the Umjikelezo project it will mainly be operated by Casme, who is paying for fuel, insurance and taxes.
The team usually meets at a central location to drive together to the schools. One of the challenges was that on the first day the UKZN - Science4U outreach vehicle reached the meeting point but would not start afterwards. Luckily there was enough space available in the other outreach vehicles and the content of the van including its passengers were distributed. The trip was further delayed by the closure of a bridge close to the school. The convoy had to take a detour and was further delayed. Not a good start for the handover. Through great teamwork we managed to set up a science fair within 15 minutes, even though we had lots of new people joining us.

At the schools each organization provided a busking table (Fig. 4). At these tables’ learners engaged in science on a personal level. Learners got involved with science experiments, for example checking on their reaction, mixing chemicals and seeing chemical reactions, Cartesian divers, balancing cans to name but a few of these activities. But they also were exposed to museum exhibits such as a preserved snake, a crocodile skull, and different kind of rocks, fossils and much more.

The visits were finished off with a science show performed by Dr. Stephen Ashworth from the UK based Kitchen Chemistry project. The Science Show uses the simple idea of demonstrating chemical concepts with materials found in the home. The goal of the Science Show was to transfer scientific knowledge and promote science literacy in a fun and interactive way. Because of the accessibility of the material used, learners were able to replicate the majority of the experiments at home or in school. A second science show on day 3 was performed by the KZN Science Centre.

For the higher grade learners we included a career talk into the programme, either presented by the University of KwaZulu-Natal, or by one of the industry partners (Sasol, Nautilus Engineering).
Conclusion
The 4 day event provided an opportunity for over 1200 learners from different parts of the eThekwini Municipality and iLemba districts to experience the excitement and wonders of science. This year’s Umjikelezo We-Science targeted learners from all Grades (grade 1 to 12). Through career talks the learners were able to learn more about careers in STEM fields. The aim of the project was to expose learners who usually have not an opportunity to visit museums and science centres to various STEMI fields, and to encourage an interest in Science and Mathematics and improve learner enrolment in Physical Sciences and Mathematics.

The project aligns to the UNESCO and Sustainable Development Goals, providing on a small-scale quality education, reduced inequality as we were visiting areas that usually are neglected in terms of science outreach, and on a larger scale partnerships for the goal.

The project draws on the wealth of expertise of partners. All of them have been in the business of science education for a very long time. Another advantage is that the partners come from various backgrounds, e.g. Higher Education Institutions, Science Centres, Teacher Development, and the Natural Science Museum.

In the past collaboration at small scale amongst participating organisation was present, but Umjikelezo We-Science fostered a real partnership with sharing organisational resources and manpower. Therefore, putting less pressure on the individual organisations. The consensus of the participating organisations was that it was the most relaxed project in which they had participated. Especially with the problems encountered this year, it showed that working in a big team provides great back-up in the event of difficulties.

The strategy of travelling in a convoy with all the very exciting looking cars proves a great drawing card for attention. When we travel through the rural parts we often have people staring, pointing in and waving.

Even though we don’t get to see 10000 people in 4 days, we are deliberately going to places that do not otherwise get exposed to these kind of events.
Understanding the use of pre- and post-tests in the grade 8 and 9 Natural Sciences teachers inMpumalanga province

Maria Catherine Kekana, Sipho Nhlanhla Dlamini, MST Academy

This paper reports a study about the effectiveness of the usage of pre- and post-test results to measure the impact of teacher trainings. Little has been reported about the effectiveness of the usage of the pre-and post-tests results to measure the impact of teacher trainings. The aim of this paper was to investigate the effectiveness of using pre- and post-test results to measure the impact of teacher trainings. The research question was: What is an extent at which pre- and post-testing measure the impact of teacher trainings? A pragmatic paradigm based on the integration of the positivistic and interpretive research paradigms, following the mixed method approach, was used to achieve the aim of this research. Consequently, data were analyzed both quantitatively and qualitatively by two researchers who are subject specialists.

Quantitative data analysis revealed that pre and post testing during teacher training do measure the impact of the workshops and the statistical data analysis provided sufficient evidence that the training had a positive impact on the Natural Sciences teachers. Qualitative data analysis revealed that it is not all the NS teachers who attended the Mathematics, Science and Technology (MST) Academy trainings who demonstrated that they learnt from the trainings. Secondly, some teachers were not willing to write the pre- and post-test even though they were not required to indicate their real names. Thirdly, observations were made that some teachers perpetually arrived in the training venue so late such that they were unable to write the pre-test. Therefore, the paper recommends that since pre- and post-testing can measure the impact of teacher trainings to a large extent, prolonged teacher trainings be initiated; the impact of teacher trainings be traced down to learners; post-testing be conducted months after the training as opposed to the last day of the training.
In response to the critical need to provide meaningful opportunities for the enhancement of mathematics and science education through pedagogic innovation, the University of Johannesburg Soweto Science Centre provides tuition to 600 – 800 learners and over 200 teachers annually in the same Mathematics and Science Stream dynamic environment. Learners attend intensive sessions on Fridays, Saturdays and during school recess. These sessions involve provision of tuition in Mathematics, Physical Science and Life Sciences as key content knowledge areas. In addition, the sessions make provision for the performance of laboratory practical work. Teachers are trained two Fridays a month as well as during school recess. Over a number of years, substantial number of learners from schools involved with the key activities of the Soweto Science Centre showed improved performance with regard to the National Senior Examination results in terms of the content knowledge areas specified. This improvement in learner performance augers well for the meaningful consolidation of the key activities of the Soweto Science Centre through the adoption of innovative approaches.
The importance of using Science language in teaching Science subjects

Tracy Singo (MSc, Assessor, Facilitator)

Language plays a crucial role in the formation and development of concepts. This implies that a teacher’s language in a science classroom is very important in teaching science and creating the conditions for meaningful teaching and learning. If science language is taught from lower levels, this will help learners to familiarize themselves with science concepts and terminologies from early age. One of the barriers in learning science is the understanding of the science language when it is being taught in class at any level. Learners find it difficult to understand the new science concepts. Research involving a wide range of educators in a number of countries has consistently found that teachers do most of the talking in the classrooms than learners, as a result learners do not get opportunity to practice science language in classroom and worst when they are out of school. This creates negativity towards science.

Effective teaching and learning in science requires science language, whether it is written in the text books or communicated orally during classroom discussions. Science language is also necessary while doing practical work or in the laboratory as some concepts used during practical’s are hardly used in the classroom. This will increase science vocabulary in learners thereby increasing the motivation to take science as a career. Teachers must explain what they are doing and learners need to ask questions to be clarified in order to understand the materials well.

The general assumption among teachers is that all learning follows through smoothly once learners have attained some proficiency in the language of learning and teaching. But this does not imply that everyone who is proficient in the science language of teaching and learning will excel in science but will make learners to realize that science is best understood when science language is used to communicate science.
Impact of e-Learning on academic performance: A case study of Grade 12 Physical Sciences learners in secondary schools

Ngoako Norman Moshokoa, Palabora Foundation

Since its inception, Palabora Foundation focused on education, training and empowerment as cornerstones of sustainable development of communities within 50km radius of Phalaborwa. The Foundation has established e-learning programme to three secondary schools in the surrounding villages of Phalaborwa. The purpose of this study was to investigate the impact of e-learning on the academic performance of Grade 12 learners in Physical Sciences. All three secondary schools participated in this study. Quasi-experimental design was used and a survey questionnaire was distributed to three science teachers and fifty-two learners. This study was guided by the following main research question: What is the impact of e-learning on the academic performance of learners in Physical Sciences?

The study sought to contribute in increasing participation and performance in Physical Sciences. The study is also intended to increase the number of learners taking up careers in areas of Science, Engineering and Technology (SET). The study was based on two groups of learners, namely; those who participate in e-Learning programme and those who do not participate. The questionnaires for teachers and learners’ were adopted. The question paper was designed by the Department of Education as Trial examination paper. The Grade 12 science teachers were responsible for marking learners’ scripts. The scripts and marks were submitted to the researcher for analysis. Data was analysed quantitatively using the Chi-Square and Anova data research analysis.

**Keywords:** E-learning, E-Education system, impact of E-Learning in education, learning resources

1. **INTRODUCTION**
   The concept e-learning refers to the use of modern technology in the field of teaching and learning. The information and communication technologies (ICT) provide the opportunities and enhance teaching and learning for individuals and organisations (Ala-Mutka, Punie and Redecker, 2008). E-learning includes various electronic media in the field of science education. It includes the use of advanced technology of information communication in the teaching and learning process which involves electronic media (Prucha, 2003). It includes various types of media that provide audio, video, text, and images. E-learning utilizes communication and information technology. E-learning uses the internet which widens the traditional methods of learning science. Naidu, (2006) alluded that e-learning is cheaper than traditional teaching and learning methods because it does not involve the use of paper and pencil. Nady further adds that e-learning can be implemented at any place and anywhere, it is not limited to the number of learners and it saves a lot of time. E-learning is also flexible because it can be conducted anywhere without strict time constraint, which leads to a more flexible environment for various students in various subjects. It also assists the learners to obtain their own requirements of learning (Naidu, 2006). The purpose of the current study is to investigate the impact of e-learning on the performance of learners in physical Sciences.

2. **LITERATURE REVIEW**
One of the strategies of promoting effective learning of Physical Science is e-Learning. The concept “E-learning” refers to the intentional use of networked information and communications technology (ICT) in teaching and learning (Naidu, 2006). E-Learning identifies various types of computer-aided learning, usually using modern technological means; CD-ROM. Prucha, 2003 suggested that e-learning is expanding especially in the sphere of distance education and corporate training. E-learning is also understood as an educational process, using information and communication technologies to create training, to distribute learning content, communication between learners and teachers and for management of studies (Wagner, 2005).

In simple terms e-Learning is the application of electronic systems such as internet, computers, multimedia CDs in order to improve learning. There are many advantages of e-learning. According to Naidu (2006), the major advantage of e-Learning is that it is learner-centred teaching process where the teacher is responsible for facilitating the learning process. E-Learning is very fast and dynamic and reduces the amount of expenses because it can be done by the learners at any place and at any time. E-Learning is also comprehensive learning because the lessons are prepared by different professors from different places. All the activities of e-learning such as enrolment, supervision, tuition are done by internet and learners can learn more than one major. The main disadvantage of e-Learning is that it reduces face to face interaction with the teachers and other learners.

Many studies were conducted about e-Learning. According to Keller and Suzuki (2004), e-Learning enhances instruction and reduces drop-out rates in schools. A study conducted by Zare et al. (2015) revealed that e-Learning motivates learners to learn effectively. The learners who are taught by e-learning are more intrinsically motivated than students who go to traditional classroom. A study by Keshavarz et al. (2013) indicates that e-Learning does not decrease the time of teaching but encourages more active learning, moreover a better understanding of technology for students to proceed with their own ability. According to studies, e-learning has a positive impact on academic achievement of learners (Zeying, Yinglei and Nicole (2008); Keshavarz, Rahimi, and Esmaili (2013).

3. HYPOTHESIS
The e-learning programme has a strong impact on learner performance in Physical Sciences.

4. RESEARCH METHODOLOGY

4.1 Research method
Research methodology refers to a model to conduct a research within the context of a particular paradigm (Wahyuni, 2012). A positivistic paradigm, descriptive research design and quantitative approach were used to determine the impact of e-learning on the academic performance of the learners. Positivists believe that different researchers observing the same factual problem will generate a similar result by carefully using statistical tests and applying a similar research process in investigating a large sample (Creswell, 2014). According to Babbie (2014), studies aimed at quantifying relationships are of two types, namely; descriptive and experimental. In descriptive study,
no attempt is made to change behaviour or conditions – the researcher measures things as they are. A quantitative approach is a formal, objective and systematic process in which numerical data are used to obtain information about the phenomenon under investigation (Van Rensburg, 2010).

4.2 Population and sample

The statistical population of the study was 115 learners who study Physical Science in the three selected schools of Namakgale and Lulekani Circuits, Mopani District, Limpopo Province. A sample of this study consisted of 104 learners (52 learners who participated in the e-learning programme and 52 learners who did not participate in the programme).

4.3 Instruments

In this study, the questionnaires and Physical Science test were used to collect data. All the questions were based on the following main research question: *What impact did the e-learning programme have on learner performance in Physical Sciences?* Structured questionnaires were administered to 3 physical science teachers and 104 Physical Science learners from three schools. The teachers were asked to indicate their perceptions on the effectiveness of e-learning for student learning using Likert type closed-ended questions and a four-point rating scale: 1-Strongly Agree (SA), 2-Agree (A), 4-Disagree (D), and 5-Strongly Disagree (SD).

5. RESULT, DATA ANALYSIS AND DISCUSSION

Data from questionnaires and Physical Science test were captured and analysed quantitatively. The following section presents the findings of the study. The data analysis of teachers’ and learners’ questionnaires revealed the following findings:

5.1 Teachers’ perceptions

1-Strongly Agree (SA), 2-Agree (A), 4-Disagree (D), and 5-Strongly Disagree (SD).

<table>
<thead>
<tr>
<th>Item</th>
<th>SA</th>
<th>A</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers feel confident learning new computer skills.</td>
<td>66.7%</td>
<td>33.3%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Teachers find it easier to teach by using e-learning</td>
<td>83.3%</td>
<td>16.7%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>E-learning offers great opportunities for effective teaching.</td>
<td>83.3%</td>
<td>16.7%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>E-learning support teaching and makes learning more effective.</td>
<td>66.7%</td>
<td>33.3%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>I have more time to cater to students’ needs if E-learning is used in teaching.</td>
<td>83.3%</td>
<td>16.7%</td>
<td>0%</td>
<td>0%</td>
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</tbody>
</table>
The use of e-learning helps teachers to improve teaching with more updated materials.  

<table>
<thead>
<tr>
<th>Item</th>
<th>SA</th>
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<th>SD</th>
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</thead>
<tbody>
<tr>
<td>The use of e-learning enables the students’ to be more active and engaging in the lesson.</td>
<td>66.7%</td>
<td>33.3%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>E-learning helps to prepare teaching resources and materials.</td>
<td>83.3%</td>
<td>16.7%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

5.2 Learners’ perspectives

<table>
<thead>
<tr>
<th>Item</th>
<th>SA</th>
<th>A</th>
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<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-learning encourages students to communicate more with their classmates.</td>
<td>54.4%</td>
<td>36.9</td>
<td>8.7%</td>
<td>0%</td>
</tr>
<tr>
<td>E-learning promotes active and engaging lesson for students’ best learning experience.</td>
<td>39.1 %</td>
<td>52.2%</td>
<td>8.7%</td>
<td>0%</td>
</tr>
<tr>
<td>The use of e-learning helps students to find related knowledge and information for learning.</td>
<td>45.7%</td>
<td>47.8%</td>
<td>6.5%</td>
<td>0%</td>
</tr>
<tr>
<td>E-learning enables students’ to express their ideas and thoughts better.</td>
<td>41.4%</td>
<td>54.3%</td>
<td>4.3%</td>
<td>0%</td>
</tr>
<tr>
<td>The students’ are more behaved and under control.</td>
<td>32.6%</td>
<td>65.2%</td>
<td>2.2%</td>
<td>0%</td>
</tr>
<tr>
<td>E-learning increases students’ confidence to participate actively in the class.</td>
<td>41.4%</td>
<td>54.3%</td>
<td>4.3%</td>
<td>0%</td>
</tr>
<tr>
<td>Students learn more effectively with use of e-learning</td>
<td>23.9%</td>
<td>60.9%</td>
<td>15.2%</td>
<td>0%</td>
</tr>
<tr>
<td>E-learning helps to broaden students’ knowledge paradigm.</td>
<td>43.5%</td>
<td>45.7%</td>
<td>10.8%</td>
<td>0%</td>
</tr>
<tr>
<td>E-learning improves students’ ability specifically in reading, follow instructions and writing.</td>
<td>36.9%</td>
<td>63.1%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
E-learning allows students’ to be more creative and imaginative

56.5%  39.2%  4.3%  0%

5.3 Test results
A t-Test was calculated to determine if there is any significant difference between the performance of learners who attend e-learning classes and those who do not attend. The results were interpreted by comparing the means and by using the t-test at P < 0.05, level of significance.

The following results were obtained:

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<tbody>
<tr>
<td>∑x</td>
<td>∑x²</td>
<td>∑x₁</td>
<td>∑x₂</td>
</tr>
<tr>
<td>2278</td>
<td>5189284</td>
<td>99793.9</td>
<td>82083.8</td>
</tr>
<tr>
<td>n=52</td>
<td>n=52</td>
<td>n=52</td>
<td>n=52</td>
</tr>
<tr>
<td>x₁=43.8</td>
<td>x₁=99793.9</td>
<td>x₂=32.8</td>
<td>x₂=82083.8</td>
</tr>
</tbody>
</table>

\[ t = \frac{x_1 - x_2}{s} = \frac{2278 - 1706}{572} \]

6. CONCLUSION AND RECOMMENDATIONS
The availability of e-learning provides teachers and managers the opportunity to undertake educational improvements and effectiveness of an education system. E-learning also has been shown to support problem solving, critical learning and creative learning. Managers should seriously consider ways of integrating the use of ICT in education. According to the above findings, there is significant difference between the performance of learners who attend e-Learning classes and the learners who do not attend. It is therefore recommended that E-Learning be introduced in all the schools of the Lulekani and Namakgale Circuits in Ba-Phalaborwa Municipality. It is also recommended that the Limpopo Department of Education establish e-learning in all the schools particularly the secondary schools in the province.

7. REFERENCES


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Curbing demotivation
Busisiwe Hadebe and Matsobane Mapheto, Sci-Enza, University of Pretoria

In celebration of the ‘100 years of Mandela’, Sci-Enza took the opportunity to interrogate ‘Mandela’s Legacy’ with the Mae Jemison learners. The aim was to find out ‘what learners understood about the ‘value of education’, what education means to them and what they feel is the role of science in their lives’. This study targeted high school learners mainly because they have the potential to be change makers within their communities. This paper looks challenges that learners face within their school environment and how that affects them, their learning and community.

Introduction

It is a well-known fact that as a nation, we still face a lot of illiteracy and inadequacy in the Math and Science fields. This is attributable to a couple of factors from historical to socio-economic factors. This simply exposes the challenges that we still face as a country with these subjects. Worthy of noting is the negative attitude that learners project towards Math and Science. It has thus been the intention of the education fraternity as a whole, from classrooms to science centres to counteract and curb the demotivation factor that hinders learning spaces.

In celebration of Mandela’s centenary, and as part of the initiatives Sci-Enza was involved in during Mandela month, Sci-Enza visited the Mae Jemison Reading Room learners, as part of a continuous collaboration commitment, to probe the learners on what their understanding was of the value of education and the role of science in their lives. This was in part influenced by a debate Sci-Enza had in the previous year titled “The Sci-Enza big debate”, which was a discussion among science communicators aimed at finding solutions to the demotivation factors that affect both the learners and educators during their visits to Sci-Enza.

The aim of the study was to interrogate the challenges they are facing within and outside their schooling environment, and how that affects their learning. This also afforded us as science communicators the opportunity of finding out the root of the demotivation factor(s) that we are experiencing with the learners during their visits at our science centre.

Mae Jemison Reading Room learning space is an initiative by the United States Embassy, aimed at exposing learners to gaining knowledge in Math and Science. It is located in a township northeast of Pretoria, at the University of Pretoria Mamelodi campus. It comprises of learners from different high schools neighbouring the Reading Room within the township, providing a diversity of young and fresh minds from the community at large. The Mae Jemison Reading Room is set up to help learners with educational needs, through providing resources (books, computers, and tutors), closing the of lack of resource gap within the community and thus curbing the demotivation factor that exists.
1. Challenges faced by science communicators that prompted the study.

As a science centre, we pride ourselves in enhancing science and technology education while raising awareness on the importance of engagement in science and technology. We do this through performing science shows, giving informative and hands-on workshops, as well as facilitating the interaction of our visitors with exhibits.

