SAASTEC
Southern African Association of Science & Technology Centres

21st SAASTEC CONFERENCE

Hosted by

Inkcubeko Youth and Science Centre, Ithembalethu, George, Western Cape

11th -14th November 2019

THEME:

INCLUSIVENESS IN SCIENCE AND TECHNOLOGY CENTRES

SUB-THEMES:

- ***Celebrating International Year of Periodic Table and IUPAC 100th anniversary***
- ***Advancing Technology through science centres (Next digital revolution-4IR)***
- ***Breaking barriers to positive actions against climate change***

BOOK OF ABSTRACTS

INKCUBEKO YOUTH AND SCIENCE CENTRE
NRF National Research Foundation 1999-2019
SAASTA South African Agency for Science and Technology Advancement
science & innovation
Department: Science and Innovation
REPUBLIC OF SOUTH AFRICA

CONTENTS

1. **Mentorship Program: Effects of science centres mentorship program-the case of Kalro science centres in Kenya**

Jane Evalyn Oduor, jbasigwaj@gmail.com , KALRO, SCIENCE CENTRE KENYA

Children Science Centre Kenya is an informal learning Centre where young learners and the general public are scientifically engaged, nurtured and empowered in an interactive 'hands-on' and 'minds-on' way, through science exhibitions and displays on Science, Technology, Engineering and Mathematics (STEM). It operates on the mission of promoting STEM, through interactive science experiences that engage, challenge, and inspire exploration and understanding of the world around us. Science Centre Kenya established Mentorship Program in 2019 to impact on marginalized yet talented and competent learners. The Mentorship Program mainly targets primary schools around KALRO Science Centre's in Kenya. These focuses on disadvantaged students and high performers. Students are selected in both primary and secondary schools though linkage with the school teachers for Biodata on learners dire need and their talents and academic competence in STEM subjects. Learners were connected to SCK member mentorship team comprising of National and International competent professionals across STEM disciplines. The program comprises of financial support, motivation, awards, linkage to Global opportunities and field trips. Questionnaires and interview were performed to collect data across mentorship period. Data is captured using statistical package for mentorship and analyzed and presented in frequency, percentage and bar graphs annually. Selected team has free access to SCK programs; DFC, Holiday programs, tours etc. Keywords Science Centre, Education, STEM, Mentorship,

2. **RRING Project addressing issues of inclusion, social justice and transformation in Research and Innovation**

Duduzile Kubheka , kubhekadudu@gmail.com , NRF|SAASTA

RRING H2020 project is a European funded project consisting of a global consortium. The whole project is centred on the concept of RRI. RRI is a process where all societal actors(researchers, citizens, policy makers, business) work together during the whole R&I process in order to align Research and Innovation outcomes to the values, needs and expectations of society. RRI seeks to bring issues related to research and innovation into the open, to anticipate their consequences, and to involve society in discussing how science and technology can help create the kind of world and society we want for generations to come. This term is used by the European Union's Framework Programmes to describe scientific research and technological development processes that take into account effects and potential impacts on the environment and society. The project seeks to bring issues of social justice and transformation to the forefront, not only limited to the outside environment but seeks to bring such transformation and discussions internally in our own working environment. This project brings together all members of society and decisions makers, using a bottom-up approach to

bring deliberate change in our organisations and the greater society. But ultimately, this project aims to bring RRI into the linked up global world to promote mutual learning and collaboration in RRI. The six pillars, and or, objectives of RRI are; Ethics, Gender equality, Open Access and Data, Science Education, Public Engagement and Governance. RRING will align RRI to the Sustainable Development Goals (SDGs) as a global common denominator. At the heart of this project is inclusion, at all levels. Where all members of society come together to ensure that our societal needs are met, solutions are implemented and most importantly, ensuring that no one is left behind.

3. **Disability inclusion from exhibits development to outreach.**

Kenneth Monjero, Catherine Taracha, Peter Wanuthi kentrizakari@gmail.com , Science Centre Kenya

Empowering Disabled Learners on interactive exhibits development and outreach: A case study of the Kenya Agricultural and Livestock Research Organization Children Science Centre Kenya 1, 2Monjero Kenneth, Catherine Taracha1, Peter Wanuthi1, Roy Gitonga2. 1.Kenya Agricultural and Livestock Research Organization (KALRO), Science Centre Kenya, P.O. Box 14733-00800, Nairobi Kenya, 2University of Nairobi, College of Agriculture and Veterinary Sciences P. O. Box 29053 00625. Kangemi, Nairobi. Kenya, Correspondence: kentrizakari@gmail.com Introduction The World Report on Disability estimates that 15 percent of the world population are people with disabilities. There may be some variance from one country to another. But experts believe that many countries significantly underestimate the actual prevalence rate. In Kenya, 10% of the population is disabled (4.44 million people) of which the high percentage Aged 0 – 14 is 43.4% (1.92 million people) who are in schools. The Kenya Agricultural and Livestock Research Organization's Children Science Centre Kenya (SCK) seeks to bridge this gap in empowering disabled children through science awareness, exhibits development and deploying science interactive experiences that engage, challenge, and inspire exploration and understanding of science day to day applications. In the case study, the blind leaners were engaged as above which lead to them coming up with innovations awarded by the President of Kenya. Keywords Science centre Kenya, Disabled, blind.

4. **Strategic Science Communication**

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Science communication is a powerful tool for engaging society, able to bring about measurable differences. In order to maximise the reach and impact of science communication, strategic infrastructure should be incorporated into the epistemology of our communication strategies. Life-long learning as a operational paradigm for science centres will be explored, including reference to a recent visitor study conducted at the Cape Town Science Centre and how this could influence future strategies.

5. **The Inclusiveness of Science and Technology at Science Centres**

Samuel Zondi, samukeloz@kznsc.org ,The KZN Science Centre

Science in Kwa-Zulu Natal (KZN) can be excluding due to the socioeconomic issues that challenge the province. For science and technology to be well understood and appreciated, appropriate equipment and environment such as laboratories need to be accessible and available. Well trained teachers, tutors or demonstrators lack in the province to well communicate the science. Science and technology is still a male dominated field, meaning females still shy away from these fields. Throughout the KZN province, the KZN Science Centre, implements various programs which have grown to not only develop young minds but to be all inclusive of young and old minds; for the scientifically informed minds and the not scientifically informed minds. This paper serves to elaborate on the all-inclusive programs conducted by the KZN Science Centre. Such as outreach programs which create an environment for science to be practically demonstrated and appreciated, as we bring the appropriate equipment to the rural schools making the classroom the desired laboratories. With this, those that are less privileged in the outskirts are included in the always advancing technologies and sciences. Our outreach programs extend to not only science students but also include general public from young to old through National Science Week (NSW) and Programmatic Support Grant and Intervention (PSGI) programmes. The Career Jamboree programme educates and guides not only on the science subject selection but all subjects included; programme focusing on the females to include females in the science and technology fields to balance current gender imbalances.

6. **Taking Science out of the Centre – the 25 year evolution of matric workshops**

Dr Derek Fish, thefish@iafrica.com , Unizulu Science Centre

In order to be fully inclusive, Science Centres need to recognise that distant schools may never be able to afford to travel to visit them. Outreach is essential, but needs to be carefully planned if it is to be effective and not just ad-hoc. With South Africa's multiple educational challenges, this outreach must do more than just entertain, as schools are desperate for assistance with the curriculum. Derek Fish and Alfred Tsipa pioneered a unique new format with their matric workshops in 1994. These have been running continuously in the 25 years since then and have impacted well over 100 000 pupils and their teachers. In order to stay relevant, these workshops have evolved to match the changing educational landscape (NSC to OBE to NCS to CAPS), changing technologies and changing needs of schools. Future plans include roll out in other parts of the country through other Science Centres, and the extension of subject areas beyond Physical Science to include Life Sciences and Mathematics. The long evolution of these workshops will be presented, with a critical evaluation of what worked and what didn't work, and why changes were made. Suggestions and guidance will be given for other centres wishing to present matric workshops.

7. **Matric Skills Life Science Workshop**

Diloshni Thambaran, diloshni.thambaran@gmail.com , Unizulu Science Centre

Informal science education (ISE) is a popular pursuit, with millions of scholars visiting science museums, science centres, zoos, botanic gardens, aquaria, science festivals and more around the world. Questions remain, however, about how inclusive ISE practices are in including the school curriculum in their practices. Informal science education is an often over- looked area of science learning. Broadly, defined, any science learning that takes place outside the school walls is an out-of-school learning experience (Falk & Dierking, 1992). Unizulu Science Centre has collaborated with the Cape Town Science Centre and have introduced a Matric skills based Life Science Workshop. This paper looks at how this skills based workshop was put together, introduced to learners, how science centres can work together in sharing, and developing more Life Sciences based workshops such as this one. Science as it is presented in school bears little resemblance to the natural world and this workshop aims to bring the real world to the learners. The workshop covers scientific investigation, graph skills, live dissections and interactive demonstrations.

8. **A Quick Guide to Organizing a Successful Matric Science Workshop**

Silindile Mthembu, silindilemthembu1@gmail.com , UNIZULU Science Centre

Science Workshops come in various flavors—from one-day focused workshops of 1-20 people to large-scale multiple-day workshops of 1,000 or more people; these includes learners, teachers, publics, and so on. Therefore organizing a workshop for 20 people gathered at one place may not be the same as organizing the same workshop for 2000 people at different venues. Logistics are very important! Unizulu Science Centre has been running Physical Science Workshops (both Physics and Chemistry) for grade 12 learners for about 25 years now. These are done with the aim of equipping matric science students with the skills to answer questions during the exams and also to reach out to those needy areas that cannot afford to visit the Science Centre. Two or three presenters travel to ten different towns around KwaZulu Natal to present twenty workshops to about ten thousand learners. This may sound simple but the planning behind it can be quite a daunting task. Imagine having to get the right dates where all ten halls are available, arrange travel and accommodation for presenters, printing 10 000 booklets and getting the learners to attend. Think of the technology involved, the resources one has to travel with and the budget needed to cover the whole workshop. This paper is intended to provide insights into organizing a successful Matric Workshop across the scale. Using her 10-year experience, the presenter will share how Unizulu Science Centre has been able to arrange these workshops, successfully, for 25 years and will also give advice to other Science Centres with the interest to present such workshops in future.

9. **Language as a barrier to effective assessment in science- Matric Chemistry Workshops**

Nsikelelo A Malinga, nsikelelo.malinga@gmail.com , UNIZULU Science Centre

Language is a major barrier to most pupils in learning and understanding science especially to those pupils whose first language is not English. The implication is that the majority of learners in the senior secondary school phase study sciences in their second language, which is English. A crucial problem that is often unaddressed lies in the language used to instruct and assess learners in science, however it is well understood that assessments in sciences should be taken in English as it is the common and the universal language especially for those pupils in Matric as they prepare for tertiary life. If students cannot express themselves in the language of the assessor, and if the assessor is not familiar with the cultural constraints within which students operate, it is difficult for the assessor to collect evidence of adequate performance. To understand the cognitive and language challenges of education we will look at a study undertaken by the UNIZULU Science Centre. The UNIZULU Science Centre runs all of its programmes in its two most predominant languages which are English & isiZulu. The

study conducted was as a result of the matric chemistry workshop booklets which were translated in to isiZulu to help pupils better understand the scientific concepts in chemistry. The study follows up a short survey that was done in a few schools that attended the workshops to see how the booklets were able to help the students. Through this investigation suggestions will be made for developing language policies within science centres.

10. Contribution of Science Centres in preparing early childhood development for science and technology education

Mary-Ann Makama and Innocentia Mabuza, mary-ann.makama@sci-bono.co.za , Sci-Bono Discovery Centre

Contribution of Science Centres in preparing early childhood development for science and technology education. How can Science Centers support high quality of science and technology in a way that is appropriate to early childhood development? Science and technology education is the most important program or subject in school because technology and the product of science everyday surround our daily lives. Our education system tend to have a strong focus on language and social development therefore, they do not get enough mathematics and science. As Science Centre is very important to put more effort to inclusiveness in our organization irrespective of race, culture, and age and socio economic status. Science Centres should develop a variety of interesting and challenging program that invite the young children to observe, explore and experiment. Science and technology learning for young children should involve asking questions, playing, experimenting and hands on. To become engaged in scientific thinking children need access to materials that they can take part and dedicated team to assist them. Engaging young children with exciting technology material motivates them to learn and pursue science education throughout out. Children are naturally curious about their surrounding and always want to find out as much as they can. It would be a great advantage to our young children if all informal learning area would work close with education department to encourage technology usage and science learning in young children.

11. Questioning the real impact of outreach programs and enforcing deliberate inclusion and social justice

Duduzile Kubheka kubhekadudu@gmail.com , SAASTA

This presentation questions the methods and outcomes of the science outreach programs held by SAASTA and the various science centres throughout the year. Hundreds and thousands of students are reached no doubt, and set quarterly targets are met. But at the heart of it all, how deep does this impact run? How are lives changed? An outreach programme held in Jozini, KZN, sparked this question in my heart and has been bothering me ever since. We attend to an outreach programme, thousands of moneys spent towards the logistics and then what after that? Students are taught about careers in STEM, excitement and hope is awakened and the students are told about various possibilities awaiting them. But thereafter the question still lingers, and then what? What happens after we leave and that child is still faced with the same conditions he was in before we came? The child still has no access to internet, no knowledge about the application process, and no means to actually take action and do something to reach these possibilities. How can we do things differently to ensure that the work that we do is not just work we do for the sake of doing and reaching targets but that an actual impact is made. We need to have an honest discussion and truly address the socio economic issues facing us as a society and the country and how we can play a better role in addressing these issues and making a positive and valuable impact in the lives of the students and communities we work with and influence.

