Education and Skills Development

Science Engagement Framework and Youth into Science Strategy: Science Centre Capacity Building Project Evaluation

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Abbreviations

BIUST	-	Botswana International University of Science and Technology
DST	-	Department of Science and Technology
FET	-	Further Education and Training
GET	-	General Education and Training
GM	-	Genetic Modification
HartRAO	-	Hartebeesthoek Radio Astronomy Observatory
HSRC	-	Human Sciences Research Council
ICT	-	Information and Communication Technology
IYC	-	International Year of Crystallography
JICA	-	Japan International Cooperation Agency
JOCV	-	Japanese Overseas Cooperation Volunteers
KZN	-	KwaZulu-Natal
NECSA	-	South African Nuclear Energy Corporation
NRF	-	National Research Foundation
SAAO	-	South African Astronomical Observatory
SAASTA	-	South African Agency for Science and Technology Advancement
SAASTEC	-	Southern African Association of Science and Technology Centres
SANSA	-	South African National Space Agency
SCCB	-	Science Centre Capacity Building
STEM	-	Science, Technology, Engineering and Mathematics
UNESCO	-	United Nations Educational, Scientific, and Cultural Organisation

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Executive summary

The Science Centre Capacity Building (SCCB) project was introduced by the Department of Science and Technology (DST) in response to the capacity challenge presented by the rapid increase in the number of South African Science Centres. The South African Agency for Science and Technology Advancement (SAASTA) was mandated to address capacity building through providing training aimed at supporting science centre officials to improve the effective management of their centres, as well as affording opportunities for information sharing and networking among science centres.

This study evaluated the SCCB training which took place in 2015. Six workshops were conducted during the year, and seven science centres hosted participants for job shadowing between June and October 2015. The annual Southern African Association of Science and Technology Centres (SAASTEC) Conference held in November provided a further opportunity for capacity building.

Data collection for the study occurred in three phases. In phase 1, reports, attendance registers and information regarding the various workshops were collected. Phase 2 involved the administration of questionnaires to attendees of the 2015 SAASTEC Conference. In the final phase, an online survey was used to collect data about the 2015 SCCB workshops. Respondents were asked questions related to the impact of the SCCB workshops which they participated in.

These training opportunities had an important impact on the capacity of those science centre staff members that attended the workshops or the SAASTEC Conference. The study's findings highlighted that almost ninety percent of the respondents felt that the workshops had at least some positive impact, with half highlighting an extensive positive impact on science centre capacity. In addition, many of the respondents indicated that they had gained skills and knowledge which could improve their capacity from both the conference and the workshops. It was also found that in most cases, enabling environments exist at the science centres, which encourage the transfer of knowledge which is gained through the training. In addition, over half of the respondents were given new responsibilities or asked to implement new strategies or programmes, highlighting the practical implementation of the training received.

The findings of the study informed a number of recommendations which will enhance the impact of the SCCB training and the capacity of science centres. The training should be should incorporate as many participants as possible. A set of core modules which focus on key aspect of science centres should be presented on a regular basis, and there should be certain modules targeted at the specific roles of participants at the science centres. This will require consultation with science centres to determine the most relevant training. Providing the material which is covered through various avenues will allow more staff members to gain the relevant knowledge, and the transfer of knowledge within science centres should be encouraged. In addition, it is important to implement strategies which will promote the retention of human capacity within the science centre network, as well as supporting younger and less experienced staff members.

Part One: South Africa's Science Centre Network

1.1. Introduction

In order to address the capacity challenge within South African science centres as a result of the rapid pace in their growth, the Department of Science and Technology (DST) imitated the Science Centre Capacity Building (SCCB) Programme in 2005/06. This programme seeks to address capacity building through the provision of training to support science centre officials in improving the effective management of their centres, as well as providing networking and information sharing opportunities. The South African Agency for Science and Technology Advancement (SAASTA)[1] was subsequently tasked with implementing the project to capacitate the human resources in the existing science and technology centres. The target audience of the SCCB project is science centre staff, science outreach programmes from National Facilities, and science outreach staff from Institutions of Higher Learning (SAASTA, 2009b; SAASTA, 2012; SAASTA, 2013).