Despite our efforts to get the learners engaged, we have, on several occasions, experienced situations where learners showed disinterest or unwillingness to engage with the activities we offer. It is often the teachers that are enthusiastic about the programmes that we offer at Sci-Enza, thus bringing their learners to the centre in hopes of inspiring and motivating them in science. However, in some cases it is the learners that are enthusiastic and not the teachers. In some instances, we have had teachers drop the learners off in the centre and disappear for the duration of the programme.

It is disheartening to us as science communicators to be confronted by an attitude showing unwillingness to participate and it can demotivate whoever is performing or facilitating the science. As a result, we took the initiative to investigate the root cause of this attitude by having an informative session with the Mae Jemison learners.

We saw the Mae Jemison Reading Room as a perfect platform to engage and gain the perspective of learners across varying high schools in a form of a debate. The debate provided us with a deeper and thorough understanding of the challenges the learners are facing, which is ultimately the driving force behind this demotivation factor experienced by us as science communicators.

2. The value of education through the learner’s eyes.

While initiatives such as winter and Saturday schools focus on assisting learners to pass their senior certificate examinations, they merely help individuals and thus do not improve the education system (Kriek and Grayson, 2009). While initiatives such as extra classes and tutors exist at Mae Jemison Reading Room, a discussion with the learners revealed underlying issues that were not apparent to their educators. Learners expressed that they were uncertain of the relevance of their subjects to their career path and their position within the education system.

- A stepping-stone towards a brighter future.
  It was refreshing to see that majority of the Mae Jemison learners understood the importance of basic education. They see education as the foundation to build on and a tool they can use to advance towards their destined careers.

3. The value of Science through the learners’ eyes.

- Subject content relevance and “Our place” within the education system.
  Some learners in the debate expressed concerns regarding the usefulness of their subject to their career path. According to them, there was no correlation of what they were learning and
what they wanted to do with their lives. One learner gave an example that they want to be a fashion designer and posed a question that "how is Math and Physics going to help me become a skilled designer?"

We were able to deduce from the debate that most learners found Math and Science as challenging subjects and saw them as hurdles they have to get over. As such, many learners resorted to cramming the subject content for the sake of passing tests and exams without necessarily comprehending fully what the content entails. This shows that some learners do not understand their place within the education system and cannot readily identify the usefulness of their current subject matter to the bigger picture; their career paths.

- **There is Hope for the future.**
  With that said, most learners at Mae Jemison already understand the importance of science in the world in general, and can identify the fields in which science is most important. Some have already identified themselves as potential game changers and see the importance of gaining a thorough knowledge in science in order to make an impact in those fields.

4. **Challenges faced by the learners and teachers in the school environment.**

- **Learners**
  Although this paper is focusing on high school learners, it does not exclude the challenges that learners face from as early as foundation phase.

  **Curriculum content**
  Some learners also expressed that some of the demotivating factors arise from not understanding content matter discussed in class. In some cases, learners are even reluctant to raising their hands in class in fear of being ridiculed or mocked.

  **Hunger and Poverty.**
  Hunger and poverty are a major problem, hindering learners from being productive at school. This unproductiveness can be perceived as lack of interest when it is actually cognitive impairments due to hunger and poverty. The situation is at times so unfortunate that some learners only have access to food at school through government feeding schemes. However, this is sometimes not sufficient, because some learners can go the whole weekend without having a meal, having had their last meal at school.

  This had led to private organisations and stakeholders intervening to create a breakfast feeding scheme. The school feeding schemes are stretched to packing extra food for learners so that they can take them home for the rest of their families. It is truly heart breaking to see a learner in a grade
as low as grade 2 being the source of food in the family.

Social-family responsibility.
There are learners that have heavy family responsibilities, taking care of their siblings and bedridden parents without the help of extended families. These unfortunate situations contribute to the demotivation in learners towards education. Such situations force learners to choose between continuing with their studies under these hardships and finding work to support the family.

Peer pressure and Bullying
A considerable amount of learners mentioned that peer pressure was one of the factors that have led to their demotivation towards learning. Peer pressure can also take the form of learners forcing others, directly or indirectly into situations that they are not comfortable with such as dating or going to parties. Studies have shown that boys are more prone to this kind of pressure, although girls are not excluded from it. Other forms of peer pressure result in learners not having interest or participating in school activities. This is because some learners exude a rebellious behaviour toward schoolwork and teachers as something “cool”.

Bullying is another major contributor to demotivation as learners describe it as a big problem, especially in high school. Bullying is defined by Olweus (2010) as “A student is being victimised when he or she is exposed, repeatedly and over time, to negative actions on the part of one or more other students.” The learners expressed that both girls and boys experience bullying, although it takes different forms, either physical, emotional, or both. This also has a ripple effect, as it tends to affect the self-confidence of the learners as well.

Teachers

Educators play a vital role in the education system. As such, they are pivotal in the advancing of the education fraternity. Studies have shown that the challenge that this country is facing regarding Math and Science is multifactorial influenced. Among the critical factors lies the attitude of teachers and limited knowledge of the content, ineffective teaching approaches, and general unprofessional attitudes.

We thus saw it fitting to get their opinions through interviews, about how learner behaviour affects them and the learning space in general.

It is worth noting that demotivation does not only have its clutches on learners but on teachers as well. Teachers have many factors contributing to their demotivation, other than administrative issues such as low salaries with ever-increasing workload, lack of resources, poor working conditions etc. The worst demotivating factor is the subjection to ridicule and disrespect by the learners.
In a paper by Kriek and Grayson (2009), Math and Science teachers’ content and teaching approaches were investigated through evaluations over a four-year period, using a guide that incorporated assignments, workshops, reflective journals, peer support, and a science kit. Results showed that a substantial number of teachers did not or had sections of the curriculum which they did not understand, and as a result tend to omit these sections when teaching. This also affected their attitude and confidence when teaching these concepts.

Results also revealed that approximately 60% of the teachers involved in the study reported an increase in understanding of the content, which ultimately revived their interests for the subjects (Kriek and Grayson, 2009). Workshops and peer support were also some of the tools that were useful in the understanding of the content. The science tool kit afforded the teachers with a thorough understanding of the concepts and assisted in situations where the laboratories were unavailable. This tool has exposed the dire need of an addition of the professional development component of teaching, which is critical to the attitude and understanding of Math and Science among learners.

Additionally we found that the attitude of teachers that have been in the system longer discourages some teachers, especially the motivated new ones. Teachers that come from a science communication background also experience this. This has a ripple effect in that this attitude affects the effort of the newer teachers, who inevitably exhibit to the learners.

**Sci-Enza’s proposed solutions**

It is evident that socio-economic factors hinder the advancement of Math and Science in the country. However, as science centres, we are obligated to inspire and encourage learners to become change makers and problem solvers for the betterment of our countries’ socio-economic factors and to benefit future generations and ultimately be world changers.

Below are solutions that the Sci-Enza team recommended and implemented to curb demotivation and ensure the engagement of the visitors in the programmes we offer.

- Incorporating the different styles of learning: visual, aural, verbal, logical, social, and solitary, in our science shows, workshops, and facilitation of exhibits. For example, getting learners involved through using props when explaining concepts in a workshop or science show.
- Relating science concepts to everyday life examples that learners are familiar with, to give them a ‘Wow’ to ‘AHA’ moment.
- Having a bag of tricks to capture the attention of the learners that get distracted from time to time.
- Getting the teachers invested in the programmes just as much as the learners are, through involving them in experiments.
- Assisting the teachers expand on the content knowledge by offering training to prospective teachers (B.Ed.) in the training phase, to introduce to them to unconventional methods of
teaching that are interactive and exciting to the learners aimed at removing the stigma of difficulty that surrounds these subjects.

- Developing workshops that afford the learners the opportunity to have input on the subject matter, express creativity and enhance their problem solving skills.

Conclusion

Sci-Enza understands that curbing the demotivation that surrounds learning spaces is not a solitary effort and thus includes efforts from the education fraternity and society as a whole. While raising science awareness we aim to ensure the understanding science and how it relates to everyday experiences. A visit to Sci-Enza is not only about getting the numbers, but most importantly, it is about how much information we can saturate the learners during our interaction with them both in the centre and on outreach programmes. It is absolutely vital that we know our audience and keep on re-evaluating our programmes to ensure that they remain relevant and impactful.

As a science centre and ambassadors of Math and Science, we aim to curb this demotivation one child at a time by ensuring that each visit to Sci-Enza is a memorable one filled with positivity, enthusiasm, and motivation for Math and Science.

References


What South Africa needs to do to improve mathematics and science?
Xolani Cosmos Thikazi, ArcelorMittal Science Centre, Sebokeng.

South Africa has millions of unemployed youth and very high percentage of unemployed graduates. The question is what can be done to overturn the situation? One of the solutions is to have the nation that is ready with the new invention of technology. This may be achieved with society that has good mathematicians and scientists.

This document discusses what the countries which occupy the top half ranking table of mathematics and science have done to improve their mathematics and science.
Be the change you want to see
Patrick Zondo, Siphesihle Bukhosini, Themba Ngubane, Isibusiso Esihle Science Discovery Centre

The center focuses on three main pillars namely: Astronomy, Critical thinking and Environment focusing on Early Childhood Development, Library and Career Guidance. Though the Centre has three main pillars in this work will focus on the Environmental pillar and sub theme Early Childhood Development.

With the little resources available in the village and the environmental calendar being our guide. In collaboration with a number of role players in the field of the environment the walk started in February recreating wetlands with the scientist on the World Wetland day, in April ending plastic pollution on the Earth Day, digging soil with the SASSO in June, planting trees in September during the Arbour Day. Reading books with the children 3 times a week increasing the potential of learners to read and enjoy reading.

Through these events the centre has been able to reach the local community with the importance of the environment in which we have our being. The centre plays a critical role in involving the local community irrespective of age group to be engaging in activities that serve to educate and improves ones understanding regarding the local environment.

Being proud of the community in the village engaging on issues pertaining to their environment, being proud of children reading and enjoying it. Being the change we want to see!!!
Mouth, hands and feet that bring science to the community
Siphesihle Bukhosini, Isibusiso Esihle Science Discovery Centre

Education is key in developing a sustainable, economical active community. Science centres have become an important vehicle to bringing education to communities from all age groups. For this to be sustainable the programs offered by the science centre communities have to be robust, community specific and guided by the needs of the community being serviced. To make these programs effective, enthusiastic and committed individuals are key.

DST/SAASTA have made this a possible task for us, providing us with enthusiastic, learned people every year to make our mandate achievable, without whom education cannot be brought to our society.

These feet, hands and mouths are not without challenges however their presence is much appreciated.
Silindile Mthembu, Unizulu Science Centre

As Nelson Mandela said “If you talk to someone in a language they understand, that goes to the person’s head, but if you talk to somebody in their language, that goes to the heart”. South Africa’s appalling results in TIMSS and PIRLS prove this to be true (a brief summary of these will be presented).

Imagine sitting in a dusty-smelling classroom at a rural school, a science teacher in front of you writes an equation on the blackboard. You sit there focusing carefully on the English words the teacher is using, pens scratching as the 60-plus other people in class write. You are trying to take notes, but you don't understand what they mean and soon get lost.

You haven't encountered "acceleration" or "vector" before. Not wanting to look stupid, you keep quiet and don’t ask what they mean. You know as soon as the attention of the crowd focuses on you, you won’t be able to find the words to ask; your second-language English will let you down.

The supremacy of English has been highlighted as a reason for SA’s dismal science performance, especially to those pupils whose first language is not English. Observing this from learners that visit Unizulu, we then decided to find ways to help learners understand difficult science concepts even better. Teaching in a language they understand is one of them.

A study was conducted where a science show was presented to learners in English and IsiZulu (pupils’ first language). This paper will look deeply at the study and the results will be discussed extensively.
The Tragedy of the Commons
Ulrich Oberprieler, National Zoological Gardens

This interactive session delves into the way people think and how these thought processes affect the outcome that we, as educators, would like to achieve through our education programmes. Please come and join me for this thought-provoking session - you may even win a prize!
As Madiba would say, “Education is the most powerful weapon which you can use to change the world.” That is exactly what the Science Film Festival aims to achieve. The Science Film Festival is a celebration of science communication in Southeast Asia, Africa and the Middle East, which is run and funded by the Goethe Institute. It invites visitors to enjoy the best in international science communication and to explore various themes in science with this year’s theme being THE FOOD REVOLUTION. In cooperation with local partners, it promotes science literacy and facilitates awareness of contemporary scientific, technological and environmental issues through international films with accompanying educational activities. The Unizulu Science Centre has partnered with the Goethe Institute and has run the first Science Film Festival in 2017. This year the UNIZULU Science Centre was invited to be part of the activities workshop panel, which took place in Bangkok, Thailand.

This paper will outline the different ways in which different regions around the world run their Science Film Festivals and how the different countries & institutions collaborate successfully in preparing the activities for the films.
Hope for the future

Nonhle Magudulela, Arcelomittal Science Centre-Newcastle

Children are the foundation of a strong and dynamic nation. They need love, to be trusted, to play and have fun, to make mistakes and be told it is okay and encouraged to try again.

Rocking Readers Club provides a conducive and safe environment for children to explore themselves and inculcate in their young minds a sense of values, self-worth, discipline, dedication, commitment and lifelong learning.
Redefining Education
Zandile Nkopo, North West University Science Centre

Education is often defined as a process of learning which is one dimensional and boring to those who have access to it. It is however a dream to those who are out of reach. If used correctly it can empower and inspire many. Education comes in many forms, it is not just grades or a degree. It is nurturing one’s strengths, listening and tapping into your inquisitiveness. The North West University Science Centre focuses on attributes such as attitude, hard work, determination and dedication. One of the most important attributes of education is attitude as it can make or break you. Like a flat tire, you cannot go anywhere with a negative attitude. Changing the way we respond to new and foreign situations by making the learning environment fun and less formal is one way of helping learners and students change their attitudes towards science education. The main question we are to ask ourselves is what education is and what it means to us.
Creating intergenerational Learning and Innovation spaces in selected communities: A collaborative between the elders, schools, Dzomo la Mupo (CBO) and a University in Venda

Mphatheleni Makaulule and Vhonani Netshandama, University of Venda

The ecological calendar mapping process has been developed by the Columbia Amazon indigenous people from South America as a tool for intergenerational indigenous knowledge transfer and documenting the knowledge from local community knowledge holders. This process was initiated out of concern of destruction of nature, lack of spaces of intergenerational knowledge exchange and lack of appreciation of the indigenous knowledge practices by younger generation. Using community ecological dialogue between elders and school learners, which include the mapping the ecological calendars, we undertook to initiate several platforms for knowledge and skills exchange. Gaia Amazonas in collaboration with Dzomo la Mupo, a community based organisation in Venda did the initial training with key community participants and knowledgeable elders from Venda communities. This paper discusses the origin of the ecological calendar, its significance, processes, methods and tools used to educate school learners in Vhembe to produce an ecological calendar for their community. In addition, it will show how intergenerational learning platforms contribute to learner motivation to learn about science and vice versa. We will conclude by outlining the areas of reflections regarding the role that science centres might play in accommodating these kinds of initiatives
Communicating malaria information through the use of modern, innovative tools to raise awareness and promote good health and well-being

Taneshka Kruger, Christiaan de Jager, University of Pretoria Institute for Sustainable Malaria Control (UP ISMC), School of Health

Malaria decreases a country’s socio-economic growth by up to 25%. A significant portion of the annual income of poor households is spent on malaria in terms of prevention, treatment and loss of productivity. Effective communication is critical within any public health system to encourage disease prevention. Rural populations have limited access to modern technology and encounter obstacles to obtain health information. This is true for the African continent, but the tide may be turning. In 2016 the number of smartphone connections in Africa had reached 226 million, and this may increase by a further 500 million by 2020. Information technologies are transforming health promotion strategies. Social media platforms are being used across the health sector to incorporate new strategies to deliver care. This interactive platform is connecting large audiences with regards to information sharing, communication, knowledge creation and understanding, and an earnest collaborative effort towards action on priority health issues. The WHO and UN’s Sustainable Development Goals (SDGs) proposes that malaria cases and death rates will be reduced by at least 90% and that malaria will be eliminated in 35 countries by the year 2030. However, the disease presents an ongoing challenge that requires a combination of intervention methods to reach elimination. The University of Pretoria Institute for Sustainable Malaria Control (UP ISMC) contributes towards the malaria elimination agenda through high quality, trans-disciplinary research, and novel innovation. The UP ISMC focuses on the Vhembe District for most of its malaria research. Malaria awareness and prevention is promoted by communicating scientific research to the public and affected communities through formal, informal and more innovative methods. The Institute is using social media (Facebook and Twitter) to communicate malaria-related news to its researchers, stakeholders and the public on a daily basis, after recommendations reported in a communication strategy study. Innovative control and modern communication tools inform malaria prevention so people can avoid contracting malaria. The ‘Malaria Buddy’ App is such a tool and is available free of charge. These platforms hold scope for communicating to vulnerable, rural communities. Communities informed about malaria, research and/or control programme methods, allow for people to make informed decisions about their personal well-being and can assist in the fight against malaria.
Science and Story Telling
Ginny Stone, SAASTEC / Writer.

Communicating science in a clear, concise, yet fun manner has become of paramount importance over the last few years.

What better way than to weave facts into a storyline, so that children do not even realise that they are learning. The Sibo Series started in 2008, with the first title, Sibo Makes A Difference, on the topic of global warming – being published. There are now fourteen titles in the series and many of these have been sponsored and given freely to children. Topics ranging from chemistry, nanotechnology, biodiversity, sustainability, HIV Aids, astronomy and malaria, to recycling, road safety, etiquette when using public transport and saving strays. The books are being read in libraries and schools around the country. Children are being empowered, one page at a time.

But how do we come up with such stories...

Nelson Mandela said… “What counts in life is not the mere fact that we have lived. It is what difference we have made to the lives of others that will determine the significance of the life we lead.”

Why do we tell stories? There are many reasons: communication, self-expression, catharsis, to make sense of who we are, to entertain or to learn more about places and other people. In my case, specifically with the Sibo Series, I tell stories to relay information to children in an interesting manner. To sneakily empower them with knowledge without even realising that they are learning.

This presentation took delegates through the steps I take when writing a story—I used the herb rosemary as an example. It’s useful for many things, but the one thing I particularly wanted to communicate is that sniffing rosemary boosts memory.

I had written a Sibo blog on the topic, but felt that was still too high level for younger children so wracked my brains and came up with a little story about Jack (our cat) and a Unicorn.

I had especially chosen the after lunch slot to read the story—when people are full and tired. Not only did I have sleepy delegates, but I also had no power to actually use my presentation. Fortunately, it did not really matter as there was still enough light to read.

Once again, I would like to thank the DST and SAASTA for the part that they have played in supporting the Sibo Series—books that empower children, one page at a time.

If anybody would like to win a copy of The Kindness Book (an anthology of stories on the topic of Kindness, which includes Jack and the Unicorn) send me an email before the 28th February—we’ll have a lucky draw from all the entries.
A Global Icon – Nelson Rolihlahla Mandela

Marsha Kalika, KZN Museum

Nelson Rolihlahla Mandela, born in 1918, was a history maker and an influential figure. His distinctive nature allowed him the ability to transform lives through his dedication to social cohesion and his stance towards social justice, equality, democracy and freedom. This global icon and hero participated in the liberation struggle as he fought against racialism, colonialism, oppression and discrimination. The year 2018 marks the centenary birth of Nelson Mandela and the KwaZulu Natal Museum will be using this as an opportunity to dedicate a gallery to reflect Nelson Mandela’s heritage, life and promote his legacy. The aim of this celebration is to inspire South Africans to build inclusivity into our society, eradicate poverty, build democracy, and promote freedom and diversity.

The Nelson Mandela Gallery was initiated by the KwaZulu - Natal Museum in the late of December 2017 with the focus to look at the man behind the public person. This would engage the public as well as create awareness through the involvement of Nelson Mandela’s background, tradition, lifestyle and time as a president including the associated impacts after presidency, landscape and education. The exhibit will comprise of two panels on Nelson Mandela’s education, fifteen on his life and childhood story, a life size replica of Nelson Mandela including the rondavel which represents his background and home life. Colours in the beadwork reflect heritage and a strong value system and the three walls will exhibit timelines and events that highlight Nelson Mandela as one of the most respected and well known public figures.
Mandela day with the kids
SS Sibiya & S Bukhosini, Isibusiso Esihle Science Discovery Centre, Velabusha, KwaNgwanase.