12. Boys Inclusivity Through Science Centres

Dorothy Mlambo, dorrymlambo@gmail.com ,CHRISTOPHMEYER MATHS & SCIENCE CENTRE

Christoph Maths & Science Centre in Kwa -Zulu Natal operates for publics and learners from rural based communities. The community does not not just lack basic STEMI background but have social -economic development challenges problems which can be overwhelming. Massive socio-economic development challenges faced by the communities needs concerted effort of all sectors of society government, corporates and individuals working together for a better society.Some of the major problems are, high unemployment and low incomes leading to crime ,hopelessness,inequality and drug abuse and a poverty cycle. Breakdown in nuclear family,high divorce rates ,absent of parents amounting to lack of guidance and value instilled in young people is also a major issue.This has ripple effect leading to other effects on teenage parenting and drug abuse, poor standards of education and others To try tackling some of these challenges from the Science Centre , The Science centre opens for everyone irrespective

of their background, gender, ethnicity and language. However with the current problems in the country the Science centre made a decision to pay more attention to boys beyond ordinary science activities. Boys are often not given responsibilities and equipped enough through their families to prepare and give values needed in life. Most families are broken and a broken family prepares broken hearts. More boys are raised by female parents and there is always a missing link in a boys life science the father figure plays a role in upbringing of a child. Education system in South Africa also fails to adequately equip the boys academically and socially .This is due to the differences that exist in boys and girls during their early days of development , more boys may not be included in the education system at that stage which bears negative effects in future. Insight of the above mentioned back ground of the problem creates a man with problems in future. Boys are not included, they are softly neglected and most of them gives them a special position in society based on the cultural norms that a man is of greater value than a female.On another hand some also witness their own fathers abusing their mothers. Most of the challenges the country faces emanates from the fact that Boys are usually not given responsibilities in the communities. Hence their active minds seeks some other activities that are undesirable.The investigation was meant to help the boys to be more responsible and address undesirable behavior such as of drug and substance abuse ,early girl pregnancies and a lot more. A sample of 30 boys of agegroup 15-16years picked up randomly from the community was used on research.Father figures were selected ,Pastor ,social worker .Round talk tables were set for discussion Questionaire was used to investigate how many wash dishes ,cook, do laundry and serving food ,clean the garden etc.. The questionnaire also asked them how they want to be treated at home and school and how they envisage their lives as future adults . Results obtained after the talking to the boys and giving them opportunity to taking responsibilities shows a massive change in behavior . The investigation is still in progress and positive outcome is already resurfacing. Science Centre programs such as chess ,robotics and other games are also used as tool to engage the boys for a change. In conclusion, science centres can play an important role to help address socio- economic issues through inclusion of boys.

13. Science intervention as a tool for improving pass rate of Physical Science

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There is a national crisis at the basic education of high failure rate of all scientific subject. This is clearly observed with grade 12 results. It is believed that the main cause of this high failure rate is due to the lack of subjects teaching skills, lack of necessary resources and learner's attitude towards these subjects. The highest failure is mostly observed in mathematics and

physical science subjects. This paper seeks to root out the course of this high failure rates by starting a three years' intervention program for further education and training (FET) starting from 2020 to 2022. The intervention program will be focused on Physical science and mathematics on three school that will be chosen base on their accessibility and their 2018 and 2019 pass rates. This intervention program will focus on demonstration, tutoring and conducting practical for all abstract concepts in these selected subjects. Improved pass rate after the three years' period in these selected schools is envisaged.

14. CompLit4U -Bringing Computer Literacy to Cleaning Staff

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While many assume that people in the 21st century have basic computer skills, this is not always the case for support staff working at a University, especially the cleaning staff. The CompLit4U project was a joint effort of the Science and Technology Education Centre (STEC@UKZN) and the College of Agriculture, Engineering and Science (CAES) PR-team. The aim of this project is to empower cleaning staff with basic computer literacy skills. STEC@UKZN and CAES developed the curriculum, enlisted participants, obtained resources and taught the content. The course was run as a pilot project over five days with 10 cleaning staff. It covered computer basics, Microsoft Word, how to use the Internet, how to send an email and computer/online security.

15. Rural- Township based Science and Technology centres. Roles they play in fostering inclusive culture in science education.

Gabolwelwe Mosina, gabolwelwem@yahoo.com , UJ Soweto Science Centre

In the past years, South Africa has witnessed an exponential growth in the number of Science and Technology centres. Centres of this nature rank amongst top institutions considered to play a role in stimulating individual's interest in science. There is also significant evidence that these centres increase visitor's knowledge and understanding of science, further providing learning experiences that impact on attitudes and behaviour of individuals. The centres play critical roles in informal education giving individuals opportunity to physically interact with exhibits through most of the five senses – sight, touch, smell and hearing. It is a fact that the education system is divided across the South African landscape when looking at public and private schooling environments. Resulting from this division, we see an influx of initiatives aimed at trying to bridge the gap created by the two systems amongst learners. Thus in the pursuit to expose individuals from marginalized settlements, schools organise visits to science museums, science centres, zoos, botanic gardens, aquariums and science festivals. The current paper reviews research on the roles of rural-township based Science and Technology

centres in South Africa through the lens of social and cultural inclusion. It draws on perspectives from research on social justice, social reproduction and pedagogy to adapt an all-inclusive system. The study also reflects on success and failures of two South African Science Centres based in rural and township areas respectively. Lastly, a model of how a Science Centre can better serve in a rural or township setting is discussed.

16. The importance of Public Engagement

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"The problem in society is not kids not knowing science. The problem is adults not knowing science. They outnumber kids 5 to 1, they wield power, they write legislation. When you have scientificallly illetirate adults, you have undermined the very fabric of what makes a nation wealthy and strong."- Neil deGrasse Tyson

The role of Public Engagement in Science is to inclusively integrate all knowledge fields such as natural sciences, engineering, social sciences and humanities to pursue a society that understands and values science and technology. It's critical role is national prosperity and sustainable development, while engaging critically in social development.

17. Science, Technology and Innovation enabling inclusive and sustainable South African development in a changing world.

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According to the 2019 Department of Science and Innovation (DSI) White Paper on Science, Technology and Innovation (STI), collaboration with science centres is essential for the awareness of science, technology, engineering and mathematics (STEM) education. STEM education awareness campaigns and programmes can be defined as Informal Science Education (ISE). ISE communicates knowledge differently from what school learners are used to in class and it manages to create interest for target audiences who may have not been exposed to the world of science. Science centre programmes may fail to reach different audiences, therefore monitoring and evaluation systems can play a fundamental role in collecting, storing and tracking the performance of the implementation of inclusivity and sustainable development. Geographic Information System (GIS) can be used as a tool for monitoring and evaluation due to its ability to store, analyse and distribute location-based data. The introduction or access to Free and Open Source Software models (such as QGIS or Google Earth Pro) will enable the exchange of knowledge, ideas and/or information in an efficient way that will promote inclusiveness. This paper will, therefore, discuss the potential

of GIS or satellite data in promoting inclusiveness in science and technology centres and how this may make the centres more accessible and enhance Informal Science Education. This paper discusses how GIS or Satellite data is essential for planning, monitoring, addressing gaps between programmes and for supporting national development. This paper also concludes that science centres are able to monitor and generate reports based on marginalized communities, disability, socioeconomic status and how they are able to map their footprint using GIS.

18. Using Space as a driver for STEMI literacy

Elisa Fraser efraser@sansa.org.za , SANSA Science Centre

The SANSA Science Centre celebrates 15 years of existence on 1 October 2019. The centre is located within a space science research environment. The public, learners and educators have the benefit of being exposed to the aspects of space science research as a process and technology as a product. The SANSA Space weather centre on site also provides visitors with the opportunity to view space weather imagery and engage with space weather scientists on the changing conditions of the sun. This presentation will be a reflection past 15 years of science engagement and how the centre uses space as a driver through engagement with different audiences.

19. An introspection of Sci-Enza's inclusivity

Tshepiso Maroga, maroga.tshepiso@up.ac.za , Sci-Enza science centre

THEME: An introspection of Sci-Enza's inclusivity At Sci-Enza we act in a way that welcomes diversity among our own team members and the public. We do so by creating an environment where all different kinds of people can thrive and succeed. With a cultural diversity that we have among our team members, some of the activities are conducted in different South African Languages at a level of our audience's best understanding, considering the fact that non-English speaking kids in foundation phase in public schools are taught in their home languages. We exhibit inclusivity through the activities that we run for people with disabilities, learning challenges, all genders, all age groups and lay audience. Our holiday programmes are inclusive of lay audience in a sense that, previously we ran it for Grade 1-9 but recently we expanded it to cater for the Grade Rs and Grade RR. Our centre is located in an urban area, which led to an exclusion of disentangled kids in remote area that we could not reach in the past. With the evolution of time, our budget was amended which allowed us to reach some of the previously excluded communities. Another factor that contributes to the exclusion was the use of only English and Afrikaans in our activities. The disabled communities are still isolated from us, disadvantaged people are unable to reach us and also teaching science in a South African indigenous language that we (science communicators) were not taught in becomes a challenge and it affects our reach.

20. Science Centres as hubs for inclusive provision of high quality STEMI (Science, Technology, Engineering, Mathematics and Innovation) skills for inclusive STEMI driven socio-economic development

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This paper provides a descriptive analytic reflection of the efforts by the Greater Tzaneen Community Foundation (GTCF) to implement inclusive socio-economic development through the science centre driven inclusive deployment of science and technology interventions. The basic assumption buttressing this initiative is the notion that science, technology, engineering, mathematics and innovation (STEMI) skills have the potential to unlock the capacities of communities, and enable them to transform their thwarting conditions of poverty. The communities targeted for the inclusion are in predominantly rural Limpopo Province, with a view to replicate the initiative throughout rural South and Southern Africa. This GTCF concept of science centre coordinated STEMI driven inclusive socio-economic development was inspired mainly by the 2002 South Africa hosted World Summit on Sustainable Development legacy project, the "i-Community Project". The i-Community Project piloted how ICTs (information and communication technologies) can be strategically deployed to achieve inclusive socio-economic development. The pilot was implemented in Mogalakwena Municipality from June 2003 to March 2006 as part of the "New Partnership for Africa Development" (NEPAD). The project ensured participation and inclusion of all appropriate parties into an ecosystem of support institutions to achieve tangible improvements in indices such as literacy, skills, jobs, income, business support and access to government services. Among the innovative solutions piloted at the i-Community Project which are envisaged for the GTCF initiative are: (a) Digital skills development (Sector Education and Training (SETA) accredited and unaccredited) (b) Business Resource Centre to drive the business incubation program (c) Call Centre to provide comprehensive learners support services and business linkages (d) Community Socio-Economic Empowerment programs: - Renewable Energy - Nutri-Health program - Multi-Media Cultural Conservation Centre (with film and video production capabilities) - Talent Development Program focusing on sports and arts - Sustainable Water and Sanitation project - Research (social, empirical and business), dialogue and exchange program (e) Program based partnerships and institutional design for replicating the i-Community Project.

21. Breaking the barriers within limitations

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"Children are the living messages we send to a time we will not see." Giving hope, love, support and exposure to underprivileged children/youth irrespective of their backgrounds nurture their wellbeing, allowing them to thrive to greater heights. To accomplish this goal, we are obliged to participate in initiatives that address social and economic issues such as: skills development, disability marginalisation and child care in our community. We therefore participate in the Yes4Youth and community service programmes, which focus on children fighting to overcome physical, mental and social challenges, with the hope that they may feel included into society, uplift their self-esteem and instil a sense of dignity and pride, so that they may one day create their own destiny breaking through the barriers of their limitations

22. Inclusiveness in Science and Technology Centres

Theshnie Naidoo; Busisiwe Gumede and Nokwanda Cele Theshnie.Naidoo@durban.gov.za , The Durban Natural Science Museum

Museums have become significant hubs for public engagement. The Durban Natural Science Museum (DNSM) has made huge strides in ensuring access and inclusivity within the education framework that contributes to EThekwini Municipality's strategic goals. Enhancing creativity when delivering education programmes has become key to ensure museums spaces remain relevant and are inclusive of different audiences. The introduction of science theatre has become novel way of presenting curriculum linked programmes to learners within the FET phase. The 4th Industrial Revolution has proved a challenge for museum spaces. The DNSM has focused on a pilot project using advanced technology such as Augmented Reality (AR) within museum exhibitions. Visitors now have the opportunity to view some exhibitions in real time. This is essential in introducing new publics. Dioramas now have accompanying isiZulu translations which are accessible as a gallery catalogue as well as via the new Natural Science Museum application. The DNSM also continues to engage on topical issues such as Climate Change. This has been highlighted within various education programmes. It is to encourage citizens to acknowledge the impact of Climate Change on the environment and biodiversity; and to take responsibility in contributing toward positive actions against Climate Change. Community engagement has ensured the success of projects such as permaculture that were introduced within communities. Collaboration with internal and external stakeholders have provided opportunities to extend the museum reach on these issues.