In January 2015, the DST adopted the Science Engagement Strategy, which recognises science centres (including natural science museums, zoos, aquaria and botanical gardens) as providing the basic platform or infrastructure for pursuing the strategic goals[2] of the strategy (DST, 2014). Capacity building for these spaces has therefore become even more important, and the SCCB project has a critical role to play in ensuring that science centres are able to promote Science, Technology, Engineering and Mathematics (STEM) engagement, awareness and education.

The purpose of this study was to evaluate the training which was provided through the SCCB project in 2015, in order to determine its impact on the capacity of South Africa's science centres. This report presents the findings of the study from secondary data, including workshop outlines and attendance registers, as well as from a questionnaire and an online survey completed by participants of the SCCB training.

The purpose and importance of science centres is discussed in the first part of this report. In addition, information is provided on the location and characteristics of the science centres in South Africa. The second part of the report provides details of the SCCB project and the intervention areas which it addresses. The research questions and the methodology which was used to evaluate the training are described in part three. Thereafter, the findings of the study are presented in parts four, five and six. The report concludes with a number of recommendations related to the findings which emerged from the study.

1.1. Science centres and capacity

A science centre can be defined as "a permanently established education facility that provides an interactive educational experience through the use of interactive science, technology, engineering

[1] SAASTA is a business unit of the National Research Foundation (NRF) and the key South African institution for promoting science (SAASTA, 2009b).

[2] The strategic goals of the strategy are: 1) To popularise science, engineering, technology and innovation, 2) To develop a critical public that actively engages and participates in the national discourse of science and technology, 3) To promote science communication that will enhance science engagement, and 4) To profile South African science and science achievements domestically and internationally.

and mathematics exhibits, displays and programmes" (Department of Science and Technology, 2005: 9). These centres incorporate "…exhibits that embody a mix of scientific knowledge and science-based technology" (Tlili, 2008: 131), with the goal of inspiring individuals to engage with science and technology (Meisner *et al*, 2007). These centres provide learning environments intended to promote more positive attitudes towards science and develop basic skills for science (Cigrik and Oskan, 2015). Due to the potential they possess to promote science and technology, it is important that these science centres have the capacity to adequately accomplish these goals.