In South Africa everybody is entitled to access to health facilities, this is why we have Government hospitals situated remotely in our communities. In Manguze like all other hospitals there is a Pediatric ward with sick children as young as 3 months, this is a sad picture to see such young souls laying there helpless in such an environment.

Wondering if science can be an instrument to support courage where there is fear and inspire hope where there is despair. The team of the Isibusiso Esihle Science Discovery Centre sort to prove this and visited the Pediatric ward in Manguze Hospital with the hope of making their stay in the hospital less stressful and dull. Choosing carefully what could work in 45 minutes and leaving a lasting impact on the children and parents mind. Science, Fun, Colour, Interaction and Story -telling became the main focus of the moment.

The wonder became ours when we saw the amount of time parents and children spend in hospital and the need for education, fun to be brought to them, the excitement became ours when we realized that Science is really one of the tools to bring back hope and comfort as we make Mandela Proud.
Making everyday a Mandela Day
Phinah Manamela, ArcelorMittal Science Centre- Newcastle

Society provides us with a system and a platform to collaborate for the betterment of other people’s lives and contribute towards the common good of giving and adding hope to those in need.

While handing over a small gift might seem like a meagre task, the opportunities it presents to the user are infinite and it is rewarding to see the direct impact.

Introduction
The idea of Mandela Day was inspired by Nelson Mandela at his 90th birthday celebration in London’s Hyde Park in 2008 when he said: "It is time for new hands to lift the burdens. It is in your hands now”

As part of CSI (Corporate Social Investment) we serve as a bridge of hope between the community and industry to transform lives in our areas of operation. Stakeholders who share the same vision collaborated to find solutions to the identified problems of lack of mobility and poor infrastructure in schools.

Lack of mobility hampers people with disabilities to lead a normal life within their constraints.
Welcoming environment and good sporting facilities enhance learning in a number of ways.

What could be done to improve these conditions?

Objectives

• To make life easy for those with lack of mobility
• To improve conditions at school

Methodology
We collaborated with different stakeholders (Department of Education, Department of Social Development, Amajuba Rotary and NGOs) to identify deserving learners and community members. Full service, special schools and households in Amajuba District were visited for evaluation.

Discussion
One often does not realise the impact a wheelchair has on the life of a person who has difficulty in mobility. Able bodied persons go about their day to day business often oblivious to the suffering of so many around us.

10 modern wheelchairs, tailored to suit the needs of an individual were handed over to deserving beneficiaries, thanks to ArcelorMittal and Amajuba Rotary for taking the lead in this initiative.

Mr Michael Shabalala is one who is no stranger to suffering. Michael is disabled from the waist down and has been getting around his house in Section 4 Madadeni by sitting on the floor and propelling himself forward.

Fortunately, he was noticed by passer-by’s and his plight was brought to ArcelorMittal & Amajuba Rotary who have now provided him with a wheelchair that eases his living burden.

Phendukani School is another area that was visited where 6 wheelchairs were handed over to various students including a boisterous Sizwe, who is the captain of the basketball team, and he could not wait to try out his new “go-shesh” and began spinning around and doing “wheelies”
A heart-warming tale is that of little Lindokuhle Mjiyako. 7-year-old Lindokuhle is disabled and also has speech difficulties; No words could describe the joy this little angel felt as she was placed onto her own specialized kiddies chair. Her smile was so enchanting that it brought joy to all those witnessing it; She called it a “Vurrrrr pha” as she could now be outside with her twin brother and they would have such fun. Lindo’s mum Hlengiwe was immensely grateful for this gesture and sees this as a new lease on life for her daughter.

Nonhlanhla was born without arms from the elbows and legs but this disability did not stop her from continuing her studies at Majuba TVET College. Those who know her confirm that if you get into her room you will find her on her bed surrounded by books. She sees herself as no different from other physically able people. She had a choice to sit back and become a victim but instead she pursues life despite the challenges. She started to miss classes when her old wheelchair got damaged and she didn’t have other means. She was easily noticed by her lecturer as she is the brightest student in her class. An electric wheelchair and removable steel ramp were donated to her. She was excited to go back to the college and write her exams and she said gladly, “I thought angels only lived in heaven “.

After making difference in the lives of Newcastle’s destitute and disabled community the Mobility Freedom Wheelchair Project has crossed the boarders to change the life of 88-year-old Zimbabwean woman, Constance. Charity begins at home. Constance’s son who is an electrical technician at ArcelorMittal heard about the project and submitted a request for a wheelchair for his beloved mother who struggled to walk. Approval was granted but only to discover that the mother is in Zimbabwe, 1700km away from Newcastle. Local transport assisted with this mission of taking a wheelchair to Zimbabwe. Excitement was overwhelming for the mother when she received her precious gift. The son thanked ArcelorMittal and Amajuba Rotary for helping his mother become mobile for the first time in years

ArcelorMittal joined the rest of the world in celebrating Mandela Day 2018 through an initiative to revamp a primary school in Dannhauser. The project involved painting the whole school, demarcating soccer and netball fields, donations of poles, nets, balls and beanies and socks to deserving learners to keep them warm in winter. Learners could not wait for their first goals.

We make Steel, we donate Steel and that’s how we are giving back to the community.

Conclusion

The wheelchair initiative brought pride and joy to the beneficiaries in a special way. It is rewarding to see the direct impact of the opportunities presented by this initiative, as we are indeed lifting the burdens and giving people hope

Acknowledgements

I would like to thank SAASTEC for accepting my paper, SAASTA for funding us to attend the conference, ArcelorMittal for allowing me this opportunity and Amajuba Rotary for the good work they do for our communities
The NSTF Share ‘n Dare Programme

Fulu Gelebe, National Science and Technology Forum (NSTF)

The NSTF Share ‘n Dare programme was started as part of the NSTF Awards. It provides a platform for NSTF Award winners to act as role models and ambassadors for science, engineering, technology (SET) and innovation. The winners share knowledge with youth and communities, inspiring young people to pursue studies and careers in SET and innovation. This programme annually starts after the awards ceremony.
DigiGirlz are everywhere
Nomusa Keninda, Mpumalanga ICT Club

Every school or community do have girls who are doing grade 9. These girls are about to choose their careers. Some of them especially those who are not introduced to proper career guidance, the become confused and that's where we lose them out of STEM Careers. DigiGirlz events encourage and inspire grade 9 girls to do best in Maths and Science in grade 9 so that they can choose STEM/IT Career. Microsoft employees are involved to Skype with the DigiGirlz relating their life journey into IT careers at Microsoft. Anyone can assist our girls and organise a DigiGirlz event. During the event these girls are taught basic Computer Science - Coding on two themes: Scratch and Hour of Code Minecraft. This allows them to do hands on activities Coding their preferred projects on Scratch.

DigiGirlz are everywhere....
Nomusa Keninda- Mpumalanga ICT CLUB Founder has joined forces with Science Centres in South Africa to teach and motivate young girls into STREAM Careers. She presented her paper “DigiGirlz are everywhere” at the 20th SAASTEC Conference held on the 26-29 November 2018 at Thohoyando in Venda by Vuwani Science Centre.

STREAM is an extension of STEM for Science, Technology, Robotics, Engineering, Art and Mathematics. Although she strongly believes in adding another big A for Agriculture, she is actively participating and advocating for it in the near future. “Yes, DigiGirlz are everywhere.., my target is with the grade 9 girls in all schools because of many reports which suggested that there are few women in the Tech industry” Keninda said. Grooming girls into IT careers is a great idea. They will be making subjects choices the following year in grade 10 therefore, they need role models in the tech space.

The South African Advance Science and Technology Centres (SAASTEC) gave her an opportunity to relate her story about the DigiGirlz events she hosted in schools in 2017/2018 year in the conference plenary. “She is an excellent presenter and motivated all of us in the SAASTEC community to look for DigiGirlz and host such events with an aim of recruiting girls into STEM Careers” said Ginny Stone, SAASTEC Secretary.

DigiGirlz event is a Microsoft Initiative under its Youth Spark Programme which motivates young girls into IT careers. During the event three sessions are put together by Mpumalanga ICT CLUB: Ice breaking with girls presenting their talents in Art, Poetry, Music and Dance, secondly, Motivation Session and lastly Coding Skills where girls are introduced into Basic Computer Science Education.

“We are excited as a club to have taken this initiative into a reality for young girls and we will be hosting the DigiGirlz event in all schools with grade 9 in Mpumalanga and other provinces” Keninda related with passion. DigiGirlz are everywhere... presentation can be accessed on twitter and facebook posts @musakeninda, @ictclub_mp, Nomusa Keninda and Mpumalanga ICT CLUB
Career Development Services Training

Thembani Mabasa and Ditupa Fothane, Department of Higher Education and Training Career Development Services

This is a basic orientation to career development and information on post-school education and training opportunities. The Department of Higher Education and Training (DHET) seeks to equip Career Development Practitioners (Science centres officials) with information and guidelines on the provision of career development. The presentation focuses on career theories, Career decision making, The Post School Education and Training System, The Facilitation Process: Skilled Helper Model, Frequently Asked Question and Mediation of career resources and tools.
Making Madiba proud through affording an informed decision making using career guidance.

Solly Simelane, Anglo-American Science Centre

Majority of learners and the general public (particularly the out-of-school youth) in South Africa have had been excluded in most careers as most these careers were reserved for a minority of our population. This has more evident in STEMI careers. Majority was channelled towards menial careers or just jobs. The consequence of this exclusion has resulted in lack of information in STEMI careers. To most people STEMI careers refers to Civil, mechanical and chemical engineering. The vast fields of engineering are less known by our people especially the learners.

With the advent of democracy through the struggle waged by Madiba and other struggle heroes, a ray of hope for the excluded majority emerged. Science centres were established to advance STEMI in South Africa under the auspices of the Department of Science and Technology. One of the goals of the Science Engagement Strategy is to make STEMI appealing to learners, such that they consider SET as preferable career options. Science centres are tasked with making this goal a reality. 69. Career guidance comes in handy in advancing this goal. Our science centre has ensured that learners and the out-of-school youth get career counselling.

Through the career guidance section in our centre we invite/visit learners and out-of-school youth afford them an opportunity to make informed decisions on the available SET careers. This is to ensure that, wherever he is, Madiba becomes proud of what we have achieved as a nation, in realising a democratic, free and prosperous South Africa.
The RSA University of Johannesburg and Germany Stuttgart University have set-up EnerKey R&D Programme of 2008-2013 for Green Economy in RSA Gauteng Province. EnerKey Programme Management Committee Office Bearers have now agreed to set-up Partnerships with SAASTEC for Green Economy Technology Transfers and Commercialisation processes for SADC Rural Villages & Townships in 2013-2018. Mr Gcinimuzi Jeremia Mafrika - Chairman of EnerKey PMC would like to present on 20th Annual SAASTEC Conference, his topic will be about reflective/evaluation of acquired knowledge and experiences of the past 8 years of progressive seed capital investments in Renewable Energy, Water and Climate Change as Key Elements [EnerKey] for Sustainable Enterprises Development and Jobs Creation Models for 4th Industrial and Commercial Undertakings in Rural Villages and Townships Green Economy and Blue Skies Technologies. The EnerKey R&D PhD Thesis Branded Buyalingi Business Consulting (Pty) Company in its joint venture agreement with Mboyi Global Logistics and Skills Repository (Pty) Ltd Company that have been appointed as lead EnerKey implementing agencies.
Enhancing Critical thinking through Gardening for Wildlife
Armstrong Mashakeni, National Zoological Gardens

In order to enable and create a conducive learning environment for critical thinking, we planned to facilitate learning activities through discussions, analysis, evaluation and other thinking processes (Halx and Reybold, 2005; Arend, 2009). The theme on Gardening for wildlife is used to enhance critical thinking in zooclub learners. Activities that include essay writing and questionnaires that are based on the Bloom’s Taxonomy are some of the methods that will help in enabling learners to think critical in the classroom environment (Smith and Syzmanski, 2013). The use of wikis in education is another way of engaging and helping learners to think critical by creating or analyzing wikis (Snodgrass, 2011). The revised Bloom’s taxonomy consists of six fundamental principles, namely, remembering; understanding; applying; analysis; evaluating and creating. As part of the critical thinking through tasks and assessments, learners need to show the ability to adhere to and apply all six theoretical framework of Bloom’s Taxonomy. Benjamin Bloom and associates have developed this theoretical framework that explored the aspects of pedagogical learning and critical thinking (Krathwohl and Anderson, 2001). This taxonomy is one of the most widely cited sources for educational practitioners when it comes to teaching and assessing higher-order thinking skills (Kennedy et al., 1991). The revised Bloom Taxonomy group was assembled by Anderson and Krathwohl and included people with expertise in the areas of cognitive psychology, curriculum and instruction, and educational testing, measurement, and assessment to improve the framework. This paper will explain the constraints and enablers of critical thinking in the Gardening for wildlife project.
How is Uranium Related to Energy

Gilbert Lekwe, Necsa

Uranium is an element found in nature. Used as a nuclear fuel, it is a source of energy. Uranium fuel is emissions-free, making it safe for the environment and in comparison to other fuels; only a tiny quantity is required to generate an equivalent amount of electricity. South Africa has the 4th largest uranium resource in the world; other major reserves are in Niger and Namibia. It is therefore imperative for South Africa and Africa as a whole to look into this wonderful God given mineral for our energy solution.
Piloting the Process of Evaluating Interactive Exhibits within the Science Centre Environment

Dr Shadrack Mahapa and Ms Silindokuhle Mbonane, Sci-Bono Discovery Centre

Exhibit evaluation is a very crucial exercise for every science centre. The process can assist both the science centre and management to establish the success of an exhibit that will ultimately contribute to all other requirements leading to the success of a science centre. The process of removal of exhibits from the exhibition floor is not properly documented. This is suspected to be the case too with quite a number of other science centres in the country.

Several science centre stakeholders were consulted for their opinions regarding the exhibit evaluation. In addition, some officials from key stakeholder institutions such as SAASTA and the DST were included as well. Fifteen (15) science centres, amongst them, the newly established centre (less than 5 years old), middle aged centres (between 6 years and 15 years) and relatively old centres (Over 16 years old) were consulted to verify their processes of new inclusion and removal of exhibits from the exhibition floor space.

Consequently, in consideration of local and international practice, it was worth a while to establish a process of evaluating a science exhibit for the purpose of inclusion or exclusion on the exhibition floor space. The process was then determined and tested with three (3) interactive exhibits at Sci-Bono Discovery Centre. These included the exhibits which were perceived as either very dull, just okay and the most attractive ones. The results were tabulated for further inputs by the science centre stakeholders.
The Inkcubeko Youth and Science Centre is focusing on our young in a holistic way.

By utilising the space we have to encourage the search for knowledge and community as well as healthy living, our centre offers a science centre, youth centre and adolescent clinic on our premises.

To inspire each person to develop and grow to reach their full potential. Nelson Mandela said that “as we let our own light shine, we unconsciously give other people permission to do the same”, this is what we are encouraging the next generation to do, let their light shine. Develop a culture of dreaming big, and not to stop at dreaming, but to work hard to see their dreams turn into a realities. To take hold of the opportunities presented to them and to teach them how to persevere through difficulties. If they do not succeed with the first try, to take courage and try again. Every success will inspire and grant permission for those around them to do the same.

We offer a safe space to be used by clubs, such as the homework hub, chess club and the Thembalethu wellness club, and by hosting events for the whole community in our different venues we plan to reach the youth of our community and ignite curiosity and interest in science, technology, arts, mathematics, innovation and healthy living.
Vuwani Science Resource Centre was established through ZENEX Foundation funding and was officially opened on the 19th May 2000 with a building, consisting of four laboratories, offices and ablution facilities. The Centre used to reach about 1500 learners annually with programmes such as computer training and physical science experiments. Through the Department of Science and Technology, the Centre has an extended building that has Exhibition Hall, Renewable energy Hall and small Centre hall. Currently, the Centre is a hub of the Limpopo Province Indigenous Knowledge System Documentation Centre (IKSDC).

The science engagement has increased for the last 18 years in SA science industry due to different strategies developed through different departments and Department of Science and Technology as the main driver. Vuwani Science Resource Centre has been mitigating the same strategy of promoting Science, Technology, Engineering Mathematics and Innovation (STEMI), science coordination and it has been operating for the last 18 years. For the programmatic support program, the Centre used to reach 2500 learners, this has increases to 100 000 learners due to the mobile lab vehicle donated by DST.

The current work shows the development of VSRC on its impact of number of learners reached annually, community members and different projects supported by the Centre from 2000 until 2018.
Science shows: to theme or not to theme

Umr Chippendale, Cape Town Science Centre

To theme or not to theme, that is the question? There is various different ways to package a science show, but which is the right way? And if there is a right way, for who is it right? This presentation will explore with a fresh critical eye the modus operandi within science centres.

The presentation will include an in depth literature review examining the impact a science has on audiences. Different audience types and their respective experiences will be discussed, including examination of which aspects of a science show have long term retention.

A pilot study conducted at the Cape Town Science Centre focusing on themed to non-themed shows will form part of this presentation.

Results and recommendations will be shared.

Is a themed science show more effective than a non-themed “magic” show? Come and find out.
When It’s Time To Say Goodbye – Letting go of a project

Meeloni Tanna, Sci-Enza, University of Pretoria

As science centres we run quite a number of projects and programmes as part of our core business. Projects have a lifespan and more than anything they need to be continuously evaluated on their effectiveness. Once found to be ineffective they need to be cut – otherwise they raise the risk of highly impacting a various number of factors that are essential for a well-running, impactful science centre. Some of these factors are the draining of human capacity, when too much time and human resources are used on a project that is not fruitful, it is time and resources stolen from other projects that could have been more effective. Another factor that can highly affect a project is finances, spending too much money getting a project of the ground or either for its maintenance can also drain the financial resources from other projects. And since, resources tend to be scarce, one cannot be fooled into investing too much in projects that aren’t worth it.

Recently, Sci-Enza bid farewell to one of its longstanding projects and will share on the process undertaken in making this decision and discuss how that has benefited the centre.

Introduction

A pilot project began creating the community garden project as it was the international year of farming in 2014. In the following year 2015 ‘Re ja mmoho’ the community garden project was established in celebration of the international year of soils in partnership with Junior Tukkie (JT) and the department of student affairs. The aims of the project were to create awareness of the importance of soil for food security and essential ecosystem functions. The second aim was to feed the University of Pretoria students who were financially disadvantaged.

The journey of the ‘Re ja mmoho’ the community garden project

The ‘Re ja mmoho’ the community garden project came to existence with the following agreements in place.

The agreement between the departments was the following, JT would offer seeds, seedlings, and labour and the student affairs department would offer labour from the feeding scheme. The Sci-Enza interns would maintain and supervise the garden and offer labour when needed.

Atleast ten patches, vertical and tunnel garden were used to plant seeds and seedlings. The seeds and seedlings planted were spinach, beetroot, tomatoes, cabbage and carrots which then were harvested by the students who worked on the garden. Students use to harvest as and when they needed this was normally once a week. The project was a success as there was one massive harvest, the excess of the produce went the orphanage in mamoldei on Nelson Mandela day. The donation of the produce resulted in the vertical gardens existence. The fees must fall strike affected the process of the garden over time.

The success of the project was due to the following factors, the number of interns at Sci-Enza at the time, the contribution of the other two departments. There was an approximation of 40 students
working in the garden, therefore, the work was spread evenly. Secondly, the weather conditions were
good as a result of a good amount of rainfall and good soil condition.

In 2016 it was discussed with the three departments how to take the project forward. The student
affairs department pulled out of the project as the students were no longer interested. JT recommitted
to the project, however, the project coordinator did not effectively manage the timing for the students
to work on the garden. Drought impacted the garden resulting in little produce being produced.