23. Responsible Communication of Science, a global RRI trend

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Exploring Responsible Research and Innovation within engaged science is a concept where South Africa played a role in societal participation. This paper will outline a major role played by a Horizon2020 funded RRI project called RRING (Responsible Research and Innovation Networked Globally) involving 22 partners from Africa, Asia and Europe. It will further share the achievements made through SAASTA's participation in the project as an 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 the combination of RRI partner conference held in Belgium. The paper will further recommend ways of ensuring inclusivity in science engagement through responsible communication of science.

24. Levelling the playing field for the Class of 2032.

Shemoné Bokhary shemone@amsasciencecentre.co.za , ArcelorMittal Science Centre Saldanha

We've passed the point of debating the importance of Early Childhood Development (ECD) programs at Science and Technology Centre's. Perfectly positioned to effectively service its local community, Science Centre's play a key role in the development of the ECD sector at large. However the question at hand is, How are we as Science and Technology Centre's planning for the class of 2032? Is our centre's ECD friendly? In our efforts to promote ECD Science education does our exhibits accommodate the ECD learner? Lastly, how do we capacitate our Science Centre staff to effectively communicate Science on a ECD level? Many may ask, can we do this and is it even possible to communicate science on ECD level without diluting the science. Yes we can do it and Yes it is possible. The ArcelorMittal Science Centre Saldanha focus on three pathways with one objective in mind. Creating opportunities and spaces for young learners to learn and develop holistically. ECD teacher development is crucial. It is important for the ECD teacher to understand STEMI and to know how to integrate STEMI education with the normal ECD Daily Program. With our Think STEMI 8 week course we have the opportunity to introduce ECD teachers to the wonderful world of science. However more than 95% of the ECD teachers that attended the Think STEMI course this year never had any form of science education . That confirmed the importance of ECD teacher development with regards to STEMI. This is critical if we want to reach our objective as mentioned before. As long as the teacher fail to understand the importance of merging science education with the ECD curriculum, we will have a problem. The impact of ECD teacher

development can be viewed as a long term investment. Continued support and keeping training current and relevant directly impacts on the ECD learner in her charge. The sooner the young learner gets introduced to science the better. We all know that the playing field is not level for all children. Many start off with the advantage in life gaining full access to the best early years education. But where does it leave the rest? As a Science Centre we have the opportunity to make a big change in the lives of the young children visiting our centre's. We have no other option but to start planning our programs with the class of 2032 in mind. The future is already here, they currently sitting in the ECD centre's waiting for us to prep them for jobs that does not exist yet!!!

25. Extensive Research Inclusive Science Centres

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Extensive research has and will always be a way of getting information to the world's problems and finding ways to solve the problems. Extensive research is mostly undertaken by research institutions and university for either commercial or academic purpose. Most learners at primary/secondary school have an inquisitive mind to explore and try fix problems encountered. Though they never get a chance or resources to further/answer their question. This paper will outline the importance of exposing learners to an extensive research and its impact on the communities where the science centres are based. Furthermore, it outlines the need for science centres to get involved in research, challenges and possible outcome for such implementation to their programme and the community at large. Questionnaires will be given to learners, teachers, community members and university students based on the inclusion of extensive research by science centres for learners and community members.

26. Inclusivity as a strategy for growing a science center

Mdumiseni Nxumalo, NxumaloM@unizulu.ac.za , University of Zululand

Science communication provides an opportunity to reach to diverse audiences. Science communicators should be conscious of these opportunities to expand their reach to a broader community. There are, however, some different characteristics of different audiences that science communicators need to take into account. This being different age groups, diverse cultures and language among other, such as indigenous knowledge relevant to the subject being communicated. This presentation demonstrates how a science center can broaden its reach just by targeting being inclusive in its programs. Some exemplary experiences will be shared.

27. Indigenous astronomy : A hook and a powerful resource for public engagement at science centres

Sivuyile Manxoyi, sivuyile@saao.ac.za ,South African Astronomical Observatory

This presentation explores and evaluates how indigenous astronomy can be used a hook and a resource to include the previously disadvantaged communities (urban and rural) in science and technology , particularly astronomy. The Southern African indigenous people have a deep and profound relationship with the stars and have for centuries used stars for various purposes including developing calendars, agriculture, regulation of ceremonies and navigation. A frank appraisal of the approaches, methods and resources developed based on indigenous astronomy will be conducted. Lessons and recommendations for science centres based on all the efforts undertaken by the SAAO to utilize indigenous astronomy in communicating modern astronomy will be shared.

28. STOCVEL - Science Revitilisation

Joseph Taetsane moiponescienceacademy@gmail.com , Moipone Academy Science Centre

Community empowerment and employment creation has proved to be a challenge in our country, as a results most people are discouraged to further their studies. Moipone Academy Science centre have adopted a strategy to tackle this issues through an initiative of training unemployed communities for job preparedness and start their own businesses. This initiative has increased the number of general public visiting our centre. This presentation is aimed at sharing the changes of community as a result of our science centre intervention. It will look at the impact of the capacity building programme since its inception in Tembisa. We will share comments from the beneficiaries on this programme. The presentation will conclude by showing the need for further capacity building interventions to ensure continuity in the management and running by science centres

29. Interactive exhibits for Grade 5 and 6 learners

Annelize Potgieter, Martin Valcke, Tammy Schellens, Mahlatse Ncha, hlatsedee@gmail.com, University of Limpopo Science Centre

In 2015, South Africa participated for the first time at the Grade 5 level in the TIMMS assessment for Science and Mathematics baseline knowledge. Future results can be compared to evaluate worldwide progress, this would also allow more time for appropriate interventions to be introduced into the schooling system. As part of these interventions, the University of Limpopo Science centre designed interactive exhibits for grade 5 and 6 learners. In order to make this possible, field research was done at a local primary school in Mankweng,

Limpopo. The research included curriculum based baseline tests in Natural Sciences for both grades. The aim was to gain insight into the learners understanding about the subject. The results indicated that for grade 5 learners, there were several topics the learners understood, while the topics where the learners scored badly on were life cycles and uses of metals. Grade 6 learners also performed well on several topics and the topics where they scored badly on were: nutrients in food; solutions and processes to purify water. With these results, four interactive exhibits were designed using an exhibit design guideline that was compiled prior to this research. The four exhibits focused on the topics that learners from both grades found difficult. The exhibits were taken back to the school for learners to interact with and gain relevant knowledge.

30. **Real laboratories available online: Establishment of ReVEL as a conceptual framework for implementing remote experimentation in South African Higher Education Institutions(HEIs) and rural-based schools – A case study at the University of Fort Hare**
Mr Phumezo Kwinana,Mr Mncedi Rani and Mr Phumzile Nomnga mrani@ufh.ac.za , FOSST Discovery Centre (UFH)

The aim of this paper is to propose an ideal conceptual framework for the establishment of ReVEL (Remote and Virtual Education Laboratory) for implementation in South Africa, a developing country. It is also aimed at give a qualitative account of relevant stakeholder's perception on the implementation of ReVEL model in the South African context. A survey and a series of in-depth, semi-structured individual and focus group interviews on the perception of implementation of remote labs were conducted for data collection guided by a thematic analysis approach to the University of Fort Hare (UFH) community (instructors and students) and to twenty rural-based science high schools. 28 UFH instructors, 50 UFH students and 50 learners from high schools participated in the survey. 100 students from both UFH and rural-based high schools undertook lessons in remote lab sessions accessed through collaboration with Labsland Company. Responses were analysed accordingly. Interesting survey responses were received from both instructors and students. 91.4% of instructors applauded this technology and strongly agreed on its advantages of enabling sharing of larger variety of specialized equipment while reducing the financial burden and improving the educational experience. Others were cautious about the lack of hands-on interaction with the real equipment in the remote laboratory, citing the fact that it might compromise some critical educational aspects if students do not have the feeling of the actual equipment. 96.7% of Students admitted that they had never experienced a remote lab work environment but praised its convenience and flexibility for obtaining results for analysis. A few preferred to work in both face-to-face and remote lab.

31. Mathematics and Sciences Focused Learner Enrichment Programs – The case of the University of Johannesburg Soweto Science Centre

Phenyane Patrick Monama, patm@uj.ac.za , Soweto Science Centre, University of Johannesburg.

South Africa's performance in Mathematics and Sciences at school level is among the worst in the world. These key subjects are vital in addressing significant shortage of skilled jobs (engineering, technology, IT space & related careers) and hence the national economic growth. However, Mathematics and Science subjects had fewer learners writing examinations, resulting in lower pass rates with adverse impacts on the overall quality of Higher Education and generation of critical skills. 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 over 500 learners and 200 teachers annually in the same Mathematics and Science Stream dynamic environment. Learners and teachers attend intensive sessions which 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. Over a number of years, substantial number of learners from underprivileged 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. Therefore, this displays 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.

32. Umjikelezo WeScience – Beyond

Dr. Tanja Reinhardt & The Umjikelezo We-Science team, Reinhardtt2@ukzn.ac.za, (CASME, Durban Natural Science Museum, Kitchen Chemistry, KZN Science Centre, STEC@UKZN, Unizulu Science Centre),

In its 3rd year running Umjikelezo We-Science went beyond the borders of the greater Ethekwini area. In this presentation we will share our experiences of visiting a mall, staying away for 2 nights and how we dealt with bad weather. We will also shed some light on how we handled the temporary Brexit of one of our team members.

33. Advancing Technology (4IR) through Science Centres

Mr. Alfred Hanyane, alfred.hanyane@sci-bono.co.za , Sci-Bono Discovery Centre

The fourth industrial revolution presents both opportunities and challenges to society, especially the lay public. Raising awareness about new scientific inventions and discoveries and their impact in people's lives is essential and will be very critical for the fourth industrial revolution (4IR). Science Centres with their dynamic approach are in good position to engage and raise awareness about fourth industrial revolution (4IR) both in schools and public spaces. This necessitates development of fourth industrial revolution exhibitions, projects, programmes and activities that would not only raise awareness but equip our society with knowledge, skills, and attitudes to cope with opportunities and challenges that will come along with the fourth industrial revolution. Sci-Bono Discovery Centre facilitates projects relevant to fourth industrial revolution which include coding, robotics, and artificial intelligence. This paper aims to outline the impact of activities facilitated by Sci-Bono Discovery Centre to raise awareness about the fourth industrial revolution.

34. Science Centres playing an active role in advancing the Fourth Industrial Revolution

Norman Pillay, norman.pillay@sci-bono.co.za , Sci-bono Discovery Centre

According to the World Economic Forum, the Fourth Industrial Revolution can be described as the advent of "cyber – physical systems" involving entirely new capabilities for people and machines. The 4IR represents entirely new ways in which technology becomes embedded with society and even in our bodies. The South African Science and Technology Minister indicated that the 4IR affects every aspect of life and it is not possible to discuss economic development without considering the impact of the 4IR on the economy. With unemployment currently at 27% and it is the highest among young people in this country, Science Centres can be a medium to increase public understanding, drive public engagement and influence public discourse with regards to the 4IR. Science Centres can assist in increasing public understanding of the 4IR so that the general public is made aware of the developments and happenings around them, and how these developments affect their own lives. Science Centres can assist in community mobilisation for science awareness. This is important in order to maximise reach, address challenges unique to the community of interest and monitor impact. When 4IR information is communicated, we indirectly give people the opportunity to mobilise and educate themselves so that they can make informed decisions. If we fail to communicate, we dis empower the majority, leaving them in limbo and this would be detrimental to the South African child. This paper will explore how Science Centres can actively contribute to the advancement of the 4IR in South Africa.

35. Revolutionize basic learning through design simulations

Mpiyakhe Stephens Khumalo khumalomavovo@gmail.com , Life Navigators

The Higher education understands what the Fourth Industrial revolution means and always encourages reinvention of existing academic plan based on industrial demands particularly demands of high level of adequate skills based on new technology. That means practical learning made more realistic based on science applications (technology). The basic education (Schools and Science centers) needs as well to not lag behind in adapting methods of advancing practical that will impose real life science applications (technology) to the learners. The implementation of science simulations design projects that are facilitated by undergraduates who have adequate training skills and practical experience is discussed in this paper. Simulations can bridge the gap between theory and reality in ways that are meaningful to the learners, and the undergraduate instruction programme can cut experience real thin for learners from Grade 3 up until senior levels. In the stages of building a base and stable foundation for learners, the design of simulations will encourage innovation, creativity and guidance towards further study and work that matches skills and abilities. Learning simulations might sound very costly, but a discussion of the design and building of these disruptive methods of simulations out of reachable and waste materials is outlined as cost friendly. They are aimed to break through barriers of effective learning constraint by lack of necessary equipment, insufficient technical support to student's interest and attitude and lack of teachers experience in practical delivery. Tell me, I forget, show me I remember, involve me I understand.

36. Is this the Fourth Industrial Revolution or the First Post-Industrial Revolution: Implications for science centres

Mike Bruton mikefishesbruton@gmail.com . Mike Bruton Imagineering

I will argue that we are not in the Fourth Industrial Revolution but in the first Post-Industrial Revolution during which, equipped with digital technologies, infinite connectivity and the Internet of Things, we are able to address the damage caused by the first three Industrial Revolutions to human society, the other inhabitants of the planet, and the natural environment, and develop a more sustainable way of living. The role that science centres can and should play in this Post-Industrial Revolution will be outlined.