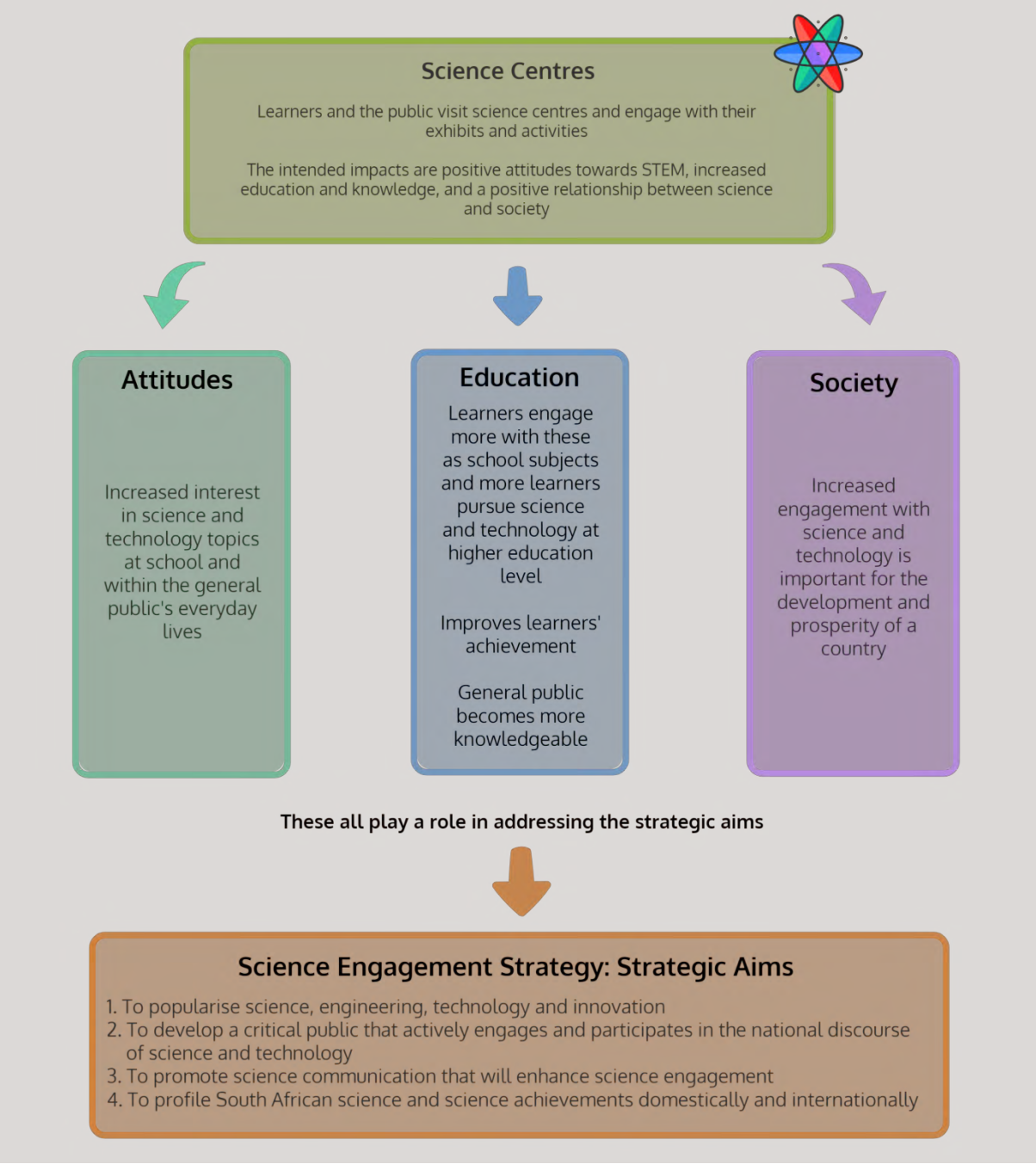
Consequently, capacity building or development is vital for the success of these centres, and can be defined as "the process by which individuals, groups, organizations, institutions and societies increase their abilities to: (a) perform core functions, solve problems, define and achieve objectives; and (b) understand and deal with their development needs in a broad context and a sustainable manner" (International Institute for Educational Planning, 2006: 1). The SCCB project therefore has an important role to play in building the capacity of South African science centres to ensure they are able to achieve their objectives.

1.2. Importance of science centres for learners and the public

Learners' engagement with science centres has been found to positively influence the learning of scientific knowledge, and scientific skills and processes (Rix and McSorley, 1999; Cigrik and Oskan, 2015). The largest gains however are made in the influence which science centres have on the development of positive attitudes towards science, which may also result in an increase in learners' interest and enthusiasm for their everyday science lessons (Rix and McSorley, 1999). Learners' achievement may therefore be positively influenced by more positive attitudes towards science (Juan *et al*, 2014).

Science centres have also been identified as an important resource in encouraging youth to pursue science and technology at the higher education level (Fors, 2006). This has important implications for society as there has been a lack of learners choosing to continue science in the final years of their secondary education and thereafter (Fors, 2006; George, 2006; Mji and Makgato, 2006; Sarjou *et al*, 2012). This is also the case in South Africa where many students perform poorly in science, and therefore do not choose to continue with it, or may not qualify to study science at university (Mji and Makgato, 2006; Martin *et al*, 2012). These centres also play an important role in improving the understanding and interest of the public in science and technology. These aspects are important for the development and future prosperity of a country (Fors, 2006). Figure 1 illustrates the significant impact which science centres may have on learners and the general public, highlighting the importance of these spaces in achieving the aims of the Science Engagement Strategy.