In 2016, 2017 and 2018 showed slow progress due to the cut down of the volunteers, from 10 to 5.
Sci-Enza had to reprioritise tasks to continue with the project. Collaborating partners support
decreased as the project coordinators changed.

In the last two years of the ‘Re ja mmoho’ the community garden project the soil was fertilised,
wooden nets were built to protect the produce from birds, produce were replanted when produce
failed to grow, weeds were removed that were invading the space of the produce and a weed spray
was made to decrease the number of weeds growing.

Since there was not much time being spent on the garden and produce being harvested, it was then
decided in 2018 for an evaluation process to continue or not to continue with the ‘Re ja mmoho’ the
community garden project.

It is not easy to let go of a project when time and resources have been invested into a project,
therefore before making a decision to let go of a project, an evaluation process should be done to
consider factors that determine whether or not a project should continue or let go.

These are the following factors to consider when letting go of a project:

1. **Partnership collaboration**
The different partners have different reasons for being part of the project, such as approaches and
values of a project. These factors must be considered. The three departments involved had different
reasons for the project yet the values aligned. One of the reasons JT was involved was to create an
opportunity for community outreach for students. The department of student affairs aim was to feed
the finically struggling students. Sci-Enza’s aim was to create awareness of the importance of soil for
food security and essential ecosystem functions. Initially all departments were invested, however, in
the end, Sci-Enza was the only department that was still invested in the project. The reason for the
other departments showing little or no interest in the project, as goals change overtime.

2. **Value of the project**
The importance of the project needs to be considered during the evaluation process. Everything
based on the project should align with the values. Values can change overtime, some values may
take more preference over other values. One of the values of this project was to educate the public
on the importance of soil and the role it plays in food security, this value was decreased after 2015 the
international year of the soil. Providing food to the finically struggling students became a value that
increased over time, however, since the project was not fulfilling this value, steps needed to be looked at how to meet this value or let go of the project.

3. **Milestones in the project**
Looking at the milestones can help evaluate if the project is going in the intended direction. Sometimes not having milestone does not necessarily mean the project is not going in the intended direction and making an impact. A possible milestone in the garden project is when the produce was harvested. When the project began, the first milestone was when the first harvest was to be distributed to the students and the orphanage in mamoledi. After the initial milestone, there were no clear milestones and no proper evaluation was considered until recently.

4. **Cost-effectiveness**
The cost of running the project should be considered when deciding whether to continue with the project or not, such as money, time and effectiveness should be used as a guideline. An estimate of R5000 was spent on the project. The money was used buying seeds and buying materials to make wooden nets for each patch, which was 6 patches in total. Any project requires money to get it off the ground, however, in this case, the money could have been used for other projects when looking back as most of the vegetables were not growing and were not feeding the needy.

5. **Human capacity**
Human resources are considered, as having too many or too little can hinder the project. At the start of the project, there were around 40 students working in the garden, about 6 to 7 students worked in the garden daily. The human resources decreased overtime having about two Sci-Enza staff members working weekly on the garden and about 10 when it came to planting and taking out weeds. The decrease in human capacity, therefore, increased the amount of time taken out of other projects.

6. **Execution of the project**
The way the project is running affects the outcome of the project. The departments gave students a minimum amount of time they needed to work on the garden with the supervision of the Sci-Enza interns who took turns to supervise and assist in maintaining the garden. This approach worked initially, however, when the project coordinator changed from the JT department, the project coordinator struggled to effectively plan when students could work in the garden. The reason for this was that each student's free time was not corresponding. Towards the end, not many students from JT came to work on the garden due to tests and exams thus there would be days where the garden was not worked on from the students.

7. **Measures of Success**
To determine whether or not the project is a success, there needs to be a clear definition of what success is on the project. In terms of the ‘Re ja mmoho’ the community garden project, success would be defined as the amount of produce being harvested and distributed to those in need. The first harvest was a success and the students working on garden took the harvest and the excess went to the mamoledi orphanage, thereafter the success of the first year of harvest the harvest did not go the orphanage or finically needy students.
8. **Overlooking the negative outcomes**

You are trying to justify the negative, it is good to have a positive approach when the outcome is not the one you expected. Justifying why things are happening is an indication that something needs to be fixed. Seeing the negativity for what it is can help you let go of a project as negativity can drag you down. Despite the drought impacting the produce, maintaining the garden still continued hoping that there would be a positive outcome. The Sci-Enza interns were cut to five interns from 10 at the time the project was initiated. Now there were about 10 Sci-Enza members maintaining the garden to the initial 40 working on the garden.

**The project is stagnant**

You've tried different ways to make it work but it never does, first, you need to look at whether or not you have tried different approaches to reach the goal. When different avenues have been considered and yet the end result is the same or has no positive effect, it is time to let go of the project.

Certain produce was not growing, therefore it was decided to plant more of the produce that was growing such as spinach and tomatoes. The produce that was growing was not enough to give to the orphanage which resulted in the Sci-Enza interns haven turns to take it home. The birds were eating some of the produce thus it was decided to add more net stands to the current ones that we had. Time was taken out to build the wooden nets. We turned over the soil and added fertiliser hoping that the next produce will grow better and faster. Every idea tried resulted in the same outcome.

Losing time, energy and your motivation is also another indication that you need to let go of the project as you feel something is dragging you down, it takes your energy away which then, in turn, demotivates you resulting in no drive to do the project. Towards the end of the garden project everyone had lost interest in the project as a lot of time was given to maintain the garden and there were no results. More time had to be taken from focusing on other projects towards the end. One of the reasons was that there was a lot of weeds growing around the little amount of produce. There was not enough labour to maintain the garden.

It was finally decided to terminate the project as:

- There were no results
- The harvest was not going to an orphanage as only small amounts were produced
- Not enough man labour
- Prioritise other projects
- No passion
- Not benefiting anyone

There is a number of factors that need to be considered when evaluating whether to look at the project or not. Depending on the project different factors will contribute to whether a project should continue or not. Passion is one important factor to have when conducting any project, without passion the resources and time will not be used effectively. Another factor is a partnership when everyone does not pull their weight or loss in interest that can impact the outcome of the project. Depending on
the project some factors will weigh more importance than the others. Since each project is unique it is important to go through the evaluation process before making the final decision.

**Conclusion**

Science centre’s continuously run many projects which require human and finical resources and time. It is important to have evaluation process on projects to determine whether or not the project is going in the intended direction. Factors are dependent on the type of project and will determine whether the project is on the right path. When the project is not going in the right direction, steps can be taken for the project to go in the intended direction or to let go of the project. It is never easy to let go of a project therefore it is important to have an evaluation process.
Meeting Generation Z where they are.
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The science centre environment offers an opportunity to interact with different generations at any given moment, from ‘Baby Boomers’ to Generation Z. Generation Z (also known as Post-Millennials, the iGeneration, Founders, Plurals, or the Homeland Generation) is the demographic cohort following the Millennials. Gen Zs don't know a world before mobile technology! This generation has been labeled to be less focused, better multi-taskers, early starters, and global impact orientated. This article zooms into the future to identify tools and methods to utilise in order to communicate science effectively by meeting generation Z they it's at...

Who is Generation Z?

Generation z is composed of people who are born after the year 2000. Their character and mind sets are different as compared to previous generations. They tend to be more practical and goal driven therefore following in the footsteps of Generation X (1990-2000). They are known as the internet generation, as it is perceived that they have a digital DNA. The internet has become a powerful force among this generation in relation to communication, co-operation, collaboration and connection. Because of this, Generation Z has the tendency to live and survive alone. Generation Z tends to follow trends of seeking purpose, early adaption of artificial intelligence and placing emphasis on self-care. Compared to previous generations, Generation Z has strengths of being technology competent, natural entrepreneurs, multitaskers who are fully operational when the Wi-Fi signal is strong. They rely on technology and the internet to solve all their problems including social problems. Generation Z's weakness lie in merging reality with virtual reality. They are said to be more cynical than their predecessors, favour realistic outlook over the idealism of previous generations. There are many differences in ‘Generation Z’ in various continents and countries because of the development of the country itself. The more developed a country is the more technology advanced a generation is, the less developed a country is the less technology advanced a country is i.e. South Africa verses the United States.

We cannot dispute and overlook the fact that South Africa has 3 demographics, namely: rural, township and urban areas, these areas play a significant role in influencing the population at large. As much as generation z is generally presumed to be technology advanced, we still get a population i.e. Rural, which is not advanced and have yet to be exposed to technology. Rural areas are the most populated areas in South Africa, as this country is stricken with poverty dominated rural areas. Developing countries, like South Africa, are the countries we presume as being slow with advancement of any and everything. These developing countries have therefore taken the initiative of creating science centres that will expose developing country Generation Z to scientific technology and its advancements. The science centres therefore communicate science, technology and engineering to students of all demographics.
The establishment of science communication was mainly to make science education accessible to ordinary people in order to impart knowledge, stimulate science enthusiasm, curiosity and wonder and developing inquiring minds. Throughout history different fun and entertainment methods have been used relatively to the characteristics of that particular generation in order to achieve the goal of equipping all learners with science information. Learning techniques have evolved and improved throughout time in order to meet generations where they are. The use of interactive exhibits has proven to be effective on drawing interest to learning science over time, and still proves to be effective to generation z. The exhibits are designed to increase learners’ skill and understanding of science, technology and maths, as well as enriching school curriculum and equipping learners by providing valuable hands-on learning.

**Sci-Enza & Gen Z Short Term Goals**

There are many ways to reach a stipulated target market, but because we are dealing with a generation that is technology advanced and thrives in environments that are fast paced, we have to look at pastures where they mostly dwell in-the internet (Williams, 2018). Though Facebook might be slipping, they own three of the top four channels that Generation Z’s are active on. On average a small amount of Generation Z’s population will visit a Science centre or have a Science excursion on a yearly bases. Based on this remarkable statistics, using the voice of social media is the only sensible strategy and technique to use in order to meet this I generation where they are.

**The hashtag (#) activism** is one of the biggest social channel movements that constitutes to the ‘woke’ element of Generation Z. If a concept trends, meaning that the topic is being spoken about by many people all over the world, it’s articulated as being fascinating and worthy of attention. The objective of this movement is to share certain issues with one's friends and followers in the hopes that they too will share the same information and thus leading to a widespread discussion and allowing for change to occur. This allows one to connect with people from all over the world in a short amount of time. Using this platform to communicate science will enable us to increase generation z audience, thus increasing the number of a STEM enthusiast.

**Branding and Marketing** tools are mostly used in the corporate world, it may seem farfetched in a science environment however this is one thing that will ignite the interest of Generation Z and lure them into getting out of their cocoons and experiencing science in a place that promotes science learning. Generation Z wants a brand to make them feel trendy, give them entertaining content, provide innovative products/ideas, and make them feel like a valued customer. (Williams, 2018) They expect a two-way, personalized conversation on social channels, similar to how they are engaging with their friends on these networks. This group is more likely to click on sponsored posts on social media as opposed to clicking on online ads. Generation Z care about high quality products, rewards and just overall love for the brand. (Williams, 2018) A science centre has the ability to find that one aspect that can make it appealing for a certain generation to come and visit using branding and marketing tools. By using the correct branding, the notion to play and find out new perspectives about science, one can get in an immense amount of Generation Z’s, who want to explore, play around and
find out about what's happening in the science world. The focus in branding and marketing is set on Generation Z, their interests and how we can get them out of the house and get them to interact physically, how we can introduce them to the "don't try this at home" experiments in a safe and secure environment- Science Centres. If we, science centres, can tap into these attributes, we can turn this group into brand advocates of Science centres and science as a whole.

**Live streaming** is another tool that can be used to communicate science effectively. Generation Z is most active online, internet. Live streaming entails the videography of a certain concept done live on real time, where one can interact with people from all over the world at any place and time. They thrive in environments where they can sit in the comfort of their own home and still be interactive with the world using live streams that is why the YouTube world is increasing in revenue. This is the biggest unused territory by Previous Generation's, except generation X, which allows one to get full exposure into any world without leaving their comfort zone. This tool can be used to spark interest by not doing a full live stream, where we leave some space for the "maybe I should go there and see” thought or the "I would like to be more involved in this concept or know more about this concept". That right there is how we can most certainly meet generation Z where they are.

**Sci-Enza & Gen Z Current**

There are multiple types of learning styles and multiple intelligences for learning. Traditional learning methods are mainly linguistic and logical, relying on classroom and book-based teaching, much repetition, and pressured exams for reinforcement and review. As a result often labelling those who use these learning styles and techniques as bright and those who use less favoured learning styles often find themselves in lower classes, with various not-so-complimentary labels and sometimes lower quality teaching. This can create positive and negative spirals that reinforce the belief that one is "smart" or "dumb". (Unknown, 2018). Research shows that each learning style uses different parts of the brain. By involving more of the brain during learning, we remember more of what we learn. Through using brain-imaging technologies, researchers have been able to find key areas of the brain responsible for each learning style. As a science centre we have identified the different learning styles and incorporated them in our methods in order to cater and communicate effectively to the multiple intelligences and this has required to improve the utilized tools in order to meet Generation Z (Unknown, 2018).

**Visual learning** is one of the major learning styles that is incorporated in our science communication methods. This is associated with images and requires the learners to see what they are expected to know. (Unknown, Visual Learning Style, 2016). A large body of research indicates that visual cues help us to better retrieve and remember information. Research outcomes on visual learning make complete sense when one considers the fact that our brain is mainly an image processor (much of our sensory cortex is devoted to vision), not a word processor. In fact, the part of the brain used to process words is quite small in comparison to the part that processes visual images. Based upon research outcomes, the effective use of visuals can decrease learning time, improve comprehension,
enhance retrieval, and increase retention. (Kououmdjian, 2012) This method has proven to be effective in drawing Generation z’s attention and meeting them where they are.

**Africa Code Week** is a successful proven initiative, which continues to instil digital literacy and coding skills in the young generation, working closely with private, public and non-profit partners to drive sustainable learning impact across Africa. This continent-wide initiative fosters digital literacy and sparks interest of African children, teenagers and young adults into software coding. Rural areas are area’s which do not have the resources to be technology competent, they are in need of funds and proper schooling resources and buildings. These schools are often at a disadvantage because of the lack of funds, they are located either deep in the mountains of South Africa or even in plain sight but are still under poverty. Africa Code week is the initiative that we need for all rural areas, not once a year but periodically. This initiative will get this Generation hooked on technology and gradually advance with it. Exposing a learner to this type of technology will help the learner to envision their future and believe in it, they will be able to know which steps to take when faced with a certain situation, get study materials online and even show their entrepreneurial side. This initiative will also bring more school funding and create growth in the rural areas, especially in terms of growth.

**Sci-Enza & Generation Z Future Goals**

The world is changing and moving more and more towards technology. As we have observed that over time, learning methods and tools change and improve in order to adapt to the fast changing world.(Unknown, What is web based learning, 2016). Current generation have digital DNA, it is only logical that we as science centre’s look into futuristic tools and methods that can be utilized in order to meet the future generation where they are at.

**Web-based learning** also known as online learning, e-learning, computer-based training or technology-based instruction, entails the use of web-based technology and tools in learning process. (Unknown, 2016). The biggest difference between web-based learning and traditional learning is in communication issues. Web-based learning offers many opportunities for interaction with both learners and science communicators. Communication can take place via various communication tools such as e-mail, telephone, chat etc. whereas in a traditional way of learning, communication and interaction take place mostly at the same time and place as face-to-face meetings. This method will also enable learners to interact with Science centres all over the world whilst starring at their computer screen.

**The virtual reality science centre. Virtual reality** is an interactive computer-generated experience taking place within a simulated environment. (Isaac, Joseph ). Venturing into virtual reality learning environments will enable us to meet this digital generation where they are, as this enables them to actively engage with the environment without being passive in their comfort spaces. (Isaac, 2016)

**Conclusion**

In order to meet Generation Z-rural where they are, as a Science centre we have to adapt the use of new technologies, such as social channels, web-based education programmes and remote teaching
and learning techniques in the future. We live in a world where the latest generation is more concerned with computer screens and trends making it a bit challenging for the older generations to catch up therefore us, as the older generation need to meet them at their computer screens, bring their computer screens to life. Make it worthwhile for them but also intriguing their biggest need - education. The question lies at how we help the less fortunate Generation Z meet the fortunate Generation Z where they are. Science Centres have provided a platform for science learning and throughout time they have managed to stay relevant and effective in communicating science effectively. This is due to the continuous adaption and improved communication tools and methods that meet different Generations where they are.

References
Minerals for South Africa but its wealth for the other continents
Joseph Sibiya, Mondi Science, Career Guidance & FET Skills Centre

South Africa is one of the richest countries in deposit of most of the precious and most expensive minerals. Individuals could imagine such a country to have many job opportunities in the exploration, manufacturing and processing sector which processes all these valuable minerals, nevertheless instead the job opportunities are given away by government to those who are able to invest in South Africa for their own countries.

How can science centres contribute towards reclamation of such terrific prospects for our own continental welfares? If science centre can recognise the impact of activities they conduct towards the development of the envisioned South Africa as a country and Africa as a continent, more efforts could be routed towards conducting STEM activities. The skills needed to take charge of the opportunities which are given to other continents can only be developed if a concerted and determined action is undertaken by our own citizens.
Robotics can play an important role in the development of STEMI education. It is a mind sport. STEMI education is known for developing important skills such as problem solving and critical thinking. Robotics can assist to develop such important skills in the fields of Science, Technology, Engineering, Maths and Innovation.

Robotics allow participants to play while learning and solving problems.
SKA Science Centre in Carnarvon

Takalani Nemaungani. Astronomy (SKA, AVN, SALT, HartRAO, etc)

The DST has completed the construction of the 64-Antenna MeerKAT telescope, a precursor to the SKA, in the Karoo near Carnarvon. The MeerKAT is already attracting large numbers of visitors to the Karoo, a growing trend amongst large scientific projects such as the Lovell telescope at the Jodrell Bank Observatory in Manchester, the FAST telescope in China, and locally the SALT telescope in Sutherland. It is expected that the SKA telescope, when completed, will generate even unsurpassed tourism interest in the Karoo node. To take advantage of this expected surge in tourism interest, the DST, in collaboration with the Department of Tourism is establishing a science center to be known as the Carnarvon SKA Science Tourism Exploratorium in the small town of Carnarvon. Over and above its role as a thriving globally competitive destination for sustainable tourism growth and economic development using the science of the SKA, the center will serve as a hub for enterprise development, career development, education and outreach, providing the local community with a number of socio-economic opportunities. The SKA SA is currently running a temporary visitor facility in Carnarvon as an incubation center for the Exploratorium, piloting some of the programmes to be implemented in the Exploratorium. The infrastructure development is expected to commerce mid-2019. This paper presents the conceptual framework of the Exploratorium, providing a glimpse into the creation of one of the world class science tourism facilities in the world.
Performativity in science engagement: papering over cracks

Tsepo Majake, ASSAf

(How far scientists, engineers, and researchers can be expected to participate in nurturing talent through science engagement.): Non-academic paper

The science of science engagement is applicable across all communication and is changing the communication landscape globally. The sender is the recipient and vice-versa, in a process of learning with the view of changing how things are done.

Science engagement is a process through which experts and the public’s share experiences and expertise in a neutral platform and on an equal basis to try and learn from each other. The experts do not pontificate or share their experiences and research to a passive audience. The audience is alive to the engagement and participate by contextualising it to their lived experiences, while the expert gives a theoretical background and research to explain and engage. At the moment, experts are not expected to engage with publics there are no KPAs regarding their practice. It is for this reason that engagement largely happens on a voluntary basis.

South Africa recently adopted a science engagement strategy (DST, 2015), but the strategy is quiet on how practitioners should engage and how that will impact practicum and performance systems. As a result, science communicators are continuing to do things the way they did before.

What is the problem?

The National Development Plan (NDP) (NPC, 2009) explicates the development of the country through science, technology and innovation. The personal, economic, social and other development will be realized through the wise, prudent and maximization of the research and development processes and proceeds for the country’s development.