37. ROBO-INSPIRE

LINDOKUHLE HADA lindokuhlepatricia707@gmail.com ,Arcelor Mittal Science Centre

We have recently entered the dawn of the fourth industrial evolution, in which it differs in speed, scale, complexity, and transformative power compared to previous revolutions. This PRESENTATION has examined the opportunities and challenges that are likely to arise as a result of the fourth industrial revolution. This challenges me to bring change into our country

by introducing ROBOTICS, to our young generation so that they may start at their tender age. so ROBO-INSPIRE is all about inspiring, teaching and motivating the youth of the importance of implementing ,working hard and making sure their part of the revolution. There are similarities between four industrial revolutions and the five ages of civilization: the hunter and gather age, the agricultural age, the industrial age, the information worker age, and the emerging age of wisdom. I live to share my knowledge with the young generation ,teaching them robotics as an introduction of learning about 4IR.

38. 4th Industrial Revolution Is Here Are You Ready?

Bhekani Mathebula bhekibhex@gmail.com , ArcelorMittal Science Centre

It is not clear what is meant by the Fourth Industrial Revolution, and there seems to be no agreed definition. Nor can anyone foresee exactly what the implications are for the future of human society. What is clear is that the world is changing along with the dramatic changes that are taking place in technology. There are now powerful technologies that can make life easier and enable human achievements previously (and currently) thought to be impossible. It is anticipated to change everything fundamentally - industries, economies, jobs, transport, skills and education, to name but a few. The concept of digitizing everything is becoming a reality. Automation, artificial intelligence, Information Technology Intelligence, machine learning and other advanced technologies can quickly capture and analyze a wealth of data that gives us previously unimaginable amounts and types of information to work from. Our challenge becomes moving to the next phase—changing how we think, train and work using data—to create value from the findings obtained through advanced technologies." While the Fourth Industrial Revolution has the power to change many things across a broad spectrum—work, operations, society—one thing is certain: It's here, and executives need to be ready. It is clear that the old way of doing things isn't enough anymore, and those who make the most impact will be the ones who embrace all facets of Industry 4.0 and all the opportunities it will bring. As this would be the second experiencing presenting about Technology its a great step in a Intelligent direction.

39. What & Why 4IR

Thabiso Reginald Mokose mokosetr@gmail.com , ArcelorMittal Science Centre

What is fourth industrial revolution all about, you may ask. Well, it is characterized by a fusion of technologies that is breaking barriers between the physical, digital, and biological spheres. This means the 4IR will yield in continuous changes and endless opportunities. For an example: productivity within various industries will quadruple itself, profits will double, increasing trends in artificial intelligence point to significant economic disruptions in the coming years. Now this means knowledge workers are the link to a company's other investments. The evolution of global industries in the fourth industrial revolution is both

exciting and scary. Life will change with the 3D printing, the IoT, and the fusion of technologies. The fourth industrial revolution can raise income levels by allowing entrepreneurs to "run" with their new ideas. It will improve the quality of life for many people around the world. While there are many benefits of the fourth industrial revolution, there are several key challenges that lie ahead. At the same time, the revolution could yield greater inequality, particularly in its potential to disrupt labor markets. As automation substitutes for labor across the entire economy, the net displacement of workers by machines might exacerbate the gap between returns to capital and returns to labor. In addition to the threat of massive job displacement under the ongoing fourth industrial revolution, there are a variety of challenges, such as cybersecurity, hacking, risk assessment, and others.

40. Use of virtual agricultural experimental learning platforms in supplementing agricultural practical sessions: A case study of rural-based high schools in Raymond Local Municipality

Chuma Mtyelwa and & Phumezo Kwinana cmtyelwa@ufh.ac.za , FOSST Discovery Centre

Virtual learning has been playing a prominent role in promoting technology-enhanced education. Many rural base high schools face various challenges in conducting their practical lessons using hands-on traditional demonstration such as inadequate teaching and learning materials. This study presents a study that is conducted in Amathole West District, This study sample of this will include all the rural-based high schools that offer agriculture as the subject. The aim of this study is to supplement agricultural practical demonstration with virtual learning in rural-based high school. Agricultural science is a practical oriented course and therefore requires practical instructions and application via effective demonstration strategies. Given the advances in technology, virtual learning has been adopted and have been playing an important role in enhancing teaching and learning. This adopted both qualitative and quantitative research approaches, data will be collected with the use of questionnaires and interviews will be conducted to get the learner's perception and experiences about the virtual learning that is exposed to them. Findings were that long after the practical, learners could use V.L. for revision and re-live the procedures. In addition, learners that were exposed to virtual learning had fun whilst engaging in their formal education. However, findings suggest learners preferred the integration of both traditional labs and virtual lab learning. In conclusion, virtual learning can be integrated with traditional teaching methods since learners need to be given a chance to get their hands dirty because agricultural science is a practical subject

41. Digital Science Laboratory

Xolani Maphumulo maphumuloxolani090@gmail.com , Mondi S.C

Scientific Laboratories drive out the most prestigious advancements of science, technology, medical cures, and other developments. Educated and highly skilled individuals such as scientists, researchers, and other science stakeholders use laboratories to conduct experiments, scientific investigations, and biological operations. As a result, a Lab is a facility where great work and great discoveries are produced. There are two reasons why physical laboratories don't unlock the full potential of a lab. Firstly, laboratories are very expensive to implement which adequately inhibit other interested and capable individuals to access and use Labs. Modern Labs contain very corrosive, dangerous tools or substances only experienced individuals who can adhere to safety procedures are allowed to use Labs without any intense supervision. To unlock the Labs' full potential such as the advancement of science, developing cures and technology, everyone with skills needs to have access to a Laboratory. This raises a need to create a digital science lab, which is a software simulation of the real lab. This is a virtual platform where scientific stakeholders can conduct experiments and other science operations as they would in the real lab. It is much cheaper since all resources are virtual. Digital Labs are accessible to everyone with a supported device and an internet connection. Digital Labs are very safe since any dangerous material is virtual. This would be a great tool to educate young ones and allow them to take the Lab home. A Lab that will use state of the art AR technology to create a virtual reality experience of the science Lab.

42. Science Centres Promoting Technology for Sustainable Development in Africa

Antony Kinyili, Kenneth Monjero, Stacey Obatsa and Purity Muli
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Technology has served as the foundation of social and economic well-being since the beginning of time. As science grows, Science Centres ought to play an essential role to the future advancement of technology. Africa has a wide range of important assets, which if properly managed can provide enormous opportunities for Technological advancement. Science Centres must pay special attention to the discovery and development of scientific talent at earliest stages of education. It would be necessary for them to nurture gifted children in environment that is responsive to their inquisitiveness and intellectual capabilities, hence lay a solid and enduring foundation for nurturing learners capable of reaching their full potential in enhancing technology. Science centres should be more devoted to the development and diffusion of simple, affordable and efficient technologies that address basic needs, such as clean water and renewable energies. If sufficiently funded, science centres should be able to attract the best problem-solving brains from inside and outside the continent. In addition, science centres ought to challenge the respective national governments to establish a technology and innovative fund, to provide merit-based and competitive funding for promising -innovations that have been initiated at the science centres. The paper provides an up-to-date advances in science centres' contribution to technologies for sustainable

development in Africa. Besides the paper examines interesting initiatives at the international level pursued by other science centres in promoting technology, with the objective to offer broad reference for the identification of suitable plans and approaches that can be adopted in Africa.

43. Reaching out in a digital space

Sandile Rikhotso, sandile.rikhotso@ul.ac.za , University of Limpopo Science Centre

With the availability of digital platforms, science and technology centres can reach wide range of their target markets. Optimizing digital media platforms together with traditional marketing tools will help science centres to grow their audience as well as reaching out to new ones. The paper will explore the available digital media platforms mostly used by science centres and the ones recommended on literature for marketing purposes. The talk will also recommend the cost effective digital marketing tools that science centres can use and how to make best use of them.

44. Quadrant 4. The last evolution

Brian Ndavha, ntwanarhuli@gmail.com , Giyani science centre

The evolution of science and technology is taking place at a fast pace. So fast that even the people who should be benefiting on it are instead 'trying' to catch up. With the fourth industrial revolution on course, many individuals, departments, educational institutions including science centers are still struggling to access, operate and achieve desired outcomes using the 4IR technology. 'Revolutions are a result of humankind's desire to develop, expand, and grow. This has led to all the significant inventions in our society' (interestingengineering.com). In other words, the desire for humankind has led us to the last quadrant (Quad 4) mathematically speaking. The 'Digital' revolution as it is affectionately known The Question is..? How do science centres cope with the 4IR technology? What are we doing to promote science and technological advancement? With the question of "inclusiveness" in science and technology centres as the sub-theme of 2019 annual SAASTEC conference, it is the aim of this presentation to outline the successes and barriers encountered by Giyani science center as we continue to support schools with various challenges ranging from community backgrounds to individual learner in a classroom.

45. Computer Science, Connecting Communities

Innocent Mazisi Ndlovu innocent@inkcubeko.org.za , Inkcubeko Youth and Science Centre

Rapid technological advancement across the globe, signals the supremacy of the 4th Industrial revolution, yet many African communities still fall far behind such a privilege. Moreover, this exposes our youth's lack of modern skills and adequate knowledge to comprehend and

embrace this vast change. The effect and the importance of the 4th industrial revolution is inspired by the struggles that the world has faced prior to the current technological shift. Consequently, the world is in great need of young people who are well aligned with the current technological system. Researchers have revealed that, soon the world is going to stop accommodating job seekers and embrace job creators. Computer science has proven to be the key skill of connecting communities and all those who will thrive in this era, will need such knowledge. The introduction of the Google CS-First program at the Inkcubeko Youth and Science Centre in Thembalethu 'George,' has sparked great excitement to the surrounding primary schools. Computer Science classes take place during the sessions scheduled for life skills and not only do the learners benefit, but we also get the teachers hooked up on the revolution. Teaching computer skills develops young people who are confident, creative and competent especially in the so-called impoverished areas. Learners who have finished their first project, have proven helpful to other learners and they individually continue working on other advanced projects. Starting from July 2019, the Inkcubeko Youth and Science Centre has influenced 260 learners between the ages of 10-15years to embrace computer skills, however we are aiming to reach 600 before December 2019. There is no greater joy than that of making a young person ready for the revolution, confident in using computers especially in the 4th Industrial revolution.

46. Effective Career Guidance (in the Era of the 4IR) – Cultivating Interest in STEAM Careers

Ian van den Berg, ian.vandenberg@sci-bono.co.za , Sci-Bono Discovery Centre

The coming of age of the Fourth Industrial Revolution (4IR) has impressed upon all of us the need to reflect on the future of work and employability. It raises the question to what the future of jobs and skills will look like, and how it will impact the future. We also ponder what the drivers of change will be and what resources we can access to become informed about the future. This is especially true when Career Development Practitioners (CDPs) reflect on how best to connect learners to STEAM careers, and how to create and facilitate lasting awareness about emerging careers within these occupational fields. We ask the question how best to facilitate career exploration and decision-making where learners are faced with uncertain future possibilities. Learners need to prepare for the changing world by learning about the advantages and opportunities in STEAM; they need access to career resources; and they need to become "forward-looking" by considering career options from a future perspective. As CDPs, we should be able to facilitate the career development process with our learners, and support them to construct their future career narratives; and by combining their stories with future learning and employment opportunities. This presentation examines career guidance techniques and strategies to be utilised by CDPs to facilitate awareness and interest in STEAM careers, and the future skills required, amongst our youthful populations.

47. Embracing the rising technology age in science center's with the use of Virtual and Augmented Reality.

Tasneem Daniels, Jamey Bester and Bafo Yoti jameyb@ctsc.org.za , Cape Town Science Centre

"Technology will never replace great teachers, but technology in the hands of a great teacher can be transformational" said George Courus in an online article titled "5 thoughts to push Learning" (Couros, 2015). This singular statement debunks the fears most educators have when thinking about the 'technology age' and it shows us that with technology we can transform the learning experiences our visitors have at our science centres. What does "embracing the fourth industrial revolution and the technology age" mean to you? For most, it means learning how to use the platforms in your everyday life, but a large portion of it is understanding the impact it will have and already has on our society. So, what does this all mean for Science Centres? The CEO of Accenture said, "Digital is the main reason just over half of the companies on the Fortune 500 have disappeared since the year 2000." (Hutt, 2016). This should get you thinking. As the Cape Town Science Centre, we offer workshops that use augmented reality to engage the learners with the subject of the workshop. We have the Google cardboard boxes which we use to demonstrate how virtual reality is within their grasp and how it can be used to take lessons out of the classroom without leaving the classroom. In addition to this, we also use the Oculus on the exhibition floor to immerse the public in full VR.