Figure 1: The potential impact of science centres



1.3. Science centres in South Africa

The South African Minister of Science and Technology, Naledi Pandor, stated that science centres have the potential to help the youth reach their full potential in an informal learning environment, and to promote science awareness; while also playing a role in teacher empowerment, and in showing teachers how to make their subjects more interesting to learners. Science centres also contribute to encouraging the youth to pursue careers in science and technology. She also noted that these science centres cater for children and adults with different levels of skills and knowledge (Pandor, 2011).

The aim to increase the number of science centres in the country was announced at the 6th Science Centre World Congress in Cape Town in 2011 (www.southafrica.info). This resulted in the number of science centres increasing from 26 centres in eight provinces in 2011 (Hweshe, 2011) to 35 science centres in nine provinces in 2015. There are 9 science centres in Gauteng, 6 in KwaZulu-Natal, 5 in Western Cape, 4 in Mpumalanga, 4 in Limpopo, 2 in Eastern Cape, 2 in North West Province[3], and 1 each in Northern Cape and Free State. Figure 2[4] shows the location of each of the 34 science centres in the country, and Table 1 provides the key for the map

[3] The North West University Mafikeng Science Centre was burnt down earlier in 2016 by protesting students who were unhappy about the change in their Student Representative Council.

[4] The KZN Science Centre is in the process of moving location, but they are currently using an interim office space. The location shown on the map therefore corresponds to their previous premises at the Gateway Shopping Centre.