Progress and development will only be achieved through broad consultation, relevance of innovation and investment into research and development. Broad consultation can be achieved through engagement, but that engagement needs to be substantive. This speaks to how practitioners in the science arena should be participating in nurturing talent through science engagement by creating a pipeline through which the country can benefit in the near future. This also speaks to how the society and experts can collaborate to solve problems that beset society through dialogue that lifts issues to relevance and finding crossroads between challenges and available research and innovation.

The quality of engagement will inform experts about the needs of society and the direction innovation, science and technology should take to resolve them. Society will be abreast of the developments in the science, research and innovation arena. As we speak, engagement is more like a ‘product-promotion’ and ‘career expo’ exercise, this does not measure up to the standard that will inform the progress and development of South Africa.

Methods to research problem

As a science engagement practitioner, I am in the space of sharing, promoting, popularizing and engaging with communities about South African research, science, innovation and technology. I will use my experience and lift events to relevance that will best demonstrate the problem.

I collect feedback through interviews and sometimes through questionnaires, these will also assist in bolstering the case on the problem. Due to the nature of this paper, I will use an exploratory qualitative design.

I have used six of the fifteen SAASTA science festivals to collect data. I used purposive sampling where I identified outliers in the engagement activities and events. I aimed to interview at least 20 people from each festival depending on how long the festival lasted and the number of people I engaged. I also aimed
to double the interview number for the questionnaire, in this case, the interviewee and another random attendant was purposively selected.

Intermediary findings

Science engagement practitioners use tick boxes as evidence of work carried out, their institutions are often impressed with quantities and volumes. The interactions are not substantive and at best performative.

Recommendations

This paper will recommend the following:

Formation of a Community of Practitioners to share good practice.

Development of a code of practice and minimum indicators of achievement.

Development of KPAs for practice.

Diversification of science engagement activities and audience.
A call to recognize the importance of play based-learning in our science centres

Innocentia Mabuza, Sci-Bono Discovery Centre

It is well known worldwide that Madiba was an ordinary man with extraordinary vision and love for children. He prioritized, listened and gave them attention. This is because he believed that these has a lifelong benefit. He went as far as building children’s hospital to make sure they are being taken good care of, in a special way. For us to continue with his legacy and making him proud, we have to find unique ways to honor him by starting to prioritise the (ECD) early childhood development in our science centers. We need to note that (STEM) Science, Technology, Engineering and Math concept is equally important to them as it helps them develop in everyday interactions.

We also have to bear in mind that play is a resource to develop their cognitive, sensory, motor, negotiation, creative and imaginative skills as well their physical ability. Young children would naturally gravitate toward designing and building intricate block structures, puzzles, zoob and Lego’s to nurture their developing abilities in engineering and design. Our role should mainly be focused on building a concrete foundation and ensure an understanding of the link between early childhood and Grade 12.
The word technology consists of two parts (Techno) means application, art or skill, and (Logy) means science and learning. The linguistic meaning of the word technology is: the methods and tools that a society has developed in order to facilitate the solution of its practical problems and to provide the necessary needs for the community. Consequently, the use of technology in all areas of life increases risks, threats and crimes associated with the use of this technique, which reflects negatively on the possibility of its use in absolute terms in all walks of life.

Introduction
The more advanced technology becomes, the more it seems to have control over our lives. Today, the use of technology is widely available and insistently promoted throughout our society. While technology makes life easier for people, it also creates some problems for our society such as the decline in ordinary social behaviour. Yet, modern societies realized the significance of intellectual technology which is a form of new knowledge that achieves goals or solves many problems. Since human beings are social by nature, relationships nowadays become more dominated by the use of modern technologies such as social media, which reduces the distances, despite of having negative effects on human relations in society and family.

Currently, people recognize that the use of modern technologies is a requirement for life and an indication of the cultural awareness of the community. They have positive prominent roles as one of the requirements of this era where they enter in all walks of life to provide services, improve the quality of life and increase communication and relationships since it is a developed culture reflects the culture of the community. Thus, there are increased concerns in the speed at which modern technology spreads as well as their uses and their false and negative impacts. This was due to the absence of effective guidance where some groups have become vulnerable to the negative effects of life threatening. Since education is an important area of life, the use of modern technologies makes it an essential part in education, not just a simple addition.

This research shows the negative impacts of modern technologies on society and will contribute to raise people's awareness towards the appropriate ways of using modern technologies. The authors hope that by presenting the negative effects of modern technologies on society, it will have positive influences on individuals and society in general since modern technologies play a major role in people's lives and future possibilities.

Statement of the Problem
The most important negative impacts of the use of modern technologies on society and its impact on individual behaviour are: the formation of personal beliefs, social isolation, reduction in the family ties between the family and society members, inactivity, obesity, lack of desire to work different kinetic activities, a waste of time in things that are not useful, increase in the rate of violence, especially in children because of watching violent programs, high crime rate because of spreading video clips presenting all kinds of these crimes and ways of committing them and the spread of lies and rumours causing distraction and loss of trust in such information.
Significant of the Research

- The practical significance of this research takes place in:
  - Identifying the negative impacts of the use of modern technologies and their patterns.
  - Recognizing the trend of using the modern technologies.
  - Contributing research to determine the cause of the phenomenon of the use of modern technologies with the passage of time.
  - Seeking to identify and develop ways and effective mechanisms to reduce the negative impacts of the use of modern technologies.

Research Objectives

- To demonstrate the negative impacts of the misuse of modern technologies on society. These are the major objectives of this research:
  - To recognize the use of modern technological techniques by members of the society and their impacts on the social aspects
  - To identify the reasons for gaining modern technological techniques (why people use these techniques).
  - To reveal the disadvantages of the use of modern technological techniques in all areas of life.
  - To be aware of the ideas spreading among members of the society about the positive and negative impacts of Modern technological techniques.
  - To realize the impacts of modern technological techniques on the family relations, family budget and children's achievements.
  - To be familiar with the family's role in reducing the risk of modern technological techniques.
Conclusion
Research shows that the correct use of modern technologies require a comprehensive understanding to the reality of change that happens to the community. Thus, this requires concerted efforts through full cooperation among all sectors of society, from family to government institutions, along with the presence of useful awareness programs supervised by these institutions and pursued by the family to utilize the modern technologies accurately in order to ensure and protect the future generations. Nowadays, people socialize with each other using online environments such as Facebook, MSN and phones instead of face to face interaction on these types of communications. The nature of the human is not programmed for this type of communication yet.

People must live and work together to socialize with each other’s. In conclusion, it is obvious that modern technologies can be a double edged weapon. They have their advantages, but with many inventions, they can completely change our lives, for better or worse. As a result, we must work for the interest of social connection to preserve people’s feelings towards each other away from the addiction to technology. Finally, this research is simply a little effort towards doing justice to this subject and it could assist future researchers in examining this topic with other groups and in more depth and with more relationships to the present use of modern technologies and their impacts on societies.
What Christoph Meyer Maths & Science Centre has achieved that could have made Tata Madiba proud.

Dorothy Mlambo, Christoph Meyer Maths & Science Centre

“It always seems impossible until it’s done ” as Madiba said, indeed it’s not an easy way. However unless you try, only when you will see that it is possible and ‘...’ it is in your hands to make a difference”. Huge problems in youths and communities are aggravated by failing maths & science. A learner's chronic underperformance in maths and science is not once off event. It is a crisis in teaching methodologies illustrating the debilitating burden that generations of South African children had to endure from the apartheid era to date: an education system that has failed them.

Our centre started a Youth development program in 2012 - the aim was to sow a seed of hope for young people and the community. Youths redo maths & science for a year with us and resit for the exams -which has given most of them confidence to do better than before. This creates more chances of going for tertiary institutions.

This presentation will reflect on how the Centre has changed the life of the youths in Mseleni. Tata Mandela asserted, "Education is the most powerful weapon which you use to change the world" what has the centre done today that would have made Tata smile.
An Ignited Curiosity in Science, Then What? Taking a Talent Tracking Approach
Raven Motsewabangwe, Inkubeko Youth and Science Centre

Nelson Mandela recognised education as a great vehicle to not only bring equality but also opportunities to citizens of South Africa. Fast forward over 20 years into South Africa’s democracy and Madiba’s effort to leave an inspiring educational legacy seems to be at risk. The WEF’s Global Information Technology report of 2016 ranked South Africa last in Math and Science education quality, finishing 139th out of 139 surveyed countries. South Africa’s overall education system ranked 137th out of the 139 countries.

Shortcomings in the quality of math and science education can lead to lack of interest and enthusiasm in young people pursuing a career path within the science and technology space further exasperated by negative stereotypes towards the discipline and poor communication/public engagement strategies and skills by science practitioners.

It goes without saying that science centres offer a glimmer of hope, providing teacher support initiatives and strengthening the science and technology culture among the youth while preparing them for possible career paths within science and technology related fields.

The Department of Science and Technology’s Network of Science Centres in SA lists the nurturing of youth talent in STEM as one of its core goals. It is for this reason that science centres should adopt an approach that will enable and promote the tracking of talented individuals from the moment of talent identification at grassroots level to enrolment into a science stream at tertiary level. Active mentorship in curriculum and extracurricular based initiatives such as long-term subject tuition programmes, science expos and science competitions can play a major role in nurturing talent.
**Learning without limits (Engaging rural primary schools in science and technology)**

Brian Ndavha, Giyani Science Centre

Giyani science centre prides itself by engaging learners and community members in science and technology since its establishment in 1989. Located in Giyani Township, the science centre provides enrichment programs to many rural schools around Mopani and Vhembe district. The main targets are secondary school levels who visit for mathematics, life science and physical science.

The aim of this paper is to address the new initiative taken by Giyani science centre, to fully engage primary schools in science and technology enrichment programs. The purpose for the initiative is to stimulate learners from earlier age and to break barriers to learning due to lack of resources. Currently there is a primary school program running separately from the secondary school program.

What the centre is currently doing for this initiative:

- Adopting old resources and adapting them to meet current curriculum needs
- Developing new learning programs that promote interactive learning
- Developing learning activities that stimulates creativity and logic
- Introducing new teaching skills to primary science teachers such as science classroom setup and science debates

The challenge the centre currently has is overbooking and the centre has three labs, mainly occupied by high schools and lack of facilitators.

Giyani science centre is determined however, to commit itself in meeting the needs of rural schools and offering nothing but the best education. We wish to thank our sponsors for offering us opportunities to attend science workshops throughout the country, it is the reason why we notice the gaps and mend them with a gold finishing.
Science Centres and Youth Development

Alfred Hanyane, Sci-Bono Discovery Centre

During Inauguration of Academy of Science and Technology of South Africa in 1996, our late and former President Mr. Nelson Mandela said: “On your shoulders rest the challenge of giving science a face that inspires our youth to seek our science, engineering and technology...” Science Centres are informal community-service-based educational facilities that inspire curiosity and interest in Science, Technology, Engineering and Mathematics by making them relevant to daily lives. The primary objective of Science Centres is to engage and empower the public through interactive, educational and fun activities to enhance Science literacy. Science Centres have more access to the youth, in particular school learners, which are also a component of the lay public. This paper seeks to share the contribution of Science Centres and in particular, Sci-Bono Discovery Centre in youth development through specific and dynamic projects and programmes.
Encouraging Diversity and Social Inclusion: Piloting the possibility of developing a Blueprint for science centres

Mr. X Nameka, Sci- Bono Discovery Centre

Science Centres are visited by a variety of people that differ in several ways including: culture, gender, religion, and socio-economic status, race, physical or psychological disability and linguistic backgrounds. These people are however supposed to receive the same treatment irrespective of the differences. No wonder Maya Angelou happened to say: “It is time for parents to teach young people early that in diversity there is beauty and there is strength.” To us, diversity can only be addressed through inclusivity.

This paper intends to identify and address sensitive issues of diversity and social inclusion through unstructured interviews of key subjects. Science centre participants and staff members were also interviewed for their perspective on this matter. The process intends to:

- see as to how deep these issues are entrenched and
- to what extent could they affect the operations of the science centre?

Literature was reviewed to determine how issues of diversity and social inclusion have been addressed internationally and to find out the consequences of neglecting social inclusion and diversity issues. The results of semi-structured interviews, were tabled and the total outcomes of the responses were documented with recommendations on how issues of diversity and social inclusion affect the science centre. Recommendations about measures that need to be taken to address diversity and inclusion within the science centre environment were made.
**How to monitor the learning progress of Science Centre visitors**

Michael Wolf, Formula D interactive

More and more funders and decision makers benefit from the availability of electronic user data as evidence for the impact of science centres.

Low cost NFC and RFID tagging technology allows us to personalise individual exhibits and generate data of how exhibits are being used in real-time. In his talk, Michael Wolf from Formula D in Cape Town, will talk about best practice using electronic systems to monitor visitor activity and learning. Based on their recent project work, he will share with the audience what it takes to implement the technology.
The Future is here: Industry 4.0
Akash Dusrath, Cape Town Science Centre

Technology plays a major role in our lives and continues to change the way we live. With its development being so rapid, we need to constantly be exposed to keep abreast with the latest innovations or risk being left behind. For some it can seem frightening and for others empowering, either way whether we like it or not, it is something we need to adapt to as it brings with it opportunities for economic and societal growth. The 4th Industrial Revolution also known as Industry 4.0 is this exciting wave of technologies and applications that crosses the domain of the physical, digital and biological worlds. From Robotics, Autonomous vehicles and Artificial Intelligence to 3D printing, Virtual Reality, Internet of Things and more, this is the revolution that is sweeping across the world with no boundaries and at a rapid pace. With Science Centres being hubs for the Public Understanding of Science, Engineering and Technology, how are they positioning themselves to embrace the 4th Industrial Revolution and help society adapt to it? In this paper, I will explore how the Science Centres across South Africa are embracing the 4th Industrial Revolution, the importance of doing so, and the impact this has on the current and future generations.

Industry 4.0 also known as the Fourth Industrial Revolution is the fourth major industrial era since the Industrial Revolution of the 18th century. It represents new ways in which technology becomes embedded within societies and even the human body, bringing together physical, biological and digital technologies. From robotics, autonomous vehicles and artificial intelligence to 3D printing, virtual reality, internet of things and more, it’s changing the way we live and work at a rapid pace. With all the innovation and exciting opportunities it brings, there’s still a lingering fear that robots will take over the world and so there’s a need to drive the change in attitudes about tech, from completely replacing humans to complementing, or enhancing our abilities, creating opportunities and driving innovation. This presentation provided an introduction to Industry 4.0, an insight on the future of jobs and explored how we as Science Centres are positioning ourselves to embrace the Fourth Industrial Revolution and help society prepare for it.
YouTube, a tool science centres have been sleeping on?!  
Bafo Yoti and Jamey Bester, Cape Town Science Centre

As we move further into the 4th industrial revolution, individuals are spending more time on their cell phones. According to an article posted on Digital Trends people in the US check their social media a staggering 17 times a day (Chang, 2015). These social media platforms include Twitter, Facebook, YouTube and Instagram, to name but a few.

Social Media Today posted an article in 2017 breaking down the time spent across the different social media platforms. “YouTube comes in first, consuming over 40 minutes of a person’s day” (Asano, 2017). This finding causes us to question how we as Science Centres can utilize this opportunity.

At the Cape Town Science Centre, we are revamping our YouTube Channel. These videos uploaded onto YouTube provide numerous benefits to a science centre. They communicate the nature and unique character of the Science Centre, showcasing the offerings of the science centre while exploring science in a fun and interactive way. The videos enable science centres to reach a multitude of people all across the world with a click of a button.

In addition to this, the Cape Town Science Centre is making use of QR codes that are displayed on the exhibit and linked to our YouTube channel. This will enhance the visitors experience and interactions with our exhibits. Lessons learnt and best practices will be shared in this presentation.

Introduction

At the Cape Town Science Centre, we are revamping our YouTube channel. There are many YouTube channels dedicated to educational science videos, and an ever-growing audience for them. These channels are eliminating the stale look of science as a mundane process that can only be understood by the highly intellectual by speaking it in a relatable way in bite sizes.

Our research involved finding science channels on YouTube to identify what is currently available to youngsters who take an interest in science. The top 10 channels include Veritasium (4.9 million subscribers), Vsauce (13 Million subscribers), MinutePhysics (4.5 million subscribers), AsapSCIENCE (6.9 million subscribers) and SciShow (5.3 million subscribers). These channels follow a similar formula as they tackle various science topics that may seem out of reach for the general audience and introduce them in a relatable manner.

So why use videos to engage our visitors? Science centres have been engaging with visitors face to face on the exhibition floor all this time. Well, simply put, the world is and has been moving into the fourth revolution and being left behind is not an option for science centres.

According to an article from the International Journal of Technology in Teaching and Learning, watching a movie or video provokes emotional links to the video you are watching. Whether the video be on television, in the cinema or even on YouTube. These emotions can be triggered by certain visuals or background music and may lead to the viewer downloading the video to re-watch and relive the experience, thus promoting learning. (Berk, 2009)
Using a platform like YouTube can be complex for so-called “non-Youtubers”. There are quite a few factors that need to be considered. Factors such as understanding the platform, content research skills, video editing tools, social media presence and digital awareness (Vidooly, 2018).

Understanding the platform involves learning how to add annotations and display links that guide your viewer to other videos or pages you would like them to look at. When uploading a video, you also need to select titles and thumbnail pictures that grab your viewer’s attention.

The content of your videos will have to be current or something that interests your viewers. You can achieve this by keeping up with social trends by using websites like Reddit, which is a social news collection, web content rating, and discussion website. Websites like Reddit are often referred to as your front row seats to the internet.

For us at the Cape Town Science Centre our content is largely based on the science centre exhibits. This is because the videos are to aid in the facilitation of the exhibitions and will be made available with the QR (Quick Response) code system. These QR codes are displayed on the various exhibits and with a quick scan with any QR reader app, the visitor is linked to the video and can watch it right on their cell phones.

Another factor that can help the success of your YouTube channel is social awareness. As the Cape Town Science Centre, we have multiple social media profiles. Profiles such as Twitter, Facebook and Instagram. These social media profiles can be linked to your YouTube videos and they can enhance the popularity of either one platform. This means that you now have multiple platforms for your viewers to follow you on and they can be notified about a new video upload on Facebook, Instagram or Twitter.

Once you know the content of your video, the filming of the video can proceed.

**Methods**

The filming takes place at the science centre when the centre is less busy. This would be before the schools arrive or after they have departed during the week days.

An area in our exhibition floor has been identified to run our pilot phase. This is an area that requires more explanation from the facilitator or ones generally the visitors struggle with. This area would be our test run.

A day of planning is taken out in order to write the script as well as doing more research on the science, history and background of the exhibit. Thereafter all the recording is done within one day and can take up from 1 to 2 hours.

As the videos are also meant to aid in facilitation, they are more focusing on explaining the science of solving the exhibit.

One other important factor mentioned above was the editing tools. Once all the footage has been recorded, we put it all together using the video editing software Adobe premiere pro. The clips are trimmed and combined to form a concise and attractive video, which is limited to five minutes.
The finished product is then uploaded onto the Cape Town Science Centre’s YouTube channel and can be accessed by viewers worldwide. In addition, a QR code is made, using a QR code designer, for the video, which will be placed on the exhibit for visitors to use.

The QR code is simple to use. With a quick scan by the visitor using any of the available QR code reader applications on their cell phones, they are directed to the Cape Town Science Centre YouTube Channel to watch the video linked to that specific QR code.

**Discussion**

YouTube channels dedicated to science topics has made science fun and interesting to youngsters and are becoming popular. The top 10 science channels have over a million subscribers. To name a few there is Veritasium with 4.9 million subscribers, AsapSCIENCE with 6.9 million subscribers and VSauce with 13 Million subscribers. These channels are changing the way people view science. They introduce exciting science topics in an understandable and entertaining manner.

The Cape Town Science Centre aims at accomplishing the same by showing that science is fun and interactive. As a result of the fourth revolution, everything is being digitalised and kids are learning to use devices at a young age. Therefore, we as science centres need to stay relevant and the use of YouTube and QR codes is just one of the ways we can do this.