48. TANKS coding app – An indigenous tool bring coding and robotics to learners in disadvantaged schools.

Prof Jean Greyling and Singathwa Kuli singathwa.kuli@mbda.co.za , Mandela Bay Development Agency

Within the context of the Fourth Industrial Revolution, the South African government is driving the introduction of coding and robotics as a subject in primary schools over the next 3 years. This is a very relevant vision, keeping in mind that software development is one of the scarcest skills in our country, growing in importance as our economy moves into the digitized era. The harsh reality is that nearly 16000 of the 25000 schools in South Africa do not have computer laboratories, with an estimated cost of R1 Million per school on average, to provide these schools with laboratories that are connect to the internet. Most tools developed for kids' coding either need computers (often connected to the internet) or expensive hardware such as robots. The TANKS powered by Tangibl coding app was developed by computer science honours student Byron Batteson at Nelson Mandela University in 2017. It allows facilitators to introduce most introductory coding concepts such as loops, if statements and nested constructs, through the use of cell phones, tangible tokens

and image recognition. Since it's completion over 5000 learners have been directly reached through workshops across our country. The paper will report on the rollout of the project over the past two years as well as the possible impact it can have in South Africa, as well as across Africa

49. The future is calling – Science centres in the next 10 or 20 years

Puleng Tsie Puleng.Tsie@up.ac.za , Sci-Enza, University of Pretoria

As the world around us and we ourselves change, we need to constantly redefine our practices and tools if we want to grow and develop as a sector. This panel discussion will invite different stakeholders (government, industry, higher institutes of learning, SAASTEC, etc) both directly and indirectly linked to science centre and science communication to explore issues of sector identity, skills and business practices, policy alignment, climate change, the Fourth industrial revolution and the future of science and technology centres in on the Africa continent.

50. Science Centres at the forefront of 4IR

Akash Dusrath & Julie Cleverdon, akash@ctsc.org.za ,Cape Town Science Centre

Over the past decade, the role of Science Centres has evolved becoming increasingly important contributors in society. From serving as playgrounds for STEM engagement, making science exciting, fun and attractive to being identified as institutions ideally positioned to drive national strategic goals. They provide opportunities to develop and enhance knowledge and skills, and continue to be a strong support to the formal education sector. With the advent of the Fourth Industrial Revolution (4IR) and the need for a paradigm shift in education, what role can science centres play in this 4IR? Professor Klaus Schwab, the Founder and Executive Chairman of the World Economic Forum said "There has never been a time of greater promise, or greater peril" and in this paper, we will explore the possible role of science centres as key contributors for "greater promise" in this Fourth Industrial Revolution.

51. The O.R. Tambo Mathematics, Science And Technology Academy In Advancing The Fourth Industrial Revolution

SN DLAMINI & MV MOTHOMOGOLO, sndlamini89@gmail.com , O.R. TAMBO MST ACADEMY

This paper details the state of the O.R. Tambo Mathematics, Science and Technology (MST) Academy on the integration Information and Communication Technologies (ICTs) in line with the *Fourth Industrial Revolution* (4IR). The O.R. Tambo MST Academy started its operation in 2014. The focus area of the institution is on the MST subjects. The Academy emphasizes the usage of ICTs in teaching and learning. This paper details the activities of the MST Academy in relation to the integration of the available ICTs in teaching and learning. It concludes with

some research findings from a study conducted to inform practise in the MST Academy primary and secondary schools.

52. Snap out it – Rethinking the Method of Evaluation

Tasneem Daniels, tasneem@ctsc.org.za, Cape Town Science Centre

Exit evaluations exist as a standard operating practice for schools visits but are often filed and forgotten. The logistical burden of data capture and analysis is often the downfall of these exit evaluations. Where time, human resource and capacity are valuable commodities within a science centre, embracing paperless evaluations could prove beneficial. Technology offers various points of entry and is able to streamline the entire process, surpassing paper based evaluations it's in reach, complexity and integration. The presentation will focus of a pilot project utilizing QR codes to establish a two-way mode of visitor feedback and how this data can be used to improve visitor experiences.

53. Integration of Climate-Smart Agriculture System to Improve Crop Production for Smallholder Farmers in Eastern Cape

Mr Wandile Maya, Mr Pumezo Kwinana, wmaya@ufh.ac.za , FOSST-Discovery Centre

The new realities that climate change presents to humankind require more practical cropping systems to respond to the dramatic changes noticeable by farmers. This paper explores potential climate-smart agriculture (CSA) applicable for smallholder farmers of Eastern Cape Province. Contemporary literature reveals that CSA, which is a more effective and holistic crop production system, has been lauded by many farmers who have integrated it in their farms. Main practices viewed as climate-smart systems include, among others: (a) adaptation and (b) mitigation techniques. Structured questionnaires were distributed to farmers who are currently applying this system. Also, an extensive review of past research papers was conducted and analyzed. Findings are that practices which can be adopted by small-scale farmers include: (a) growing of variety of crops with resistance to numerous stresses (both abiotic and biotic) and (b) changing of planting dates or periods, to name but a few. Mitigation strategies for this system, on the other hand, involve conservation agriculture adoption, intercropping and organic farming. The advantage of implementing these systems will improve crop productivity. The study concludes that food security can be attained if concerned stakeholders join forces to address climate change problems as explained above. Recommendations are that an awareness campaigns have to be done to farmers about these peculiar climate changes and adoption of new technologies for integrating CSA at farm level. Thus, CSA's holistic approach to farming is the foundation or basis of ensuring crop productivity in light of the realities climate change brings to the fore.

54. Possibilities Of Growing Hydroponics As An Alternative Agricultural Technique To Enhance Crop Production And Water Conservation In Raymond Mhlaba Local Municipality.

Mr PM Kwinana, Ms A Gqwede agqwede@ufh.ac.za , FOSST-Discovery Centre

This study aims to introduce Hydro-culture to previously disadvantaged crop farmers. Hydro-culture is a unit of agricultural that is aimed at reducing and resolving the cropping challenges faced by plant producers. Contaminated land areas by hazardous waste and water limitations, result in decreased expected crop yields thus affecting the economic status of crop producers and their entities. Water conservation is an increasing concern in agricultural production at large. Hydroponics farming system recirculates and reuses water. Previous studies have proven that, crops grown in soil-less culture are healthier and consistently reliable than crops grown in soil as plants nutrients are constantly added by mixing nutrients and fertilizers, Data collection was obtained through semi structured questionnaire. Previously disadvantaged crop producers who showed willingness and interest were interviewed in Raymond Mhlaba local municipality, 50 crop producers were interviewed. A Xhosa enumerator assisted in the data collection. The result of the study revealed that the majority of crop producers perceive hydroponics as system that can sustain production throughout the year and stimulate the local Agricultural economic status.29% of crop producers not showed less interest on growing crops on soil-less cultures due to complicated scientific components that are required in ensuring the viability of the system, some of the farmer's concerns were the expenses of initiating the entire cropping system. It was concluded that there are possibilities of growing plants in hydroponics in Raymond Mhlaba but maybe greatly hindered by financial constraints.

55. A review paper of effective eco-friendly techniques that can be employed to eliminate the use of Conventional pesticides.

Nompumelelo Sinxo and Pola Stofile pstofile@ufh.ac.za , FOSST-Discovery Centre

The use of conventional pesticides has changed from been successful in eliminating pest, to having a negative impact on the environment and human health. The toxicity of these pesticides has resulted in the discovery of new methods for pest control namely bio-pesticides also known as green pesticides, in order to save the environment from pesticidal pollution and humans from possible health hazards. The main aim of the study is to explore different eco-friendly methods that should be adopted in order to save the deteriorated environment and human health from pollution. Bio-pesticides are eco-friendly pesticides which are obtained from naturally occurring substances, microbes and plants. They are categorized into three major classes such as Microbial pesticides, Plant pesticides and Biochemical pesticides.

Microbial pesticides consist of microscopic living organisms (viruses, bacteria, fungi, protozoa, or nematodes) as the active ingredient and target different kinds of pests, with each active ingredient containing various specific properties for each target pest. Biochemical pesticides are substances that occur naturally, controlling pests through non-toxic mechanisms. They include substances, such as insect sex pheromones that interfere with mating many different scented plant extracts that attract insect pests to traps. Plant pesticides are substances that are produced by plants from genetic material added to the plant, Plants contain untapped reservoir of pesticides that can be used directly or as templates for synthetic pesticides. The bio-pesticides are not only beneficial to the insect pest control field but to economic considerations and potential health benefits of these and there is no evidence suggesting that bio-pesticide pose greater risk to human health.

56. Encouraging positive action against harsh Climatic changes

Ephraim Ngwenya engwenya2005@gmail.com , Christoph Meyer Maths & Science Centre

Harsh Climatic changes have become a reality. It is important to strictly monitor our day to day actions so as to restore our habitat earth. Positive and drastic actions are needed as a matter of urgent . A lot has been suggested before but has not been fully implemented in most countries and communities . Christoph Meyer Maths & Science Centre has ideas to encourage communities to take positive steps to address the drastic Climatic changes. . .

57. Breaking barriers to positive actions against climate change

C.J Sibiya cjsibiya@yahoo.com , Mondi Science Centre

Climate change refers to a change in climatic conditions over a period of time, usually characterized by: fluctuating temperatures, increased rainfall /decreased rainfall, extreme weather events. Climate change effect are caused by the release of excessive amounts of Greenhouse Gases (GHGs) into the atmosphere by industries and our homes for domestic use. The effect of climate change will be worst felt by the poorest communities that are most reliant on ecosystem services. GHGs come in the form of carbon dioxide, Ozone, water vapour, methane and others. Consented and individual efforts need to be taken to develop mitigation and adaptation strategies in order to break barriers to positive actions against climate change. To be able to break barriers to positive actions against climate change, community awareness and education must or should be prioritized, involvement of private sector and public sector dealing with climate change related issues. All stakeholders must engage themselves in

promoting, utilizing energy that is offered by nature and appreciate ecosystem resources. Preserving ecosystem is one of the best way of mitigating climate change impact.

58. Could Nuclear Energy be the answer to the harsh reality of climate change?

Gilbert Lekwe, gilbert.lekwe@necsa.co.za , Necsa

Global source of electricity in 2019 shows that 66.3% electricity comes from fossil, 16.0% hydro, 10% nuclear, wind, solar, geothermal, and tidal 4.9% and others 2.2%. There are 453 operable power reactors, 57 under construction, 150 on order or planned and 335 proposed reactors. There are 31 counties in the world who are using nuclear power to generate electricity. Countries who are leading in nuclear power reactors are USA 99, France 58, China and Japan 42 each, Russia 37, South Korea 24, Canada 19, UK 15 to mention the few. South Africa has 2 rectors which are more than 30 years old. All forms of electricity production generate some level of CO2 and other greenhouse gases (GHG), even if they do not burn fossil fuels.

59. Climate Change: How To Have "The Talk", Constructively.

Katlego Tsogang, Pelontle Malgas tsogangkatlego@gmail.com , Mothibistad Science Centre

Climate change is, unfortunately, a phenomenon that people and the next generations will battle within their lifetimes. Exposing adults, the youth, and children to the harsh realities of human existence without throwing them into a panic can be challenging. In order to solve climate change, it requires teamwork and is not achievable without effective communication. Therefore we have adopted three ways to help our audiences grasp the stakes of climate change through "Laying the foundation", "Understanding the science" and "Focusing on the solutions". Instead of explaining what climate change is, first, we develop an appreciation for the natural world using methods that will be discussed further in the paper. This builds interest in why it is important to prevent climate change. Consequently, we introduce science and relate the practical with the theoretical aspects according to the audience's level of comprehension through storytelling, debates, and presentations. Ultimately, we draw the focus of the audience on the skills and solutions that can slow down climate change before it is too late.

60. Learning for sustainable living

Armstrong Mashakeni A.MASHAKENI@SANBI.ORG.ZA , National Zoological Garden

Education for Sustainability is a learning process that increases people's knowledge and awareness about the environment and associated challenges (Fien and Trainer, 1993: 30). According to IUCN (1991: 52) "People will adopt the ethic for sustainable living when they are persuaded that it is right and necessary to do so, when they have sufficient incentives, and when they are enabled to obtain the required knowledge and skills". This paper elaborate how education at the zoo enable learners to live a sustainable lifestyle. Loubser (2001: 113) explains that the call for education to enable a sustainable lifestyle act as a response to environmental crisis that societies face. In order to combat climate change it is important to teach skills that are useful to the economy but not harming the environment. Sustainable living is the practice of reducing one's demand on natural resources by making sure that they replace what they use to the best of their ability. Sometimes that can mean not choosing to consume a product that is made using practices that don't promote sustainability and sometimes it means changing how you do things so that you start becoming more of an active part of the cycle of life. Everything from the food we eat, to how we interact and how we get around. Lifestyles are part of individual identity; people express their social position, political preferences and psychological aspirations to others through them (Scott, 2009: 1).

61. Climate change is real, let's face it!

Thabile Mthiyane thohchili@gmail.com , Science Treasures

We usually talk about the end times, and it looks like we are in a final countdown towards the fulfilment of these end times. Our world is being destroyed by the harsh climate changes. Natural events and human activities are believed to be contributing to an increase in average global temperatures. It is being clear that human activities have caused most of the world's climate change (global warming) by releasing heat-trapping gases-called greenhouse gases into the atmosphere. This issue affects everyone and everything in the world. It is issues like climate change which demands us to include race, every category in the daily running of our science centres. We have different races contributing differently (according to their way of living) into the world's ever changing climate. There are different production categories, community activities all contributing differently in the high temperatures destroying us. Climate change is already negatively affecting us globally, and is believed to continue doing so unless some adaptive measures are taken. Communicating this information to only the school kids or certain group is not enough in marking a solid footprint and encourage positivity towards acting against climate. We need everyone involved, educated and equipped with what

are the impacts and what should be done, as this matter is taken lightly. This paper aims in giving insight about climate change as to instil a positive mind-set when it comes to acting against all contributing factors as possibly can. Also to help researchers on implementing practices as for climate change adaption. And to make everyone involved in the science centre's interaction.

62. Breaking Barriers To Positive Actions Against Climate Change

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Climate change is the long-term alteration of temperature and normal weather patterns in a place. This could refer to a particular location or the planet as a whole. Climate change is currently occurring throughout the world as a result of global warming. Global warming is an increase in the planet's overall temperature due to the burning of fossil fuels, such as natural gas, oil, and coal. Burning these materials releases certain gases into Earth's atmosphere. Over the years the whole world has suffered from the harsh consequences of climate change. The emission of hazardous and toxic gases mainly from industrial areas, motor vehicles and veld fires has led to an almost depletion of the Ozone layer which is considered as the Earth's "sunscreen" – protecting living things from too much ultraviolet radiation from the sun. The emission of ozone depleting substances has been damaging the ozone layer but through domestic and international actions, the Ozone layer is slowly healing. New tried and tested scientific ways to prevent further exhaustion of this vital layer to human kind have been validated and implemented such as the "Phase out of ozone-depleting substances" protocols. This implementation has helped reduce a significant amount of the after effects in the environment caused by climate change.

63. Breaking barriers to positive actions against climate change

Slindile Mthembu , mthembuslindile22@gmail.com, Christoph Meyer Maths & Science Centre

Breaking barriers to positive actions against the climate change will help us to promote healthy environment. This year's theme is about inclusiveness in science & technology centres so it's goes hand in hand with the topic about breaking the barriers to positive actions against the climate change

64. Practicing what we preach

Thabang More, thabang.more@up.ac.za , Sci-Enza

Science centres in South Africa are involved in amazing initiatives that place them in a unique positions as hubs of enlightenment and awareness within their respective communities, they serve as an informative space where information is passed on through different programmes that involve entire communities, one such programme is the 2019 national science week which was themed "Facing harsh realities of climate change". With science centre's being at the forefront of this focus week, it only becomes natural to put them under scrutiny by asking questions such as, do science centre practice what they preach to the masses? How green are our science centres? What measures are implemented at various centres to ensure a reduced carbon footprint? And lastly, do we as science communicators practice what we preach in our personal capacities?

65. The Relationship Between Climate Change And Weather

Mathebe Sampie Mphagahla mathebemathebe@gmail.com , University of Venda, Vuwani Science Resource Centre

The research is mainly focusing on the differentiation of Climate change and Weather, how this two does impacts each other, what are the characteristics that distinguish them. Many times our society doesn't differentiate between weather and climate change, this two to them they mean one and the same whereas each has its way of operation based on the other. Therefore the study will unpack all those details about each with some images explaining well in order for our community to understand better, since we are facing the harsh realities of climate change. This study will educate our people about the impact of climate change to weather caused by human. Keywords: Climate change, Climate, Weather, temperature, Global warming, Earth, hydrosphere, Atmosphere, Permafrost, Cryosphere, Biosphere, lithosphere and Troposphere

66. Identifying Barriers To Positive Actions Against Climate Change In South Africa.

Olwethu Ntaka, olwethu.mngonyama@gmail.com , MBDA/ NMB Science & Technology Centre

Climate change is a global phenomenon that requires urgent and diligent attention from all governing parties worldwide. Human impacts on the environment globally are extremely high. In the last four years, the earth's average temperatures were the hottest on record. How does this affect us? As humans, we take for granted the direct and indirect impacts of climate change, what directly affects one area of our global eco-system will have repercussions for the other areas in the long run. In the Arctic, winter temperatures have risen by 3°C since 1990. This has resulted in sea levels rising due to

the melting of the icecaps. Currently this is having a devastating effect on low-lying islands of Indonesia and in future coastal cities around the world displacing large numbers of people reside. Other impacts of increased ocean temperatures are the bleaching of coral reefs, which are difficult to recover once damaged. The degradation of natural resources, specialised regions of biodiversity and keystone species due to overexploitation of stocks and human induced pollution on environments that have contributed to increased impacts of climate change. Not only will climate change have an effect on the natural environment, this being an issue in its own right in South Africa, it will also continue to have an effect on peoples' health such as increased rates of asthma in younger generations, food security with South Africa already being a semi-arid country and water scarcity being an issue across the country, and loss of cultural terrestrial landscapes. Through the introduction of the dialogues on climate change within the programmes at the Nelson Mandela Bay Science & Technology Centre. Learners from grades RR – 12 are afforded opportunities to understand what the broader sciences entail; the direct and indirect impacts that they have on the environment; and are inspired towards aiming for positive contributions towards the science community.

67. Making science experiments exciting: Science shows as a means to stimulate performance of STEM experiments

Sinovuyo Makinana and Khayakazi Matasimba simakinana@ufh.ac.za, FOSST-DC, University of Fort Hare

Experts believe that in order for students to stay interested in science long term, they must be involved in science activities at early stages. This fascination to science can be nurtured by making it fun and interesting using hands-on experiments and programs. The main aim of this study is to show learners that science can be exciting, thus encouraging them to follow careers in Science, Engineering and Technology (STEM). The motivation of this study is to encourage learners to start thinking about which field to follow in Grade 10 whereas early years are imperative for conditioning their minds towards a specific career. Science shows (kitchen chemistry ones) were conducted to schools in the Amathole district. The learners of these schools showed great interest in these shows and were active participants. They were also keen to try various easy experiments made from household materials. Evaluation forms were handed out to learners and educators prior and after experiments were conducted. Assessment of learners' performance was done by their educators before and after the experiments. From these shows, learners gained observation, problem solving, independent investigation skills and use of household technology. The outcome of the activities revealed that because of these science shows, learners showed more interest in their science experiments. Additionally, a large number of learners were inspired to choose STEM careers. It is therefore recommended that numerous science shows and experiments be conducted as learners showed better understanding of scientific concepts after these science shows.

68. Celebrating international year of periodic table

Sigcinile Khalishwayo, sgcinilek@gmail.com , Mondi Science Centre

The Periodic Table was discovered in the year 1869 by Dmitri Mendeleev. It is a unique tool, enabling scientist to predict the appearance and properties of matter on the Earth and in the rest of the Universe. This is one of the most significant achievements in science, capturing the essence not only of chemistry, but also of physics and biology. This discovery has led to a new nomenclature system that is called IUPAC (International Union of Pure and Applied chemistry. IUPAC's mission is to provide objective scientific expertise and develop the essential tools for the application and communication of chemical knowledge for the benefit of humankind and the world. SAASTA organisation hosted events this year that revolve around P.T.

69. Understanding the Periodic Table, the pillar of Science and Technology.

Mr Tshuma D J, djtshuma@gmail.com , Nkomazi Mathematics and Science Centre

Mpumalanga Department of Education identified 101 Mathematics, Science and Technology (MSTA) schools to offer both Mathematics and Physical Sciences as compulsory subjects in grade 10.There is poor performance in these two subjects which may be the result of the content gap from grade 9.In Physical Sciences many learners do not understand the periodic table which make makes it difficult for them to write chemical compounds, chemical reactions and prediction of the products, basic stoichiometric calculations etc.The Periodic Table of Elements is central to the study of modern Physics and Chemistry. It is however, considered by teachers as difficult to teach.The periodic table is displayed in many science classrooms. Yet, not all students have an understanding of the information these organizers display. In this lesson, participants will learn about the periodic table and the relationships between the groups of elements or atoms, writing of compounds, reactions and products prediction.

70. Laser Meets Rocks: Journey to Discovery

Sipokazi Panya Panya n.panya2@gmail.com , iThemba LABS

A rock is generally composed of more than one mineral and it forms the solid part of the earth's crust. They an inhomogeneous mixture of minerals in the form of grains. Minerals are naturally occurring and have organised crystalline structure that is either composed of a single element or a compound; and fundamentally constitute soils and rocks. Minerals can be accurately identified by chemical analysis and X-ray; both these methods show the minerals' structure and elemental composition which are the minerals' "fingerprints". The periodic table allows one to understand chemistry of an element in a rock at a glance, and one can tell much about the chemistry of the element just by its position. Communication of the lab based science to the general public brings enjoyment of unprecedented growth. This is driven by a greater need to demonstrate the impact of publicly funded research, the need for research to

be valued, increased government scrutiny and a desire for a stronger evidence base for policy. Many career opportunities are emerging at the interface between scientific research and various public groups and it is our duty as the young emerging scientist to impart the knowledge to the upcoming generation and to also inspire them to take the baton after us.

71. Is Mendeleyev's Periodic Table the Greatest Scientific Idea Ever?

Mike Bruton, mikefishesbruton@gmail.com , Mike Bruton Imagineering

The highlights of Mendeleyev's career that lead him to propose the Periodic Table of the Chemical Elements will be outlined and the significance and impact of his discovery will be discussed. It will then be compared with other great scientific discoveries, such as Einstein's 'General Relativity', Darwin's 'Evolution by Natural Selection' and Watson and Crick's structure of the DNA molecule, in order to decide whether it is the greatest scientific idea ever. Criteria for making this decision will be outlined, and the audience will then be invited to vote for their 'Greatest Scientific Idea Ever'.

72. Online platforms as a vehicle in enhancing STEM learner intervention programmes

Mr Maqoqa Lwazi and Mr Phumezo Kwinana, lmaqoqa@ufh.ac.za , FOSST-Discovery Centre

Despite several initiatives to increase the interest of Eastern Cape students for STEM (Science, Technology, Engineering, and Mathematics), enrolment of students in STEM education in the Eastern Cape is still low compared to that of other provinces. Recent data have shown that a substantial part of Eastern Cape students who initially show talent and interest in STEM, eventually leave education with a non-STEM related diploma or choose a non-STEM related programme in tertiary. Although these programmes have been widely evaluated, there seems to be no consensus about which interventions are successful in raising interest in STEM or persistence in STEM education. There seems to be no consensus about which more specific courses and professions are part of STEM. Most researches also place ICT education and ICT related jobs in the STEM. A contextual perspective on talented participants and their development in extracurricular STEM programs. In line with the majority of studies, this study focuses on building an online platform as vehicle in enhancing STEM learner intervention programmes.

73. National space awareness at SANSA

D.A. Matsapola dmatsapola@sansa.org.za , SANSA

The Ten Year Innovation Plan (2008 – 2018) of the Department of Science and Technology has identified areas of investment to address an array of social, economic, political, scientific and technological benefits. They are designed to stimulate multidisciplinary thinking and to challenge our country's researchers to answer existing questions, create new disciplines and develop new technologies. Space science and technology is one of the five grand challenges which set out to make South Africa a key contributor to global space science and technology,

with a National Space Agency, a growing satellite industry, and a range of innovations in space sciences, earth observation, communications, navigation and engineering. South Africa has made the development of a domestic space industry a priority and the development of human capacity will ensure sustainability of the industry, especially in the 4th Industrial Revolution underpinned by a global marketplace. The recent launch of the ZACUBE-02 satellite into Low Earth Orbit has sparked renewed interest in the role space science and technology plays to unlock socioeconomic benefits in the vast ocean with 23 ports and harbours which are situated along the 2500 kilometres coastline from the East coast to the West coast. The South African National Space Agency (SANSA) works with partners to support Operation Phakisa, aimed at fast tracking the development of the oceans economy. SANSA also uses space technology to monitor key infrastructure projects nationwide that serve as the backbone infrastructure to support economic growth.

74. The Mobile Science Laboratory- Either You Come Or I Come, You Can't Run Away From Me

Satisfied Chabalala schabalala@osizweni.org.za , Osizweni Science Centre

Science Centre plays a very pivotal role in the communities around them. One of the role that Science Centre plays is to provide disadvantaged schools with science laboratory experience. Science without laboratory experience is meaningless to many. Most schools in our communities are not equipped to make the science that is learned in class to come to life. Some school do not have a laboratory at all. Science Mobile lab plays a very important role in the science Centre.

In order to function fully and effectively, the coordinators of the mobile lab need to be flexible because is not all the schools that you visit that are equipped with laboratory, sometimes you find that you need to convert a normal classroom to work as a laboratory. Yes, this comes with its own challenges like no power, no sink, no tap and etc but we need to adapt and make the learners to have the same or similar feeling that they were going to have in the standard laboratory.

Mobile science lab are very effective in spreading the knowledge of science because schools and communities from different background are included in spreading science knowledge despite of their distance from school/community to the center. The beauty of this is that you are able to take science to them without them having to spend money to visit the center. Students that we are sponsoring to study Education at UNISA We also run other big competition like Sasol Technox, assist in Eskom Expo, AstroQuiz, MiniQuiz.

75. An Investigation On Grade 10 Students' Attitude Towards Science And Technology In Palabora Foundation, Limpopo Province

Norman Moshokoa norman.moshokoa@pafound.za.org, Palabora Foundation

Science education is an area of interest for long and has gained a lot of attention from science educators. Keeping this in view, the current study explored the attitude of grade 10 students in Palabora Foundation student support programme towards science and technology. The main question of the research was "what is the attitude of grade 10 students towards science and technology in Palabora Foundation students support programme?" A 5-point rating scale (1 = strongly disagree to 5 = strongly agree), Science and Technology Attitude Scale (STAS) which has 19 items was adapted from previous research. The population of the study included all the science students participating in students support programme. The sample of the study was 97 participants (59 female and 38 male) students. The data was collected by means of STAS. Data was analysed using frequency and percentage as well as student t-test. The findings of the study revealed that there is positive attitude towards science and technology among students. Also, the attitude of learners in science and technology influences the low participation of learners in science. It is the researchers' hope that the findings of this study will motivate many students to have positive attitude towards science and technology and improve their academic performance.