Our videos are largely based on the exhibits and experiments conducted within the science center. Once approved by our advisory group, they are uploaded onto our YouTube channel and a QR code is attached onto the exhibit. This will enhance the visitor experience at the Cape Town Science Centre, but at the same time, it enables us to reach a multitude of people across the world.

**Conclusion**

Our hope for this project is to provoke excitement in young individuals and to use this great platform to its full potential. Bringing the physical Science Centre onto this platform is not only a great marketing opportunity but allows large numbers of people to interact or to see and experience our science centre.

**References**


The Impact of Technologies on Society
Bhekani Mathebula, ArcelorMittal Science Centre

The word technology consists of two parts (Techno) means application, art or skill, and (Logy) means science and learning. The linguistic meaning of the word technology is: the methods and tools that a society has developed in order to facilitate the solution of its practical problems and to provide the necessary needs for the community. Consequently, the use of technology in all areas of life increases risks, threats and crimes associated with the use of this technique, which reflects negatively on the possibility of its use in absolute terms in all walks of life.

This research deals with the impacts of misusing modern technologies on members of the society and their negative influences on economic, religious and social aspect, as well as their impact on people's behaviour and the responsibility of the society in monitoring the children who are in need of attention by everyone through the guidance of appropriate educational ways. Moreover, this research shows the need of joining all efforts collectively in order to protect the entire society from the dangers of modern technologies and work together to take advantage of its resources properly. This usually starts from the family and schools and ends with the universities, mass media and the various institutions that guarantee the rights of children from all different areas. However, this research emphasizes the fact that everyone should take his/her responsibilities towards using these methods properly whether at home or outside.
The purpose of this study was to investigate the implementation of Information and Communication Technology (ICT) infrastructures in Vhembe District secondary schools, with particular attention paid to the development of an information society in Vhembe district in which it is a predominantly rural area. The adequate and feasible use of ICTs has become of absolute importance to meet the educational demands of the 21st century for both teaching and learning. As South Africa practiced democracy in 1994 the Department of Education (DoE) fully implemented ICT into the school curriculum as well as in the school administration. Implementation of ICT has become more than just an addition to the existing practices. Therefore the part played by teachers and principals in the implementation process, induce the successful implementation in the secondary schools. In South Africa computers were made known in schools in the 1980s mainly for managerial objective. Although different methods and initiatives have been tried in the implementation process throughout Vhembe District secondary schools, no systematic wide effective and sustainable ICT infrastructure development in schools has come to pass. The implementation process is moderate and teachers shun from using technology in their teaching and learning practices due to lack of morale, refusal to adjust and negative attitudes, insufficient training, insufficient technical support and insufficient infrastructure. A qualitative approach was used in this study. Various sources of data collection included questionnaire and observation.
Using Technology to Enhance Learning

Themba Zwane, Mondi Science, Career Guidance & FET Skills Centre

Information and communication technologies (ICTs) have long been perceived as having the potential to transform education and student learning, especially in developing countries. The underlying belief of many initiatives has been that learning will happen if students and learners are provided direct access to ICTs. The focus in recent years on installing ever more ICT tools in classrooms is understandable, but misguided. Policymakers hoped ICTs in schools would facilitate more effective delivery of education, but the results have been disappointing. Children may have learned more computer skills, but the positive impact on more fundamental educational needs and curricular goals has been minimal.

In preparing for creative and complex roles, peer dialogue and peer experience is very often the most important and productive type of learning. The integration has a great effectiveness for both teachers and the students. The latest findings indicate that teachers are well-equipped preparation with ICT tools and facilities are one the main factors in success of technology-based teaching and learning. It was also found that professional development training programs for teachers also played a key role in enhancing students’ quality learning. For the future studies, there is a need for consideration of other aspects of ICT integration especially from management point of view in regard to strategic planning and policy making.
Airbus Foundation Discovery Space

Didier Laval, Didier LAVAL - Culture Instable

Rather than building new resources from scratch, could science centres make the best use of existing online resources, tools and platforms? This presentation will present an on-going collaboration between the Airbus Foundation, the Autodesk software company and science centres all around the world. This project is still open, and new institutions may freely join in and benefit from the resources and exchanges.

The Airbus Foundation has teamed with Autodesk Inc., the software provider for people who make things, to launch in May 2018 the Discovery Space, a digital portal with educational animations and interactive aerospace-themed lessons in 3D-design. The platform’s activities are in large part based on Tinkercad (online 3D-design platform for children), Fusion 360 (full 3D-design software), as well as on Instructables (Do-It-Yourself activity sheets). Children and young adults can also build portfolios and submit spacecraft designs to win the “Mission to the Moon” competition, hosted by the Sqore platform. The designs can also be exported to the Minecraft environment, or 3D-printed.

In this session, we will examine how this very dynamic partnership between science centres, a private foundation and a software company built new programmes with a different approach. We will present the resources and how they are currently used by organizations, and offer an opportunity for all interested science centres to join in and benefit from them.
Shaping the future for the disadvantaged through Mechatronics.

Phathutshedzo Malivha, Sci-Bono Discovery Centre

For most people, particularly young learners, mechatronics engineering is the least known field of all the engineering fields. Mechatronics is a career which was only known by only those who are fortunate, providing the opportunity to the disadvantaged youth makes Madiba proud.

This paper explains the important role the mechatronics lab at Sci-Bono Discovery Centre is playing in introducing the public to the amazing field of mechatronics, which is a multidisciplinary field of engineering that includes a combination of mechanical engineering, electrical engineering, telecommunication engineering and computer engineering. This is done through a number of activities which include; mechatronics, bionics, pneumatics etc. The importance of mechatronics in the future of our country will also be explored.
A taste of the future: 3D printing technology as innovation tool to supplement teaching and learning of STEM

Mncedi Rani, FOSST
We all share the same sky. Regardless of who we are, where we live, or what we believe, we can all look up and experience the same wonder about our place in the universe. Everybody has a different view of it, but virtually everyone is interested in astronomy. We like astronomy because it gives us a sense of the wider universe. However, some people may be hindered by lack of exposure to science or perhaps by being from disadvantaged backgrounds. So this work aims to discuss new and existing ways to educate and engage with members of the public and help them comprehend with what astronomy entails and its importance in our lives. This presentation will also compare what other countries are engaged in, in bringing people into contact with astronomy and arousing their interest in science.

One programme that would be of interest in this particular paper would be the MAPPP NINE which was established to contribute to the advancement of the public engagement with astronomy, as well as the science engagement sector in South Africa. This is done by training high-potential individuals in the sector in project management. It also uses codesign and co-opetition to develop disruptive public engagement projects. The programme was codesigned by the SARAO Communications and Stakeholder Relations Unit and the NRAO NINE Programme. The author was privileged to be a participant in this programme earlier in 2018.
The World and Beyond
Sithembile Msweli, Siphelele Bukhosini, Isibusiso Esihle Science Discovery Centre

This paper showcase a place where people of all ages could come and experience the fascinating, simplicity of the creation that has been and still is, without fear of being judged on how much they know. Astronomy is one of the three main pillars of Isibusiso Esihle Science Discovery Centre that has been instrumental in creating this place.

The journey of engagement is in various forms that focuses on making the studying of the universe more fun and easily understood. One that is part of Grade 6, 7, 8 Natural Science curriculum: Earth and Beyond where we host the Astroquiz competition and also grade specific workshop to encourage and foster learning. The other being Stargazing, Sky viewing, whichever way you may name it. This journey has not only provided theoretical information about the universe but has also enabled the community to gaze at the sky and be fascinated by the stars, planets, and moon.

Through these programs 150 individuals has been reached so far. Mandela would be proud that through Astronomy the community at large has a place to engage on scientific topics, share the cultural believes. Thus demystifying the perception and myth that mathematics and science are difficult subjects and encouraged the appreciation of the natural laboratory that has been freely given to us-THE SKY, as the greatest teacher.
Marketing is an important part of every organisation as it plays a role of spokesperson that communicates the uniqueness and the value of products and services that organisations offer. Science centres as non-profit organisations, can benefit from having marketing strategies and tools in place. They can benefit reaching out to untapped market, increasing visitor numbers, maintaining and nurturing already existing relationships with stakeholders, generating revenue/income, building a positive image of their centres and many other benefits. The talk will focus on the landscape of marketing activities and tools within science centres in South Africa, highlighting some of the theories in science centre/museum marketing, challenges faced by Science centres in implementing their programmes, opportunities available for science centres in marketing their programmes and the centre itself, share some best practises of marketing programmes within science centres in South Africa as well as making recommendations on cost-effective marketing tools and programmes that can maximise the science centres’ visibility and give them a competitive edge.
Establishing collaborations with society that would make Madiba proud

Tshepiso Maroga & Mathipa Sebitsiwa, Sci-Enza, University of Pretoria

Establishing collaborations with society that would make Madiba proud

Over the years Sci-Enza has built and maintained collaborations with entities from across various sectors of society. It is these collaborations that have allowed for greater reach and impact to be made across our community. The various stakeholders have come from within the science centre community, within industry, with community-based organisations as well as with government affiliated entities. They have served to be beneficial in allowing us to take the wonders and knowledge that are within our walls at the centre to the spaces our audiences occupy. There is great need to form, maintain and grow these relationships with entities to advance our mission. With that said, there are always challenges to overcome that are coupled with benefits. Our aim is to highlight these collaborations and showcase the varying involvements we have had with the different organisations. Also, to identify the importance of such collaborations, to share our challenges and best practices, and to encourage the need for science centres to tap into collaborative ventures.

Introduction

The field of science has historically and to some extent is still currently perceived as a segregated space. A space that is too complex to understand, too boring, too irrelevant to society, something people cannot relate to, leading to a perception that makes the field a territory for only the brave (or seemingly crazy). Using collaborations allows us to change this narrative and to some extent liberate science from this perception. Sci-Enza has collaborated with several organisations from different sectors thus enabling us to reach more learners and advocate for science. Our collaboration includes corporate/industry, science centre community collaboration, community based collaboration as well as government-related organisations. We established his collaborations with the aim of growing our reach, acquiring new skills from our collaborating partners as well as marketing our services. Some collaborations dates back to over a decade whereas some are still new but we hope to sustain them in a long run. However, there are challenges to these collaborations and also best practices to combat these challenges.

Highlight and showcase varying involvements with organisations in sectors across society

a) Corporate/industry collaborations

Sci-Enza collaborates with SAP, a specialist company in IT solutions through various avenues. The relationship has grown greatly in just over one year with collaborative involvement in various programmes from both parties. On the one side, SAP facilitates coding training for Sci-Enza staff in Scratch, a programme used in our school programmes throughout the year. On the other hand, they
employ those very skills gained by the Sci-Enza staff to assist in facilitating those courses to some of the schools they are affiliated with. One such school is the Duetsche Shule (both in Pretoria & Johannesburg) who hosts a science career expo for its learners every two years at which Sci-Enza was present this year to facilitate Scratch workshops.

With the training we have had, Sci-Enza has managed to increase its capacity and impact in the technology arena. Our coding workshops form part of several programmes we run, such as Science is Fun Holiday Programme, American Corner Programme, Africa Code Week, and National Science Week.

SAP has also collaborated with us through giving public talks at the centre. One such talk was titled, ‘Big Data’, open to students, staff of the university and the general public.

b) Science centre community collaborations

Within the science centre community we have partnered with many of our counterparts throughout the years. It is for the purpose of this paper that we will highlight only a few of such collaborations from the past year and a half.

As Africa and South Africa’s first and oldest science centre, over the years the centre has evolved and grown to encompass the promotion of all science disciplines through programmes specifically of relevance to those disciplines, aiming always to keep abreast with current developments within the various disciplines.

It is with this in mind that the following collaborations came to being:

- **World environmental & wetlands awareness day**
  As a response to an invitation by the Johannesburg City Parks, Sci-Enza participated in school awareness programmes for the promotion of world-wide environmental awareness days. The event was organized by the Johannesburg City Parks where learners were invited to participate in activities related to environmental awareness.

- **World Biotechnology Tour**
  This was an international collaboration with ASTC as well as other science centers around the world. In South Africa more specifically, Sci-Enza collaborated with Sci-Bono and the Cape Town Science centre to run the South African leg of the world tour. Here learners were expected to work on a biotechnology project that would have some positive impact within their community. The learners worked with mentors from the centre on a regular basis to develop this project. At the very end, they presented their projects to be judged and the winner won a chance to go to Japan for the World Summit. Sci-Enza’s ambassador was runner up while Sci-Bono’s ambassador took the first prize. These collaborations between the three centers assisted to bring to South African learners a very great opportunity to participate and engage with other learners internationally on issues that face the youth within their countries and how they can use science, more accurately, biotechnology to resolve or solve these problems.
- **Africa Code Week**
  This project, saw another avenue of collaboration with the Cape Town Science centre, who administered Google grants to run the project. With the training previously gained from SAP we were in a position to competently facilitate Scratch coding workshops to learners in Mamelodi. These proved to be very successful and we have since subsequently ran the same workshops in the current year as well. Allowing us to take coding, another discipline of science to the learners. Sci-Enzo also extends these coding workshops to other programmes at the centre such as our holiday programmers, National Science Week and American Corner. Showing that an opportunity to gain skills in a particular discipline can assist to broaden the scope of our in-house and outreach programmes.

- **World Space Week outreach talks**
  Together with SANSA, this year a series of talks was given at the Mamelodi reading room and American Corner Pretoria to create awareness amongst learners in the space science. This series of talks proved very successful as the learners were engaged and gave positive feedback on the talks. Such collaborations also assist to help us draw on the specialties of other organizations within our community. Increasing our impact and reach together as we grow collaborations within the community.

- **Astronomy public engagement outreach**
  The SKA hosted a public engagement outreach programme for the community of Carnarvon and its staff to launch the MeerKAT project. We attended the programme to provide outreach activities that promote astronomy. At Sci-Enzo we have a SKA puppet show developed to communicate astronomy and this large scale project to very young learners. Although the show itself as aimed at young learners it proved to appeal to adults as well, as many of the public and staff attended and were excited by the show. As mentioned before that many of the collaborations have assisted us to reach more people and have a higher impact. They have also allowed us to develop and grow our skills in communicating various disciplines of science as well as running and developing programmes and activities that promote these various disciplines. It is for these reasons that collaborations within our community are beneficial.

c) **Community-based collaborations**

Sci-Enza Science centre has been involved in community and government based collaborations whereby we worked in collaboration with different organisations to achieve a common goal, which is advocating for science. Sci-Enza participated in various science fairs and across in communities both around Johannesburg and Pretoria.
Loxion Science Fair Expo is an educational initiative by partnership between Mams radio, Science for Ubuntu and Brainwaves. This is aimed at exposing learners from townships around Mamelodi, Pretoria to science. The first annual event was hosted on Saturday the 30th of June 2018, from 08H00 - 16H00 at Ikageng Hall, Mamelodi, Pretoria. Different science organisations were invited to come and engage learners with different science disciplines as well as to raise the awareness about science. Not only did learners get engaged, they also presented their science projects to the judges and won prizes. Sci-Enza science centre, as an interactive facility, engaged learners with an exciting science show during the event to show learners other possible disciplines of science. United together, to ignite excellence in Science, Sci-Enza participated in Ekurhuleni regional Eskom Expo on the 18th of August 2018 as judges for the science projects as well as a science show performance. After learners had to work hard on their inventions and presentations for the judges, team Sci-Enza dazzled them with a science show. This was to loosen them up, ease their conscience and also to help them better interpret and understand science concepts.

d) Government-related organisations

The department of Education, Tshwane District hosted their first annual science fair. Team Sci-Enza got an opportunity to judge both regional and provincial science fairs in Pretoria.

The American Embassy has been funding Sci-Enza science centre for over a decade, for outreach engagement program in Mamelodi Mae Jameson Science Reading room. Sci-Enza visits the science reading room once a month to present a themed hands-on, program for high school learners of Mamelodi. After a decade of a solid relationship between them, in 2018, the American Embassy extended the science education outreach program and opened another branch at Pretoria, Sammy Marks Square Library and it is called American Corner Pretoria. Still working in collaboration with Sci-Enza. The setup and arrangements are similar to Mae Jameson Science reading room, however, the difference is for ACP, Sci-Enza team presents different themed programmes twice a month. In addition to that, every school holidays, team Sci-Enza presents a holiday program for two days.

Sci-Enza also partnered with several departments within the University of Pretoria. The JuniorTukkie programme of the Department of Enrolment and Student Administration at the University of Pretoria has been established to assist learners from Grade 9 to 12 to make responsible study and career choices. Junior Tukkie in collaboration with Sci-Enza, brings learners from different schools in South Africa (Junior Tukkie goes beyond national to market University of Pretoria) to the university’s premises to familiarise UP aspiring students with campus life. Together, we give career guidance as well as science education programs to the recruited learners. Thus increasing our statistics for the year as well as our marketing strategies.

Sci-Enza is showcasing UP research from different faculties of the University of Pretoria. Researchers showcase their research in the centre for exposure and this also benefit learners in a way that they get to see young researchers who invented new technology and made new discoveries. This
collaboration is beneficial to both Sci-Enza and the University as we encourage our learners to develop passion for science as well as putting UP researchers out there for different societies, stakeholders and everyone who comes to Sci-Enza.

Currently, we have a new collaboration with the Department of Physics to host an Honours student in our facilities. This honours student is doing a practical making use of Sci-Enza’s facilities and resources with the help of staff members. Part of her elective module, She has to familiarise herself with science communication at large. Upon completion, she will develop and perform her own science show. Her work will be evaluated by the manager and her Professor/supervisor.

Some collaborations began over a decade ago and they have been sustainably maintained. DST/SAASTA has collaborated with Sci-Enza to give young science graduates an opportunity to participate in an internship program to make them employable, as employers requires previous work experience before they can hire a candidate for a certain profession. DST/SAASTA has been appointing science interns on a short term contract and places them at Sci-Enza science centre. Sci-Enza gets an opportunity to host a National Science week annual event that is funded by DST/SAASTA and we also receive a Programmatic, Support Grant Initiative (PSGI) that we use for programmes that we run for disadvantaged schools.

The benefits of collaborations.

Collaborations increase the reach and impact of science programmes within schools and communities. For example, with JuniorTukkie and science expo’s, we get a wide variety of school learners and teachers that will go back to their schools and spread the word. This serves as a good marketing strategy for and science promotion and the centre’s many other programmes. Another benefit is building a strong and lasting relationship with other stakeholders. For example, we have maintained a solid, sustainable relationship with DST/SAASTA, American Embassy and Junior Tukkie for over 10 years and we are looking into maintaining the same relationship with our much recent collaborators such as the Cape Town Science Centre and SAP. Collaboration is another way of tapping into other funding opportunities for the centre allowing us to run more programmes by referrals as well. For example American Embassy increased our funding by growing their science education outreach engagement and involving us in it. This also increases our exposure to a broader world. As been the case with the World Biotechnology Tour as well, this gave the entre international exposure and the capacity to be recognised as a hub to tap into for future projects within the continent.

One of the greatest benefits has been the avenue of increasing staff capacity, our staff continually grow and learn new skills to impact and impart on the learners. Our greatest feat thus far is most certainly the coding workshops which have featured as an aspect in many of our existing programmes. Along with gaining these fourth industrial revolution skills, we can boast to have the backing of an accredited organisation in the IT development space, i.e. SAP and Google Africa.
Lastly, it is important to highlight that these collaborations are mutually beneficial, not only do we benefit but all other organisations that we work with are enriched and supported by our partnerships.

**Challenges and best practices**

There is the possibility of challenges to arise. Some of these can be noted as; a) lack of/ insufficient funding from either the centre or other organisations, b) lack of staff capacity to run in-house and outreach activities that overlap, c) growing/ capacitating staff that then leave with skills (volunteers) therefore not being able to advance further in the skill, d) sustaining good relationships and e) conflicting interests between parties.

However, this can be solved by better planning, contingency plans and unrestricted funding to cover all/ most of the overhead costs.

One thing Sci-Enza does extremely well to curb these challenges is invest greatly in staff that understand and value the need for teamwork. We are always drawing on the different skillsets and strengths of the team members to ensure successful engagements and programmes. Another essential is adequate planning i.e. taking the time to plan out activities, constantly rework ideas and allocate enough time to the planning and preparations. This can be efficiently done by assessing demand and taking on only as much as you can handle. We are continually open to learning and imparting with those that we collaborate with. Trying to ensure that we meet the collaborator’s needs and grow together.