76. English Attack -Early Literacy Project

Priya Bisunder/Thami Mphokela tmphokela@webmai.co.za, ArcelorMittal Science Centre (Sebokeng)

Learners display failure to read and comprehend textbooks written in English, they lack confidence in orally communicating in English and fail to comprehend and answer examination questions in English

77. Living a scary-free life through science

Gumude Bonisiwe, thandoh8426@gmail.com , BSG science centre

Living in a criminal high zone area has made us as BSG science centre to consider bringing the solution to the community and a country at large through scientifical project that has assisted about more then 60% of our neighboring areas hence science centres their work is to bring solutions to problem at hand through science programs. A device has been made to stop or reduce the criminal intruders and car theft ,this is to show the advancement of science through our inclusion.

78. Spread science love through TV science activities

Gumede Ncamsile, thandoh8426@gmail.com, BSG science centre

We are located in rural areas so is our schools, schools that doesn't have laboratories for experiments,one science centre cannot be able to cover all 558 schools located in our area,thus we then decided to start a TV show program that can assist many learners through science activities.

79. New strategies of winning young minds through science activities

Nyawo Jabulile, thandoh8426@gmail.com , BSG science centre

Being located in jozini deep rural of umkhanyakude in KZN our vision is to nurture learners to be future global trend setters,through various science projects in conjunction with department of education, we are based in a society full of objects poverty, however this has not stopped us from holding successful science activities and workshops, such as computerised exhibitions, olympiads,science eskom expos ,science tutorials and science spelling competitions to boost the love of science.

80. Data Analysis

Thandamanzi Mtsweni, Duduzile Kubheka, Noliqhwa Nkosi tmtsweni761@gmail.com , NRF/SAASTA

The paper will introduce the concept of data analysis from SAASTA's point of view and, why it is essential to conduct an analysis of science centres nationally. We will discuss in depth the process involved in data analysis such as data requirements, collection, cleaning, analysis and interpretation. Our focus will be on the work we continually conduct at SAASTA in measuring our reach in our aim to fulfilling the Science Engagement and advancement in the country. This of course would not be possible without the very important role played by the science centres in reaching out to the greater community of the country and fulfilling SAASTA's mandate. Science centres collect data in the form of attendance registers, share the data with SAASTA, who in turn cleans it, and then share the cleaned data with the Department of Science and Innovation (DSI) for analysis and interpretation. We hope this will serve as a surrogate to the work conducted in each of the centres. Our discussion will include the impact of data analysis in this regard; the challenges encountered during this process, and address our recommendations. Which is why it is very relevant and important that we bring this discussion forward in this setting.

81. How does science festivals improve the quality of lives of rural communities?

Griezel Raphahlelo; Ruth Chepape; Cornet Thabiso Mamabolo , griezel.raphahlelo@redfest.org.za , REDFEST South Africa

It addresses the following: The paper/presentation & Poster will both share experiences on the theme of the conference and catalyze future knowledge exchange in the SADC region; focus on the impact of the science festivals organized at different provinces of the Republic of South Africa; moreover the paper and the poster will advance Technology through science festivals (Next digital revolution-4IR) AND Breaking barriers to positive actions against climate change

82. Organic or traditional intellectualism for science engagement?

Tsepo Majake tsepo@assaf.org.za , Academy of Science of South Africa

The four science engagement delivery vehicles: public awareness of science (PAS); public understanding of science (PUS); science literacy (SL) and science communication (SC) require a level of intellectualism from strategy to evaluation. Socrates viewed intellectualism as something that allowed one to 'do what is right or best just as soon as one understands what is right or best'. He concludes that virtue is purely an intellectual matter since virtue and knowledge are closely related and improve with dedication to reason. The Socratic intellectualism was the fundamental philosophic doctrine to stoicism. The weakness of the Socratic approach is the 'Socratic paradoxes', such as the view that there is no weakness of will. The Socratic paradoxes was the subject of study across disciplines through the years and birthed a number of interesting thought processes. Contemporary philosophers dispute the Socratic conceptions of intellectualism, Michael Foucault demonstrated that in classical antiquity 'knowing the truth' is akin to 'spiritual knowledge'. Hence, without exclusively concerning the rational intellect, spiritual knowledge is integral to the broader principle of "caring for the self". Therefore, to understand truth meant "intellectual knowledge" requiring one's integration to the (universal) truth, and authentically living it in one's speech, heart, and conduct. Achieving that difficult task required continual care of the self, but also meant being someone who embodies truth, and so can readily practice the Classical-era rhetorical device of parrhesia: "to speak candidly, and to ask forgiveness for so speaking"; and, by extension, practice the moral obligation to speak the truth for the common good, even at personal risk. This ancient, Socratic moral philosophic perspective contradicts the contemporary understanding of truth and knowledge as rational undertakings. Foucault's work explains the relationship between power and knowledge (Stokes, 2004) and Marshall, 1996) and how power can be used to control and define knowledge. His work explains how power is based on knowledge and makes use of knowledge; on the other hand, how power reproduces

knowledge by shaping it in accordance with its anonymous intentions (Foucault, 2008). With the advent of 'big-data' and 'citizen-science' the term knowledge has been closely associated with power. In the 'knowledge economy' era, where knowledge is used to create goods and services, where growth is dependent on quantity, quality and accessibility of information rather than the means of production. The informational resources control the ability to channel the interaction between information and people through 'popularization', information relevant to most people and 'personalization', information relevant to each individual. This paper explores how science communicators can use intellectuality to break the barriers to positive actions in science engagement for inclusive science dialogue and communal development. References 1. DST (2015), Science Engagement Strategy. 2. Foucault, Michel, 1926-1984. (2008). The history of sexuality. Penguin. ISBN 9780141037646. OCLC 709809777 3. J.D. Marshall (30 June 1996). Michel Foucault: Personal Autonomy and Education. Springer. p. 126. 4. J.D. Marshall (30 June 1996). Michel Foucault: Personal Autonomy and Education. Springer. p. 126. ISBN 978-0-7923-4016-4.

83. How Jcpz Uses The Mobile Lab To Combat Inclusivity Barriers By Running Sdg Outreach Programmes

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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 100 000. Subsidy of City of Johannesburg (CoJ) is limited not covering all schools in Johannesburg but with the mobile science lab JCPZ can reach more. JCPZ mobile lab is also used to engage in projects that alleviate poverty by creating vegetable gardens, planting fruit and indigenous trees that also contribute to the mitigation of climate change. Moreover, maintenance maximises job creation through hiring community based educators and parents of children in communities that are economically marginalised. Collaboration with city entities and other provincial sectors contribute to assisting other science centres in sustainable green projects. 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.

84. Determination of global solar radiation in Northern region of Limpopo province

Mathebe Sampie mathebemathebe@gmail.com ,University of Venda, Vuwani Science Resource Centre

The research mainly focuses on the determination of global solar radiation using temperature based model by Hargreaves and Samani for Northern regions of Limpopo Province South Africa. The daily maximum and minimum temperature data measured at the following six (6) stations were used i.e. Ammondale, Mutale, Nwanedi, Roedtan, Sekgosese and Xikundu for the period 2008 – 2010. The values of empirical coefficient Kr for the Inland were computed and used as an input to the model. While the observed and calculated global solar radiation data were compared on the basis of the statistical error tests that is mean bias error (MBE), the mean percentage error (MPE) and the root mean square error (R2). Based on the statistical results the model was found suitable to estimate monthly average daily global solar radiation for the regions listed above and elsewhere with similar climatic conditions and areas where the radiation data is missing or unavailable. Hence, the study will also help to advance the state of knowledge of global solar radiation to the point where it has applications in the estimation of monthly average daily global solar radiation across. Key words: Solar energy; Global solar radiation (H); Temperature based model; Extra-terrestrial solar radiation (); Kr –Empirical constant.

85. Time Series Analysis of Tropospheric CO_2 Using Remote Sensing

Bongani C Mkhize, mkhizebongani16@gmail.com, Mondi Science, Career Guidance & FET Skills Centre

Carbon Dioxide (CO_2) is a well-known atmospheric gas that has a significant net greenhouse gases contributing in terms of climate change. With the contribution of about 60% of active relative radiative forcing of CO_2 concentration in the atmosphere, the adversities through climate change and occurrence of extreme weather events are evident.

Therefore, the main aim of this study is to investigate the variability of CO_2 and forecast of the time series of CO_2 concentration over uMhlabuyalingana following the identification of the area as a potential site for carbon capture and storage (CCS) due to stable geological formation.

The CO_2 data used here is the mole fraction data retrieved from the National Aeronautics and Space Administration's (NASA) Atmospheric Infrared Sounder (AIRS). This data is a free troposphere measurement taken at a spatial resolution of 2×2.5° monthly grided for a period of 14 years (2003-2017).

86. Technological approach towards renewable energy

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There is currently, around 80% of global energy and 66% of electrical generation are supplied from fossil fuels, contributing approximately 60% of the greenhouse gas (GHG) emissions responsible for climate change. A transition to cleaner forms of energy has already begun in many countries, but despite the recent fast rate of technological innovation and cost reduction, renewable energy and energy efficiency technologies must still compete with highly subsidised carbon-intensive energy technologies. Renewable energy technologies could be deployed more rapidly if energy policies addressed both the subsidies and impacts of fossil fuels while facilitating more finance for renewable energy projects.

The movement of wind and water, the heat and light of the sun, the carbohydrates in plants, and the warmth in the Earth—all are energy sources that can supply our needs in a sustainable way. A variety of methods are used to convert these renewable resources into electricity. Each comes with its own unique set of technologies, benefits, and challenges.

87. The Role of Periodic Table & IUPAC In Our Everyday Lives

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The periodic table was first published by Dimitri Mendeleev in 1869 and since then, new elements have been discovered and added into it. The elements are arranged by atomic number, electron configuration and chemical properties. IUPAC, which stands for International Union of Pure Applied Chemistry, was formed in 1919 by a number of chemists.

The periodic Table was used as a way of communication amongst chemists around the world and today it is used to name compounds and determine their different chemical and physical properties. The periodic table plays an important role in everyday lives. Ordinary citizens have a privilege of knowing about the elements important in our bodies.

POSTER PRESENTATION

1. **Climate Change: A problem for everyone**

Akhona Lukhozi, alukhozi@nmsa.org.za , KwaZulu-Natal Museum

The vision of the KwaZulu-Natal Museum is to position the museum as a leading, inclusive and transformed heritage institution in South Africa. In doing so the museum recognizes and responds to inclusion by offering various programmes (Biodiversity day, Holiday programmes, Traditional leaders and healers workshops, Climate change gallery, National Science week and Sabalala Nolwazi environmental youth club) that allow many individuals and groups in their communities who are not able to access its resources on a regular basis. The poster will present climate change programmes that were done by the museum to break the barrier of ignorance to positive actions against climate change.

2. **Mobile science and technology labs as a means to revive STEM learning in rural-based schools in the Eastern Cape**

Yolanda Jali and Xolisa Williams yjali@ufh.ac.za , FOSST Discovery Centre

Mobile science centres have a huge potential to promote and improve performance of STEM subjects in rural-based science schools in the Eastern Cape. This will alleviate high failure caused by lack of adequate science laboratories in this region. This paper presents a study conducted in rural-based science schools in Alice and King William's Town regions. The aim is to revive teaching and learning of STEM subjects with the assistance of mobile science and technology labs. The initiative was triggered by the fact that most rural-based schools are closing STEM learning areas due to lack of adequate science facilities or laboratory equipment. The Armscor-sponsored mobile labs at the FOSST Discovery Centre were used a model to intervene in most schools to improve performance of science experiments so as to enhance understanding of scientific concepts. Activities done using mobile labs included science shows, science experiments, interactive science exhibits and presentation of lessons in two- and three dimensions using Eureka educational software. Pre and post evaluations of these activities were conducted. Results show that learners gained various cognitive skills, problem solving and hands-on experiences to conduct experiments independently. The research findings also showed an improvement of performance in these schools in comparison with the pre-evaluation results. It can be concluded that the model is effective to help learners to comprehend scientific concepts. Also, it is a cost-effective alternative to the lack of facilities or laboratories. This operation model is recommended as a supplementary tool to schools that have inadequate laboratory equipment. Future plans are to increase coverage to realize our ultimate goal of changing the education equation of rural-based schools so as to unveil hidden talents.

3. **Agri-smart innovative technologies to improve productivity of small-holder farmers: Case study of Raymond Mhlaba and Buffalo City Metropolitan Municipality.**
Hlumelo Zondani and Wandile Mashece hzondani@ufh.ac.za , FOSST Discovery Centre.

In majority of the population of less developed countries derives its livelihood from agricultural production, because new technology seems to offer an opportunity to increase production and income substantially together with food security. Studies indicated that, continuing population and consumption growth means that the global demand for food will increase for at least another 40 years. The effects of climate change are a further threat to crop production. Hence, new modern technology needs to be introduced and developed to accelerate crop production. Smart farming provides farmers with better decision making or more efficient exploitation operations such as management of spatial and temporal variability to improve economic returns following the use of inputs and reduce environmental impact. Including whole farm management with the goal of optimizing returns on inputs while preserving resources. The study is conducted in East London in Buffalo City Metropolitan Municipality and Raymond Mhlaba Municipality in Eastern Cape, South Africa. Questionnaires were distributed in ten agriculture companies using these modern technologies to improve crop production and analysed using SAS code 2006. Results indicated that the use of modern technology improves crop yield and increase productivity in farmers. Therefore Agri-smart innovative technologies serve as an aiding tool in the agricultural sector's sustainability and growth.

4. **Robotics Competition with a twist**
Bafana Mavuso bafana@amsasciencecentre.co.za , ArcelorMittal Science Centre Sebokeng

Afrobot is an amateur robotics tournament that was introduced to the country by the French Embassy and SciFest Africa. It aims to provide South African learners with an opportunity to get involved in a technical project within a supportive and entertaining environment. The purpose of Afrobot is to offer learners an entertaining and friendly platform to conduct a technical project. It is an opportunity for learners to get hands on experience, develop skills and know-how, and to demonstrate innovation and creativity as well as employ a strategic mindset and to promote fair-play. It encourages team members to use basic electronic components and household material to build a robot, thus making a tournament accessible to anyone. The tournament is open to all learners between the ages of 8 – 18 years old. ArcelorMittal Sebokeng Science Centre first participated at the Scifest Africa science festival in Grahamstown in 2011. For 2011, six learners from the centre participated in the Afrobot competition. These two girls and four boys were selected from the surrounding disadvantaged schools in Sebokeng. Participating in such an event was a first for them and they took it in high strides. The programme has now been introduced to more than 30 schools in the region and the results show growing interest from learners even at primary level. The use of robots in

the classroom subconsciously introduces students to possible career paths they may not have ever considered. Engineering principles, such as electrical, mechanical, and chemical, as well as IT skills are required to successfully complete a robotic based project. This is important to ensure that the skilled worker shortage that exists, particularly in engineering, is addressed during the years when students are thinking about planning their careers. Robotics is a perfect way to show students that engineering and IT can be fun.

5. **How to make mathematics fun, easy for learners?**
Khuliso Makungo khumbelom@webmail.co.za, ArcelorMittal Science Centre (Sebokeng)

Many of learners they feel bored in mathematics classroom because they feel like doing something that is not important in their lives. They ask themselves question, why do we solve for x? It is important that every learner understand why they are doing mathematics. Many teachers they just teach the topic in mathematics to learners without telling them background of the topic or the real live example about the topic. Mathematics is more than just a subject in our life. When learners know the relationship between mathematics as a subject and they lives they will enjoy the subject. That why Arcelormital Edutainer we make mathematics easy in the classroom by telling them important of each topic in our lives. Most learners only know financial maths because it talks about money and we use money in our daily lives. When learners know the important maths in our lives they start to love the subject and perform well. Mathematics teaches us how to solve problems, know how structures are build and many more.

6. **Graphing Calculator as an innovative hands-on gadget of teaching and for learning mathematics: A case study of Saturday STEM classes.**
Sinayo Booi, sbooi1@ufh.ac.za , FOSST-Discovery Centre

The purpose of this study was to introduce graphing calculators in rural based schools of Eastern Cape and provide means to teach mathematics in an interactive and hands-on way. In the traditional teaching of mathematics, learners are passive recipients. Graphing calculators encourages full engagement by learners for better understanding. Also, graphic representation of mathematics enables learners to better understand relationships between objects and their properties through visualization. This type of technology was used to explain some of tricky sections like functions, graphing and modeling, differential equations and its applications, etc. Saturday Classes learners in Grade 11 were taught these sections using graphing calculators. They were given group projects to solve and tutorials were interactive to promote full engagement with the gadgets. They wrote formative and summative tests to test their knowledge and understanding of the scientific concepts. Results suggest that this technology facilitates greater understanding of scientific concepts. Learners confessed that they used to memorize the answers to questions but after the use of the graphing calculators, they were able to write answers with understanding. Graphing calculators are advantageous since they enable learners to visualize graphs in three-dimensions. Same thing applies to subjects like physical sciences and life sciences. It can be concluded that graphing calculators

are instrumental to enhance understanding of mathematical and physical properties. They also enabled learners to visualize scientific concepts in multiple dimensions, thereby encouraging full spectrum view of a tricky concept. This has a huge potential to improve results in these scarce skills subjects.

7. **Green house gases and how we can stop production**

Thembikile Mdletshe, thembikilekhwezi@gmail.com , Christoph Meyer Maths & Science Centre

Green house gases will be identified in this poster which are produced in our day to day life but methods of minimizing and ultimately stopping production will be illustrated by in the poster.

8. **Spread science love through TV science activities**

Gumede Ncamsile, thandoh8426@gmail.com, BSG science centre

We are located in rural areas so is our schools, schools that doesn't have laboratories for experiments,one science centre cannot be able to cover all 558 schools located in our area,thus we then decided to start a TV show program that can assist many learners through science activities.

9. **New strategies of winning young minds through science activities**

Nyawo Jabulile, thandoh8426@gmail.com , BSG science centre

Being located in jozini deep rural of umkhanyakude in KZN our vision is to nurture learners to be future global trend setters,through various science projects in conjunction with department of education, we are based in a society full of objects poverty, however this has not stopped us from holding successful science activities and workshops, such as computerised exhibitions, olympiads,science eskom expos ,science tutorials and science spelling competitions to boost the love of science.

10. **Science for Everyone**

Njabulo Duma and Alfred Rasakanya, nezduma@fastmail.fm , SAASTA

Science and Technology centres provide a platform for society to engage with Science Engineering and Technology. Science and Technology centres should therefore reflect the diversity of their surrounding communities and provide inclusive programmes and activities that are accessible and promote learning opportunities for all. The poster explores 7 aspects of inclusivity that Science and Technology centres need to consider in order to ensure that all participants who visit Science and Technology centres feel welcomed, included and supported.

11. What is the public perception of science?

Goitseona Ramonnye, goitse11ramonnye@gmail.com , iThemba LABS-National Research Foundation

The paper presents a reflection of National Science Week (NSW), as an initiative of the Department of Science and Technology (DST), which was hosted by iThemba LABS-National Research Foundation from July 29th to August 2nd 2019, with the aim of promoting science. Career sessions and hands on workshops were held both onsite and offsite for high school learners. Staff members made presentations on career opportunities. Post Graduate students from iThemba LABS visited shopping malls in Khayelitsha, Eerste River and Blue Downs, interacting with the general public while also handing out information pamphlets about iThemba LABS. Physics students from the Universities of the Western Cape and Stellenbosch visited iThemba LABS to expose them to research and career development opportunities. The main objective of this paper is summaries what is the purpose of science engagements, how is it relevant to the community, how postgraduates and researchers can promote mutual understanding to the community by presenting their work and effectively implementing science awareness. The paper will illustrate the science and technology roadmap in South Africa leading to the fourth industrial revolution. The paper will also single out a study, about the lotus leaf, which is focused on Nanoscience and Technology as an emerging disciple and a career that put South Africa at the cutting edge of scientific discovery and at the forefront of technological developments which hold the potential to change the world we live in.

12. How Can Science Centres Remain Relevant in the New Age of 4IR?

Tshepiso Mokoena, tshepisomokoena29@gmail.com , UJ Soweto Science Centre

Artificial Intelligence, Coding, Digitalization, E-learning and Robotics are the current buzz words used to describe the Fourth Industrial Revolution. This new wave of technological advancement is starting to change the way we live, work and learn. The following investigation will look into how science centres in South Africa can remain relevant as they advance towards the Fourth Industrial Revolution. Science centres, being educational facilities that use effective methods such as hands on learning, science exhibitions and experiments to teach STEM, should ensure that the need for technological advancement in our centres becomes unignorable. Although our science centres have access to internet connectivity and others are already making use of technologies attractive to the movement of the Fourth Industrial Revolution, it is vital that the introduction of virtual science labs as well as the use of multimedia in the learning environment are in coherence with the learning programs to provide a meaningful learning experience. Therefore, science centres can adopt and make use of advanced technological strategies based on the Fourth Industrial Revolution

and its Technology, such as training learners in basic computer literacy, basic coding and other useful technological skills that are improved by significant skills developed in mathematics and science. Furthermore, science centres can remain relevant by continuing to give learners access to the use of scientific tools and opportunities made available to them to enhance their inquiry skills and conceptual understanding enabling them to learn and explore with no limitations. These skills and initiatives will ensure that the centres remain relevant as they move towards The Fourth Industrial Revolution.

13. XinaBox for education to enhance interest in learners towards 4IR

Thandile Vuntu tvuntu@sansa.org.za , SANSA

The poster will concentrate on how to use the XinaBox chips to collect and process, analyse data real time DATA. This is in line with the 4IR and knowledge creation amongst learners through the use of the science centre.

14. Adapting to the changing world

Nthabiseng Moloi, nthabisengmoloi95@gmail.com , ArcelorMittal Science Centre - Newcastle

The world is changing, and so should we. Powerful technologies have been introduced that can make life easier and enable human achievements previously (and currently) thought to be impossible. It is expected to change everything fundamentally; industries, economies, jobs, transport, skills and education. In attempts to adapt to the Fourth Industrial Revolution; we engage with pupils from different schools on a weekly basis to develop their technological skills. These include Google CS First, a programme that teaches computer programming and coding to young pupils; Google online safety training ; Cami, a fun and interactive educational software system that helps learners understand mathematical concepts, literature and scientific concepts and lastly, a Techno-Youth programme where we expose learners to robotics and programming. We believe our current contribution towards the awareness of the 4th Industrial Revolution will prepare our community to embrace change and be able to interact with various technological equipment.

15. Climate change Awareness

Hlongwani Ntshuxeko Elson, ntshuxekoelson@gmail.com, University of Venda (Vuwani Science Resource Centre)

Climate change refers to significant changes in global temperature, precipitation, wind patterns and other measures of climate that occur over several decades or longer. This kind of change causes the sea to rise, hence the food that we take are threatened. In this study will be focusing on the things Science Centre can do to alert the community about this development that affect our climate.. Our community members don't have enough information about climate change, due to pollution and littering happening, hence the study we assist in resolving this problems around the area. Keywords: Climate change, Weather, Temperature and Climate.

16. How does science festivals improve the quality of lives of rural communities? / The use of a community library in communicating science

Griezel Raphahlelo; Ruth Chepape; Cornet Thabiso Mamabolo , griezel.raphahlelo@redfest.org.za , REDFEST South Africa

It addresses the following: The paper/presentation & Poster will both share experiences on the theme of the conference and catalyze future knowledge exchange in the SADC region; focus on the impact of the science festivals organized at different provinces of the Republic of South Africa; moreover the paper and the poster will advance Technology through science festivals (Next digital revolution-4IR) AND Breaking barriers to positive actions against climate change.

17. Climate change mitigation

Pandelani Ndou , pandi.ndou23@gmail.com, University of Venda Vuwani Science Resource Centre

Climate change is increasing and impacting the world on a daily basis. The rising of sea levels and temperatures are some of the signs of climate change. Ways in which we can reduce it is by using renewable energy, growing our own food and many more.

18. Image analysis by CIEL*a*b* and RGB colour coordinates for the colorimetric detection of hexavalent chromium using gold nanoparticles functionalized 1,5-diphenylcarbazide

Sindisiwe F. Muthwa, Nontuthuko S. Zulu, Mbuso Mlambo, Phumlani S. Mdluli, sindimuthwa@gmail.com , Durban University of Technology

This paper demonstrates a quantitative analysis based on colorimetric detection of hexavalent chromium (Cr(VI)) using gold nanoparticles (AuNPs) functionalized with 1.5-diphenylcarbazide (DPC). The CIEL*a*b* and RGB colour coordinates were applied to analyse the obtained digital images. CIEL*a*b colour space is referred to as instrument independent while colour coordinates red (R), green (G) and blue (B) are referred to as instrument dependent. The instrument dependent colour coordinates RGB were measured ImageJ software to determine the colour dynamics between the reaction of DPC-AuNPs and Cr(VI). It was observed that DPC-AuNPs aggregate in the presence of Cr(VI). This resulted in a decrease in the intensity of the surface plasmon resonance (SPR) band at 520 nm and the formation of a new red-shifted band at 670 nm and subsequently a colour change from red to blue. The R colour coordinates gradually decreased as the Cr(VI) concentration increased up to 16 µM then a rapid decrease was noted between 18–25 µM. The G and B colour coordinates followed the same trend with a gradual increase between 0.5–16 µM followed by a rapid decrease up to 50 µM. Colour difference (ΔE) was increasing significantly as the Cr(VI) concentration increased. A rapid decrease was noticed in hue angle between 16-25 µM while chroma decreased significantly as the Cr(VI) concentration increased. The LOD and LOQ was 0.08 and 0.27 µM, respectively. Thus, excellent selectivity was observed in the presence Cr(VI) than other metal ions and anion that were investigated. The method was then applied for the determination of hexavalent chromium in spiked tap and river water samples and the recoveries ranged from 76.64-100.93% and the RSD between the ranges of 0.000-0.046%.

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