In conclusion, the successes of effective collaborations come from aligning one’s organisation to meet the needs of not only yourselves but the collaborators as well. From all of the centre’s collaborators highlighted in this paper, the centre has benefitted tremendously from their involvement. We have seen our staff, programmes and reach grow. Our reach has grown in terms of the levels in which we cater to within society, whether that be schools, communities, corporate entities, staff and students, our university environment (staff and students included). We believe that this is to what our former president, Nelson Mandela, eluded to when he highlighted education as key factor to growing the nation. We take science education, awareness and promotion to society and in so doing contribute to building a legacy he would have truly been proud of. A legacy even the science centre community can be proud to be part of and contribute towards. All done through the collaborations.
The Importance of being an Entrepreneur
Martins Mpotu, ArcelorMittal Science Centre (Sebokeng)

What is Entrepreneurship? The capacity and willingness to develop, organize and manage a business venture along with any of its risks in order to make a profit. The most obvious example of entrepreneurship is the starting of new businesses. In economics, entrepreneurship combined with land, labour, natural resources and capital can produce profit. Entrepreneurial spirit is characterized by innovation and risk-taking, and is an essential part of a nation's ability to succeed in an ever changing and increasingly competitive global marketplace.

The importance of entrepreneurship considers the vital role entrepreneurs are perceived as playing in a capitalist economy in promoting economic development and looks at the history of the entrepreneur. They can act as agents of innovative change and they can transform existing firms to exploit new opportunities. However, the expectation that entrepreneurs can provide the panacea to economic ills is not always a realistic one. It has been overestimated. Despite growing interest and activity relating to the entrepreneurship phenomenon, considerable debate surrounds the notion of entrepreneurs and entrepreneurship.
Mathematics is an Art, Let Learners Be Creative

Daniel Motsapi, Khuliso Makungo, ArcelorMittal Science Centre

It is often thought that mathematics is a stringent subject, that needs a tough teacher and completely focused learners that get to the classroom and the session become teacher talking, learner listening and the END. This poster explores means done at ArcelorMittal Science Centre Sebokeng to remove the incorrect view of the subject. It looks at the methods applied by Mathematics edutainers at the science centre and the focus is on the class called FUNDA Care, which is an afternoon programme aimed at learners that are not part of the focus groups, who in their nature are met with the same problem outlined in the first two lines of this abstract. The process includes how learners are introduced to the subject they already know and how they can enhance their knowledge by use of extra means such as music and use of social media.

Introduction

Mathematics occupies an odd place among the arts and sciences. It is usually lumped together with the sciences---and it is, after all, more rigorous and exacting than any of them. That said, mathematics shares a surprising amount with art. Mathematicians care not only that a result is proven, but that it is proven clearly and simply. There is a notion of Mathematical beauty that is difficult to put into words, but anyone who has ever felt it knows exactly what elegance means in math. Mathematics teaches learners how to solve problems and being creative. Our aim is to change negative thinking in learner’s minds about maths. We want each learner to improve the maths marks by at least 30%.

This is achieved by Adapting Maths Teaching to the Following Programmes:

Focus Group

Is a group of learners adopted from surrounding schools which are selected by the department of education to attended structured classes at the science centre on a weekly basis.

• They Spend 36 Weeks with the science centre (Once a Week)
• Their learning is formal (Classes Starts from 8 am – 2 pm)
• Spent an average of 1 hour 30 minutes per class
• They are Subjected to Formal Assessment (Baseline and Output)

In Mathematics the programme changes from teacher centred (as it is done in School) learner centre (Learners are leading whilst the edutainers facilitates)

Funda Care
It is an extension to the focus group, learners on this programme are not selected as with other learners, they are learners who request help with subjects that are offered at the Science Centre.

- This is a special programme
- Delivered after school (2pm – 4pm)
- Adjusted to the needs of the group
- No assessment (Use of Social Media encouraged)

**AET Group**

These are out of school youth, second chance learners and those that want to upgrade their marks. They mostly come from the neighbouring community Adult Education and Training Centre. For them the programme is far different:

- They are allowed to come at anytime (Between 8am – 4pm)
- Some are completely struggling as those without prior knowledge
- Other are given help based on their prior knowledge

**Methods Employed at AMSC**

Mathematics and art are related in a variety of ways. Mathematics has itself been described as an art motivated by beauty. Mathematics can be discerned in arts such as music, dance, painting, architecture, sculpture, and textiles.

- Maths role-play
- Sing songs to make it stick
- Physical as well as the visual aids
- Dancing maths
- Introduce an Acting & Maths Week
- Use the power of music
- Remember that Find maths in stories
- Geometry is everywhere – Go on a maths adventure –

**Mathematics Results at AMSC**

The results below shows how the science centre has improved the maths result in schools compare to the average obtained by the national department, district we serve and the science centre. What we derive from the table below, is that indeed as a centre we can adjust our methods to ensure that mathematics improve
<table>
<thead>
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<th></th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
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<td><strong>National</strong></td>
<td>49.1%</td>
<td>51.1%</td>
<td>51.9%</td>
</tr>
<tr>
<td><strong>District</strong></td>
<td>61.6%</td>
<td>61.5%</td>
<td>50.9%</td>
</tr>
<tr>
<td><strong>Science Centre</strong></td>
<td>75.3%</td>
<td>77.2%</td>
<td>61.1%</td>
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**Conclusion**

Learners must be able to solve world problem for better future. Creativity is what real world wants. Learners qualify for University and bursary from different companies.

**REFERENCES**


**CONTACT INFORMATION**

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The Great South African Invention: Post democracy
Happy Vilakazi and Njabulo Duma SAASTA

This paper looks at the ground-breaking achievement by South African inventors and innovators post democracy. A list and timeline of innovations as well as inventions and discoveries that involved South African people or South Africa including predecessor states in the history of the formation of South Africa is provided in Appendix A. It should be noted the list is not exhaustive. This list covers innovation and invention in the mechanical, electronic, and industrial fields, as well as medicine, military devices and theory, artistic and scientific discovery and innovation, and ideas in religion and ethics.
Adding value

Vuyolwethu Ngalo, Nelson Mandela Bay Science Centre

The year of 2018 marks the centenary year of the independence leader of South Africa Tata Mandela. Despite the passing of this world icon in 2013 at the grand age of 95, his entire life still stands as a testament of the power of the human spirit. In the face of dire circumstances, Mandela nonetheless exerted his inimitable spirit of resilience, activism, leadership, civic duty, public engagement and overall seeker of knowledge. leader and ultimately one of the world’s greatest-ever humanitarians. The Nelson Mandela Bay Science and Technology Centre, through its programmes carries Madiba's legacy, through public engagement, tours provided to disadvantaged schools, revisions and holiday programmes.

As SAASTA volunteers and science promoters, we do not only get the privilege and enjoyment of working with brilliant and exciting young minds, but also grow as individuals in our career fields, accentuating and cultivating our practical experience. The science centre hosts a number of 15 – 20 schools per quarter, through in-reach programmes providing free access to our facilities and programmes, and also conduct outreach programmes, going out to seek the most disadvantaged schools around the Nelson Mandela bay, and providing free educational material. Furthermore, we rigorously measure our level of impact with our learners through pre and post evaluation test, to ensure that we provide meaningful change, and thus far we have had increasing results ranging from above 20% pass rate.

The legacy of Nelson Mandela is by far one the greatest inspiration towards the attainment of education. In his words Madiba said ‘A good head and a good heart are always a formidable combination. But when you add to that a literate tongue or pen, then you have something very special’ in deed science centres around the country carry this torch as their beacon of hope for the development of South Africa. The focus on the most untainted, spirited and most creative minds of young individuals at the tender ages of exploration and experimentation, driven by a need to discover new frontiers. With the combination of science and technology this focus is more magnified opening up a world of imagination and what would appear to a child as only wonder and magic.

With grave statistics in the country, it is crucial to focus on these skill, and with science centres, and most significantly the Nelson Mandela science and technology centre, which does not only bare the name of a legend, but being the first standalone science centre that is not part of an institute of higher learning in the Eastern Cape, it bridges the gap of financial burden and access to the most in need of education, truly signifying the triumphant spirit of Nelson Mandela of breaking barrier towards the search of knowledge. Science opens our minds to new ideas and teaches us all about the world around us.

The presentation will share how the Nelson Mandela Bay Science & Technology Centre continues to inspire learners through its programmes, making Mandela’s Legacy more than a slogan.
Impacting Communities through Education
Sci-Bono Outreach Team

Bettering Lives of the Community through Education

Mandela Quote

“Education is the great engine of personal development. It is through education that the daughter of a peasant can become a doctor, that the son of a mine worker can become the head of the mine, that a child of farm workers can become the president of a great nation. It is what we make out of what we have, not what we are given, that separates one person from another.”
Pathogenic Escherichia coli strains recovered from selected aquatic resources in the Eastern Cape, South Africa and its Significance to Public Health

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The prevalence of pathogenic microorganisms as well as the proliferation of antimicrobial resistance is significant to public health, but the magnitude of impact of aquatic environs concerning the advent and propagation of resistance genes remains vague. Escherichia coli are widespread and encompass variety of strains ranging from non-pathogenic to highly pathogenic. This study reports on the incidence and antibiotic susceptibility profiles of E. coli isolates recovered from the Nahoon beach and its canal waters in South Africa. A total of 73 out of 107 (68.2%) PCR-confirmed E. coli isolates were affirmative for at least one virulence factor these comprised enteropathogenic E. coli 11 (10.3%), enteroinvasive E. coli 14 (13.1%) and neonatal meningitis E. coli 48 (44.9%). The phenotypic antibiogram profiles of the confirmed isolates revealed that all 73 (100%) were resistant to ampicillin, whereas 67 (91.8%) of the pathotypes were resistant to amikacin, gentamicin and ceftazidime. About 61 (83.6%) and 51 (69.9%) were resistant to tetracycline and ciprofloxacin respectively. About 21.9% (16) demonstrated multiple antibiotic resistances with 100% exhibiting resistance to eight antibiotics. We conclude that the Nahoon beach and the canal waters are reservoirs of potentially virulent and antibiotic resistant E. coli strains thus, constitute a public health risk.
Applications of Telecommunications in the 21st Century Science Centres to enhance Public Communication and Bridge the Barriers in Learning.

Zibusiso Nyoni, Sci-Bono Discovery Centre

This is the century of Information Technology, almost anything and everything will apply IT as we move forward as the human race. Also termed, the fourth Industrial Revolution. Artificial intelligence is gaining momentum and traction and being applied widely especially in the first World. Science Centres are in the communication business, they aim to educate. They entertain and thrive to conscientize the public, effectively/ ineffectively. They translate the otherwise unfamiliar and inaccessible into the familiar and accessible. Science Centres are a form of media just like the broadcasts, e.g. tv, radio and newspapers. Research has shown some striking parallels between museum and tradition media audience. The phenomenon of “Active Dozing” where the audience often seem bored as they interact with the media at some point during their interactions. The visitors in the Science Centres sometime seem to get bored and wonder aimlessly during their visits to our Centres. They also seem to attract the young ones more than the teens. This shows that visitors do not get the full value out of their visits to our Science Centres.

Science Centres occupy physical spaces, and the majority have exhibits and signages that briefly explain the principles behind the display. Majority of exhibits are built like this and maybe the source of boredom to our visitors. Science Centres could do more to attract visitors if they would provide more information and entertainment or a combination of both, also known as edutainment, bearing in mind that Science Centres are in direct competition with other leisure pursuits and mass media that use IT extensively. Science Centres should emphasize more and work by putting information on various multimedia rather than objects. Findings show that visitors think that information is more important for the exhibits, and if there is lack of information, visitors tend to lack the understanding thereby becoming disinterested in the exhibit. Communication is key to the understanding of exhibits. It is important for Science Centres to understand connectedness’ between visitors, exhibits and information. This also fosters inclusivity especially for the disabled community which will be able to learn and benefit through the use of various multimedia.

In the developing world, South Africa included, Science Centres lack the application of Information Technology for the enhancement of Public communication. The use of “Virtual Science Centres” to add onto the existing physical infrastructure should be considered immensely. Virtual Science Centres can add value to the connectedness principle. This “connectedness” is the basic feature of a “virtual Science Centre” which has the ability to transcend the abilities of the traditional Science Centre in presenting information. This is done by displaying digital representations of the exhibit, more in depth information on it, videos, and everyday applications. “Virtual Science Centres” provide multiple levels of perspectives, and dimensions of information on a particular topic, it provides a range of multimedia (print, visual images, photographs, video and audio)

Then, in this context, Science Centers especially in developing countries have to do away with exhibit-centric attitude, in this rapidly advancing technological world to incorporate “virtual” Centres in their operations. In that way they will reach audiences far and wide, enhance their public science communication initiatives to give visitors more stimulating and interesting experience through the use of world wide web.
Greatest Discoveries made from simple observations
Thembisa Ngubane, Siphesihle Bukhosini, Isibusiso Esihle Science Centre

Disadvantaged rural communities have been left out in most of the advancements made in the world, especially when it comes to technological advancement, urbanization, and education. Which limited them from opportunities to show off their potentials, skills and proper education. Isibusiso Esihle Science discovery centre has for the past 5 years been popularizing science in schools and public, engaging them on science activities, curriculum supports and career guidance. Isibusiso Esihle Science Discovery Centre aimed at unlock people’s potentials, exposing the local community to greater opportunities, communicating science, making science accessible, improve literacy skills in schools and creating a healthy mind through science play, while meeting the primary objectives of a science center. The center had a number of activities that were carried out to try and achieve its goals, activities under the three main pillars namely: Astronomy, Environmental, and Critical thinking. Under each pillar there were programs ran which are: career guidance, curriculum support, early childhood development and other programs. Activities were then carried out in various areas, with an aim to achieve the objectives of the center. Evaluation interviews were conducted to some of the schools we had visited to establish whether we had met our goal on helping the public and learners. The number of people reached was collated and the feedback from the interviews. The evaluation results indicated that the little we do with them, has far greater impact on their lives and school.
Simply BIG Science
Thabang More and Shoneez Parsons, Sci-Enza, University of Pretoria

Communicating any type of research is not only essential but it plays a critical role in extending knowledge and inspiring the young ones who will carry the baton in the future. ‘Simply BIG Science’ uses a variety of puppet shows that deal with current and core scientific information. Puppets are impeccable for grabbing attention because they are harmless, fun, and a natural advancement from educational animations that young children are exposed to from home. This paper explores puppet shows and scientific concepts such as ‘bio-mimicry’, ‘environmental pollution’ and ‘math literacy’, to instill the love for exploration, curious and learning.

Introduction

This paper intends to clear the misconception that children from the reception grade of school (grade R) are too young to learn about scientific concepts. Many believe that children in this age group (3 years – 7 years) fail to grasp scientific concepts because they seem too complex for children to comprehend, and that their minds have not yet developed to the capacity of handling scientific information. Sci-Enza refutes this by using Early Childhood Development (ECD) techniques to educate children about science. Preschool years are a period of extremely rapid brain development, it is crucial that this age group receives proper stimulation (Hunter, 2016). One of the ways in which we do this is by performing puppet shows that aim to transfer science concepts to the children. Interactive learning, audio and visual stimulus are used to aid Sci-Enza in doing this.

The brain is the command centre of the human body and a new born baby has all of the brain cells (neurons) they’ll have for the rest of their life, but it's the connections between these cells that really make the brain work (First Things First, 2018). The brain makes it possible for us to manoeuvre, think, and converse. The early developmental stages are important to make these connections. At least one million new neural connections (synapses) are made every second, more than at any other time in life (First Things First, 2018).

The growth of the brain is governed by many aspects, including children’s experiences, relationships and environments. At birth, the average baby’s brain is about a quarter of the size of the average adult brain (First Things First, 2018). Extraordinarily, it doubles in size during the first year. It keeps growing to about 80% of adult size by age 3 and 90% – nearly full grown – by age 5 (First Things First, 2018). Comprehensive early childhood development programs are designed to improve the cognitive and social-emotional functioning of preschool children, which, in turn, influences readiness to learn in the school setting (Anderson, et al., 2006). The techniques that we use during puppet shows are coupled with characters that the children can relate to as children enjoy television puppetry such as Takalane Sesame and Thabang Thabong. Children start off playing with their dolls and conversing with them, with puppet shows the dolls/characters come to life and because they are so
much alike to the puppet shows they see on the television set and the dolls they play with at home, children are inclined to listen and be attentive during a puppet show performance.

Interactive learning is a more active and hands-on process of conveying information. Passive learning is dependent on listening to teachers lecture or rote memorization of information, figures, or equations (Scholastic, 2018). With interactive learning children are encouraged to partake in the dialogue, through technology or through role-playing group exercises which is the technique preferred by Sci-Enza.

By introducing interaction during teaching, children are more likely to grasp concepts because they would remember the hands-on component of the scientific phenomena they are being taught. Sci-Enza’s puppet shows incorporate physical interaction such as demonstrations that the children are asked to perform and as well as sing along tunes that are easy to remember.

**Puppet shows offered at Sci-Enza**

1. **Square Kilometre Array (SKA) Puppet Show**
   
   This puppet show is about a little girl named Hannah, Lulu the wise owl and Mosha the meerkat. Hannah is visiting her grandfather in Carnarvon near the SKA site, she is interested in the large dishes that she saw and Lulu the wise owl explains to both Hannah and Mosha how these large dishes work and what the SKA project entails. Mosha is a fun and inquisitive character whose name coincidentally means meerkat which is also the name of the new radio telescopes that the SKA are currently constructing.

   The SKA puppet show teaches the children about radio astronomy and how the sound collected by the large dishes is interpreted. This is done by using very powerful computers that enable the scientists to convert the information into images that we can understand in order to answer mysteries of the universe. The idea is elaborated by using a radio as an analogy of how the signals are sent from a transmitting station and how this information travelling in radio waves, is received by the antenna on the radio and thereafter converted into signals in the form of sound waves that we can understand.

   All of the Sci-Enza puppet shows end off with a song for the children to sing along to together with the puppets. In the SKA puppet show, the song differentiates between the KAT7 which are the first dishes to be built on the site, the MeerKAT which are the successors of the KAT7, and lastly the SKA which is an arrangement of dishes scattered over a large area. The total surface area of the dishes on completion equate to one square kilometre, making it the largest radio telescope in the world, comprising of 3000 dishes and the antennas to the dishes are located on the other side of the world in Australia.

2. **Environmental awareness show – Oceans**

   Oceans is a puppet show that aims to teach children about the importance of conserving our water sources and how to protect them. It focuses on giving environmental awareness to children so that they can grow up knowing the importance of saving and understanding what exactly global
warming means. This puppet show is a dialogue between Wendy the wise Owl, Lesego the Lion and Tracey the sea turtle. The puppet show also involves a narrator who interacts with the audience and re-iterates what is being said by the puppets to ensure that there is understanding between the children and what is being said by the puppets.

The puppet show talks about how plastic affects marine life and the song at the end of the puppet show encourages the children to always clean up after themselves to avoid pollution by recycling reducing and reusing material because it will help sustain our habitats and make the environment safe for animals to live in.

3. **The Magic of Numbers Puppet Show**
This puppet show is all about numeracy and measurements, it aims to teach children counting and different measurement units. The children have to help the character in the show count the number of beans in one pot and look at different kinds of beans while they count how much of each they have. The children also get an opportunity to look at volumes and how they relate to our everyday lives, the litre is discussed and how much material can fit into a litre in terms of its uses in our day to day encounters, water is used to emphasize the use of the volumetric measurement unit.

4. **Chemistry puppet show**
The aim of this show is to educate and raise awareness about fundamental concepts of chemistry and give the learners insight about chemical reactions. Sibo is the main character who explores different chemicals and makes a reaction that causes a mess in the kitchen, she is afraid her mother will shout at her when she gets home because of the big mess she made, she also wants to understand why the chemicals reacted in that way. Carbon is one of the puppets that tries to explain what atoms are and how they make up matter, he further explains how these atoms bond to make molecules. a few examples are made from everyday life like gold jewellery and the oxygen we breathe, molecular bonding is shown by paring molecule puppets and models to make up the water molecule and oxygen molecule using oxygen atoms.

5. **Bio-mimicry puppet show**
This puppet show intends to educate children about how people get inspiration from nature to incorporate into designs of transportation and infrastructure. This puppet show is also a dialogue between two characters; Nene the Owl and Bubu the Lion. Nene notices that Bubu has burrs on his fur. Bubu notices that the burrs work in a similar way as the Velcro he noticed on some items that humans use. Nene explains to Bubu that this is an example of bio-mimicry and explains what bio-mimicry is. Examples are used throughout the show to re-iterate applications of bio-mimicry in everyday life such as the gills of a shark and gills found on fenders of some cars, the shape of a
bird’s wing and the aeroplane wing. The narrator incorporates interaction with the children using the examples given.

Experiences

The puppet shows differ in terms of complexity, the most complex being the SKA puppet show. From the feedback given by our audience the SKA puppet show is too long and introduces a lot of new concepts that the children have not interacted with as yet. Because of this they tend to get distracted easily and lose concentration. The SKA puppet show is the only one we have had the opportunity to perform to an older group and they enjoyed it more. This might be because the adults had an idea of what the SKA is about. They interacted more with the characters and enjoyed the song.

The Oceans puppet show is the least complex show that Sci-Enza offers. Children are aware of the importance of saving water and the effects that water pollution has on the environment as these concepts are already touched on in pre-school and at home. The children love interacting with the puppets and readily respond to the questions that the puppets ask. This show gives the children the confidence to ask questions and also comment on what the puppets say. The song at the end is also a component of the show that the children really enjoy and something that they can take home with.

The maths puppet show was performed for pre-schoolers and they interacted very well when it came to counting and some measurements. It was however difficult for them to understand volumetric quantities and measurements of weight. They seldom get distracted and this was attributed to the length of the show. The teachers suggested that the puppet show focuses more on counting and concepts of addition and subtraction rather than the units of measurements. This would ultimately make the show significantly shorter and keep them concentrated for the duration of the show as they have a short concentration span.

The chemistry puppet show is received very well. There was a lot of interaction between the children and the characters of the show. The show was also well received by the teachers and said that they have also learned a little more about concepts of chemistry. Initially the chemistry puppet show was a little long so the feedback that was received from the previous shows was implemented by reducing the duration of the show. This had an immediate effect on the interaction and unhindered concentration from the children.

The bio-mimicry show was received with utmost enthusiasm. The children were energetic and enjoyed interacting with the characters and initiated conversation with the puppets. The audience expressed their love for nature thus, it was easier for them to relate to the theme. It was recommended that for children that are second and third English speakers, new vocabulary such as ‘Velcro’ and ‘burrs’ should be discussed in detail during the show to ensure that the children are on par with the discussion as they are not familiar with the words but they recognise the item once they see it.

To add onto the feedback that was given by the teachers, we recommend that more colourful, eye-catching visuals should be added and more interactive activities to do during the shows. It is also
advisable that a Public Address system is used for each and every puppet show as the curtains of the puppet stand block out the sound that is coming from the puppeteers while performing.

**Conclusion**

The puppet shows that are offered at Sci-Enza encompass a variety of techniques in which to ensure that children that are watching the show are given the opportunity to imagine the concepts they are learning, to experience the science by taking part in the demonstrations and also to remember what they have learnt by using songs in the puppet show. Sci-Enza recommends that puppet shows be incorporated in the programmes that different science centres have because the children walk away having learnt at least one concept and having understood the gist of the concept that was taught. The puppet shows that Sci-Enza offers have shown that children are never too young to start learning about science. It is easier for children to grasp ideas if they are presented in easy to understand words and supplemented by the use of analogies and examples that they can relate the ideas to.

**References**


Genetic polymorphism of TNF alpha gene promoter region in a cohort of children in Northern South Africa: Distribution and potential impact on diarrhoea and malnutrition.

Caroline Davhana, Vuwani Science Resource Centre

Background: Genetic polymorphisms are responsible for inter-individual variation, therefore, they are considered as the main genetic elements involved in the development and progression of complex diseases. Diarrhoea, malnutrition and acute lower respiratory infection are among the complex diseases worldwide. The present study aims to determine the impact of the polymorphism of TNF-alpha gene promoter region on diarrhoea, acute lower respiratory infection and malnutrition among children under the aged of five.

Material and methods: A total of 199 individuals were enrolled in the study. The -1031(T/C) and -308(G/A) polymorphisms of TNF-alpha gene was analyzed by polymerase chain reaction followed by restriction fragment length polymorphism (PCR-RFLP). Diarrhoea and anthropometric data were collected from children on a monthly basis for up to 36 months of age. The chi square was used for analysis and p-value less than 0.05 was considered significant.

Results: Out of 199 participants, 52.8% were female. The CC homozygous genotype at position -1031 was significantly higher among children with lower respiratory infection (P=0.027, OR=2.656, 95% CI=1.089-6.479). However, TC heterozygous genotype was protective to children who had no diarrhoea (P=0.019, OR=0.446, 95% CI=0.226-0.882). The AA homozygous genotype at position -308GA was more common among children with diarrhoea (P=0.012, OR=0.3420, 95% CI=143-0.815), and was significantly associated with risk factors for vomiting (P=0.010, OR=0.355, 95% CI=0.159-0.792).

Conclusion: The present study shows for the first time that -1031(T/C) polymorphism of TNF alpha promoter gene is associated with diarrhoea, and acute lower respiratory infection among the children, while -308(G/A) was associated with vomiting, diarrhoea.
Knowledge Sharing for Capacity Building
Sakhile Masango, ArcelorMittal Science Centre Newcastle

Sharing of ideas with other people to improve the quality of life would undoubtedly make Nelson Mandela proud.

Education is the only tool that we can use to transform the world.
Mangaliso Mathebula, Mondi Science, Career Guidance & FET Skills Centre

We are living in the scientific and technological revolution. There is a great need to accelerate change in the fields of Science, Technology, Engineering and Innovation. The way in which Computer Science and Information Technology is rapidly advancing demands on us as the nation to seriously consider how to prepare our youth to be economically active in the society driven by Information Technology.

The application of Science, Engineering and Technology can lead to the creation of new products and services that will make our world to be a better place. To achieve this we need to look at the following:

The role of SAASTA, SAASTEC and SCIENCE CENTRES in promoting SET.
The role of MST schools and MST Academy.

Nelson Mandela said “It is impossible until it is done. The question is by whom and how?

1. The use Career Guidance Centers to fulfill the dreams of the youth and the promotion of Science today for the world of tomorrow.

2. The use of role models as a source of inspiration.

3. The role of Mathematics, Science and Life Orientation educators to open learners eyes to the possibilities that await them in SET careers.

Let us keep learning, be helpful and to inspire our learners to believe in themselves.
**Can Nano-materials be used to reduce CO2 emissions?**

Sakhile Ntshangase, Mondi Science, Career Guidance & FET Skills Centre

Science has developed today to such an extent that even bizarre ideas can be brought to life with innovations that people could not even think about a few decades ago. This is prevalent from the largest entries in the vast dark universe to the smallest particles that we know exist. The macro and the micro realms are both undergoing extensive studies and mind-boggling discoveries are being made.

CO2 emission is on the rise and needs to be curbed down. So taking into consideration recent developments, the question that arises is whether nano-materials can be used to reduce CO2 emissions. A new type of Nano material has been discovered. It efficiently separates the major greenhouse gas, carbon dioxide, from nitrogen. However, it gets pretty serious when we take into account the fact that nitrogen and carbon dioxide are the two most significant components of the gaseous waste expelled from power stations that work on coal. Now CO2 can be removed from the waste gas before it is released. This CO2 can be put to other use.

Today, when the world is slowly turning into a dark place full of pollution, we do need to change to cleaner forms of energy as soon as possible. But this approach is not straightforward. Instead, if we can clean up the hazardous emissions, we will be able to discover the correct way to utilise technology.

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**The use of Absorption metals to enhance photocatalytic applications**

Nqobile Sibeko, Mondi Science, Career Guidance & FET Skills Centre

Environmental pollution and industrialization on a global scale has drawn attention to the vital need for developing new hygienic and environmentally friendly purification technologies. The most common indoor and outdoor purification process have their corresponding limitations of electricity and/or other energy sources. To address such enormous tasks, advance oxidation technology like heterogeneous photocatalytic systems via metal oxide semiconductors such as TiO$_2$, ZnO, that are capable to operate effectively and efficiently under UV and visible light must be established. Due to the wide band gap of semiconductors, they are unable to absorb visible light. Numerous research efforts have been done to increase the photocatalytic activity and optical absorption of semiconductors by various methods.

This presents the study of enhanced absorption capability of metal modified, especially silver modified, TiO$_2$ and ZnO and silver-ceria co-doping on TiO$_2$. Experiments were to be carried out with characterization techniques being explained in detail. The present work deals with the synthesis of unmodified metals and with various mole% of metal modified TiO$_2$, and ZnO. Photocatalytic activity is analyzed using a model dye, rhodamine 6G (R6G). It is reasoned that the presence of silver facilitates the interfacial charge transfer processes in such a way to utilize the CB electrons for enhancing the photocatalytic activity. In overview, the work produced and results derived from the current study have different potential applications in the field of semiconductor photocatalysis.
Adverse environmental impacts from the establishment of hydro-electric power generation station in the semi-arid South Africa: Mbashe River

Mamagolokwe Malefane, National Zoological Garden

A study carried out by Pegels (2010), revealed that during the apartheid regime in South Africa, about 30% of households had access to electricity leaving surplus electricity by Eskom. According to Eskom SA, shortly after the inauguration of democracy, more than 70% of households were reported to be electrified as part of a development plan thus placing pressure on the major power producer i.e. Eskom. Winkler (2005) and Pegels (2010), further explained that the solution to this crisis demanded the creation and implementation of renewable energy sources which include wind, solar, biomass and hydro generated power. For the purpose of the presentation, the focus will be on the adverse environmental impacts from the establishment of a renewable energy source that is a hydroelectric power station in terms of ecosystem services to residents and aquatic ecological processes to name a few. Nelson Mandela’s dream entailed having rapid expansion of its scientific and technological skills. South Africa has relatively accomplished that dream but the major challenge is climate change. Therefore, the efficacy of hydroelectric powers will deteriorate with changing climatic conditions i.e. drought since it is a semi-arid country as described by De Wet (1990). An alternative energy source is required to ensure sustainable power supply throughout generations.

Recycling of cell phones to save gorillas in the wild

Boitumelo Moeketsi, National Zoological Garden of SA

Cell phones have become a necessity for many people throughout the world; they contain a number of hazardous substances and minerals that can impact the environment in a negative way when discarded. Coltan, also known as columbite-tantalite is a metallic ore and can be processed to becoming a heat resistant powder that can hold a high electronic charge. About 80% of this raw material is mined in The Democratic Republic of Congo to make cell phones globally. The DRC is home to the eastern lowland gorilla subspecies.

Since cell phones are a necessity, their demand has increased dramatically. Unfortunately the mining of coltan has resulted in the widespread destruction of habitat, which thus affected the ecosystem these species live in and causes a decline in the number of species.

Collecting old cell phones and recycling the coltan used can reduce the amount of coltan being mined, thus reduces the destruction of primate habitats. The National Zoological Gardens of S.A also wants to adopt the idea of recycling cell phones and other electronic devices to eventually reduce the demand of mining of coltan to manufacture new and improve cell phones.

This initiative will then bring awareness to the public regarding primate conservation. There should be a balance between mining of the raw material and conservation of species in the region of the rainforest.
RHI—TRACKER
Gumede Thandoh BS, BSG Centre

Keeping Madiba proud is not just a theme but our everyday habit. This is a device used to track the rhinos, more advance compared to the ones used in National parks, it is made of different kinds of tracking devices, such as towers and apps or installations.

AIM: To protect rhinos that are continuously killed each and every day for the past years while making Madiba proud in the process.

Rhi-tracker is a tracker that is meant to stop the rhino poaching and stops the killing of rhinos before they become cartoons or history. It tracks rhinos through towers and apps with the use of cell phones, which will be controlled only by the game reserve’s management only, so that there is no way that an outsider can intrude or come on board and hack the system then porch the rhinos. Since every staff member on board will have an access to this smart phones, an assurance is given that just in case someone is tempering to hack the system the other devices will be able to recognise that a certain device is not functioning or out of order.

Basically the device is going to read the radius around the whole yard where these rhinos are located, so every time the rhino take a move, then the rhi-tracker will be able to determine its safety for that matter. The area is going to be measured using the satellite, to make sure that the whole yard is measured accordingly.

The rhi-tracker won’t only protect rhinos but can be used in the protection of other animals as well, it is just that, our main focus is on rhinos due to their scarcity, hence people only see them as fast cash, so doing this will not just stop the rhino poaching only but also make Madiba proud.

The phones will have power bank signals to boost phones in case you are travelling in an area that might be out of network, and that will keep the area 100% safely monitored. With these phones even the rhinos and animal’s statistics or population can be read.

I therefore request that this rhi-tracker is given a chance hence none of this has been done before.
**Hydrogen Storage for Stationary and utility Vehicles**

Suprice Mnisi, Mondi Science, Career Guidance & FET Skills Centre

A description of the technologies for hydrogen production, conditioning, storage, handling, transport, and for the application in possible transport, domestic, industrial and other uses is given. Metal Hydrides (MH) provide efficient hydrogen storage for various applications, including Low Temperature Proton Exchange Membrane Fuel Cells (LT PEMFCs), when system weight is not a major and critical issue. Endothermic dehydrogenation of Metal Hydrides leading to decreased rates of $H_2$ evolution eliminates the risk of accidents even in the case of rupture of the hydrogen storage container. At the same time, it poses a number of challenges related to the constant, stable and sufficient $H_2$ supply for stable FC operation.

**Science centers as learning centres: Lessons from the grassroots**

Vhonani Netshandama, University of Venda

Challenges facing societies are intensely local. The question of resource limitation is incontestable, particularly in rural areas. The relationship between limited resources and the number of school leavers who are ready to take on Math and Science at tertiary level cannot be ignored. In this paper, I will argue for the renewed purpose of Science centres if science centres are to realise its main objectives, which is to bring Science, Mathematics and Technology education closer to the rural communities. As anchor institutions in the communities, science centres should be more open, adaptive, accommodative and fully utilized. The traditional roles, i.e. teacher empowerment and careers education are limiting.

Based on the experiences of working with communities, I will argue for their re-branding as interactive learning centres, a place where science can be made exciting, accessible, recontextualized, made possible and current. The popular narrative perpetuates making science centres exclusive. In addition, the model of attaching the science centres to the universities that we know have systemic challenges, without the necessary support could be a deterrent for effectiveness. Science centres are capable of facilitating the development of Innovative Science Outreach programmes and intergenerational learning platforms for an array of science fields such as Environmental sciences, Health Sciences, Human and social sciences, all of which are important for the development of science learning excitement. Relevant examples will be outlined.
Making Mandela Proud by providing an inclusive Science, Technology, Engineering and Mathematics (STEM) learning to all.

Fulufhelo Khomola & Mary-Ann Makama, Sci-Bono Discovery Centre

South Africa just like any other developing countries is facing several socio-economic problems such as widening gap between the poor and the rich and lack of inclusive education amongst other problems. These socio-economic problems affect learners and public member’s opportunity to access quality STEM learning and experience.

Nelson Mandela had a vision of equal society whereby all people have equal opportunity to resources regardless of age, colour, race, economic status and whether one is disabled or not. In an attempt to make Mandela’s vision a reality, Science centres can put into place programs and initiatives to provide an inclusive Science, Technology, Engineering and Mathematics (STEM) learning to all members of the community.

Different programs and initiatives such as adopt a school, outreach expos, competitions, accessibility of science centre facility and exhibits, science centre and clubhouse holiday programs were implemented and analysed in an attempt to find out if they can be used to provide an inclusive Science, Technology, Engineering and Mathematics (STEM) for all members of the community. After the analysis it was then discovered that this programs and initiatives are a good platform science centres can use to make Madiba’s vision a reality.
The Fourth Industrial Revolution: Issues and Implications for Career Research and Practice
Phe Sekele, Sci-Bono Discovery Centre

The pace and the rate in which the digitization and automation of work, known as the fourth industrial revolution, will have enormous impact on individuals’ career experiences. This is causing considerable anxiety in society but more so in basic and higher education, commerce and industry as well as the economy at large. Yet the vocational psychology fraternity has been remarkably silent on this phenomenon, its trends and implications on the future of work in general.

The conference paper will summarize some of the most important issues of the fourth industrial revolution and their influence on career development. It will also review the extent to which current models and frameworks in career development are suitable for addressing these emerging issues, perils and opportunities for future career development research and practice.
Adverse environmental impacts from the establishment of hydro-electric power generation station in the semi-arid South Africa: Mbashe River

Mamagolokwe Malefane, National Zoological Garden

A study carried out by Pegels (2010), revealed that during the apartheid regime in South Africa, about 30% of households had access to electricity leaving surplus electricity by Eskom. According to Eskom SA, shortly after the inauguration of democracy, more than 70% of households were reported to be electrified as part of a development plan thus placing pressure on the major power producer i.e. Eskom. Winkler (2005) and Pegels (2010), further explained that the solution to this crisis demanded the creation and implementation of renewable energy sources which include wind, solar, biomass and hydro generated power. For the purpose of the presentation, the focus will be on the adverse environmental impacts from the establishment of a renewable energy source that is a hydroelectric power station in terms of ecosystem services to residents and aquatic ecological processes to name a few. Nelson Mandela’s dream entailed having rapid expansion of its scientific and technological skills. South Africa has relatively accomplished that dream but the major challenge is climate change. Therefore, the efficacy of hydroelectric powers will deteriorate with changing climatic conditions i.e. drought since it is a semi-arid country as described by De Wet (1990). An alternative energy source is required to ensure sustainable power supply throughout generations.
Making Science Fashionable
Ramohlale R.M, Mariba N, Mathebula K.E, Modiba M.M, Molekoa K.A., University of Limpopo Science Centre

The poster will present activities that the University of Limpopo Science Centre has been running in the past as well as current activities including in-house, outreach as well as special events.
The Influence of Learners’ Perceptions on Mathematics Performance: A Case of the Soweto Science Centre Learner Intervention Program Hosted by the University of Johannesburg in Gauteng, South Africa.

Mosina GKE1, Sipuka D1, Macheke N1, January M1, Nhlapo S1
1Faculty of Science, Soweto Science Centre, University of Johannesburg, Chris Hanie Ave, Diepkloof, Soweto, South Africa.

The township of Soweto has produced great legends who said that education is the most powerful weapon that can change the world. With the increasing poor performance of learners in mathematics our concern as the Soweto Science Centre is whether enough is being done.

Educational research has shown a pattern of poor performance in mathematics. Mathematics has grown to become an increasingly less popular subject among learners. As a result, there has been a significant decline in the number of learners pursuing mathematics related careers. Thus, this study aims to investigating the varied learner perceptions and the impact of these perception on learners’ academic performance with respect to mathematics. Subsequently, to establish the effect that primary school education, school quintile rank, socio-economic status has on learner academics.

A questionnaire will circulate among both the learners and facilitators at the Centre to determine the i) learner perceptions towards mathematics, ii) what brought these perceptions about, iii) the relationship that exists between these perceptions and their performance, iv) the attitude of facilitators towards both the subject and the learners. Learners’ academic records will be used to determine academic performance and interviews will be conducted where deemed necessary.

One can hypothesize that learners with a strong mathematical foundation have a relatively positive perception towards the subject and that a direct relationship exists between poor performance and a negative perception. The findings of this study will show that the governments ranking system together with the new enrolment system fails to place learners according to their academic performance but based on their socio-economic background. In conclusion, are science and technology centres together with the education system making an impact? Are they continuing to building Tata’s legacy? Are they making Tata proud?
## DELEGATES

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