Figure 2: Map showing the location of the science centres in South Africa

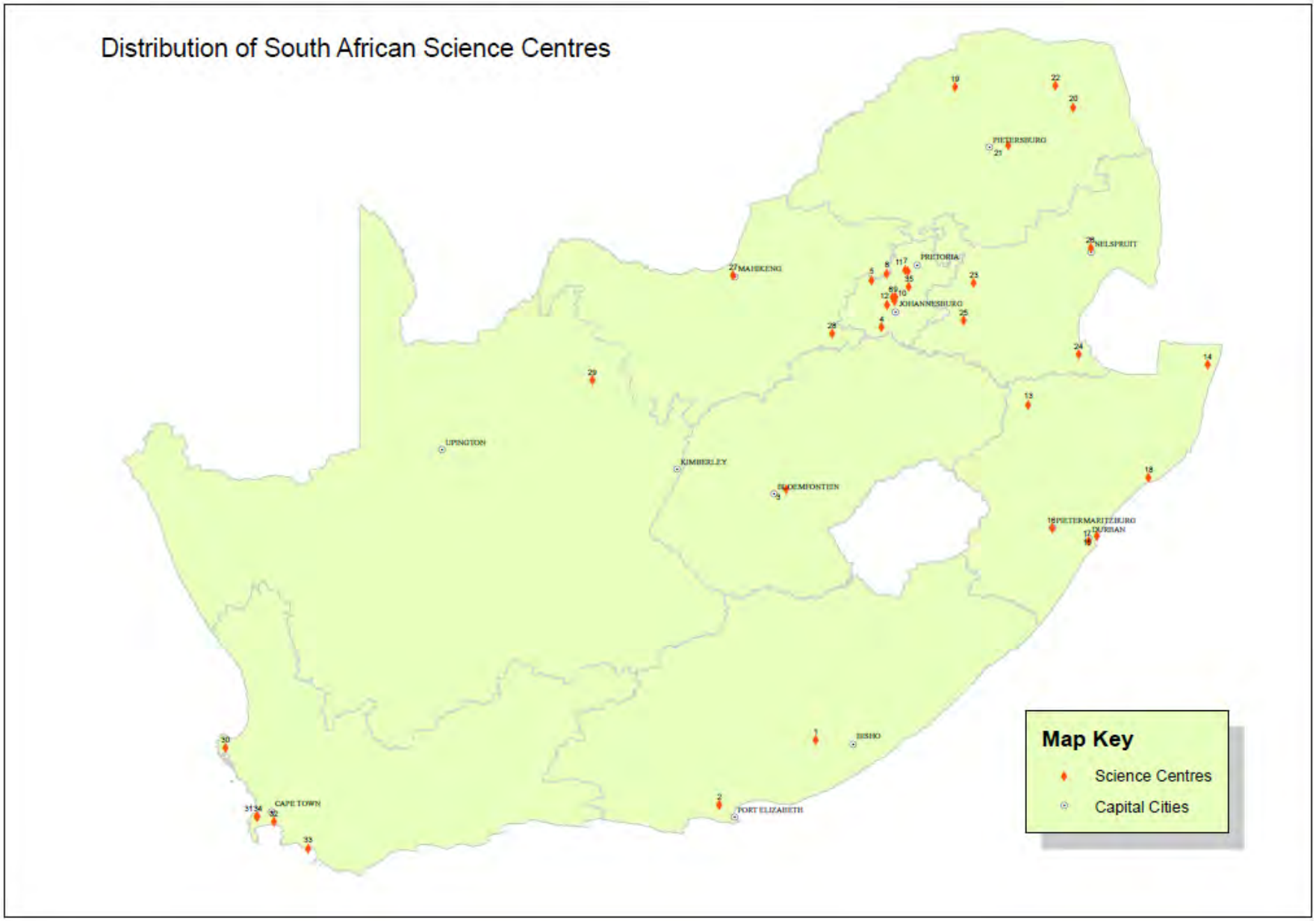


Table 1: Key for Figure 2

Science centre distribution			
1	FOSST Discovery Centre	**19**	Bostec Science Centre
2	Nelson Mandela Bay Science and Technology Centre	**20**	Giyani Science Centre
3	Boyden Observatory Science Centre	**21**	University of Limpopo Science Centre
4	Arcelor Mittal Science Centre Sebokeng	**22**	Vuwani Science Resource Centre
5	HartRao	**23**	Anglo-American Science, Career Guidance and ICT resource centre
6	Johannesburg Botanical Gardens Science Centre (Johannesburg City Parks)	**24**	Mondi Science, Career Guidance and FET Skills Centre
7	National Zoological Gardens	**25**	Osizweni Education and Development Centre
8	NECSA Visitor Centre	**26**	Penreach Science and Education Centre
9	Sasol Inzalo Foundation	**27**	North-West University Mafikeng Science Centre
10	Sci-Bono Discovery Centre	**28**	North-West University Science Centre Potchefstroom
11	Sci-Enza	**29**	Mothibistad Science Centre
12	Soweto Science Centre	**30**	Arcelor Mittal Science Centre Saldanha
13	Arcelor Mittal Science Centre Newcastle	**31**	Cape Town Science Centre
14	Isibusiso Esihle Science Discovery Centre	**32**	iThemba Labs
15	KZN Science Centre	**33**	SANSA Science Centre
16	Olwazini Discovery Centre	**34**	South African Astronomical Observatory
17	University of KZN Science and Technology Centre	**35**	Moipone Academy Science Centre
18	Unizulu Science Centre		

The following section of the report provides details of the SCCB project and the intended intervention areas which were identified for targeting through the project.

Part Two: Science Centre Capacity Building Project

The Science Centre Capacity Building (SCCB) project was implemented by SAASTA in 2005/2006, and has included a number of training workshops, international study visits and an annual job shadowing programme. The purpose of these interventions has been to improve the management of the centres through capacity building, as well as to provide opportunities for networking and the sharing of information.

2.1. Intended intervention areas of the SCCB project

The main aims of the SCCB project are:

- To provide skills and knowledge development within the science centre network
- To address South Africa's immediate need to attain scientific and technological self-resilience

The specific objectives of the SCCB project are:

- Support capacity building of science centre staff at a national level
- Support the development of capacity building for exhibit development
- Liaison with stakeholders from DST and the Science Centre Council

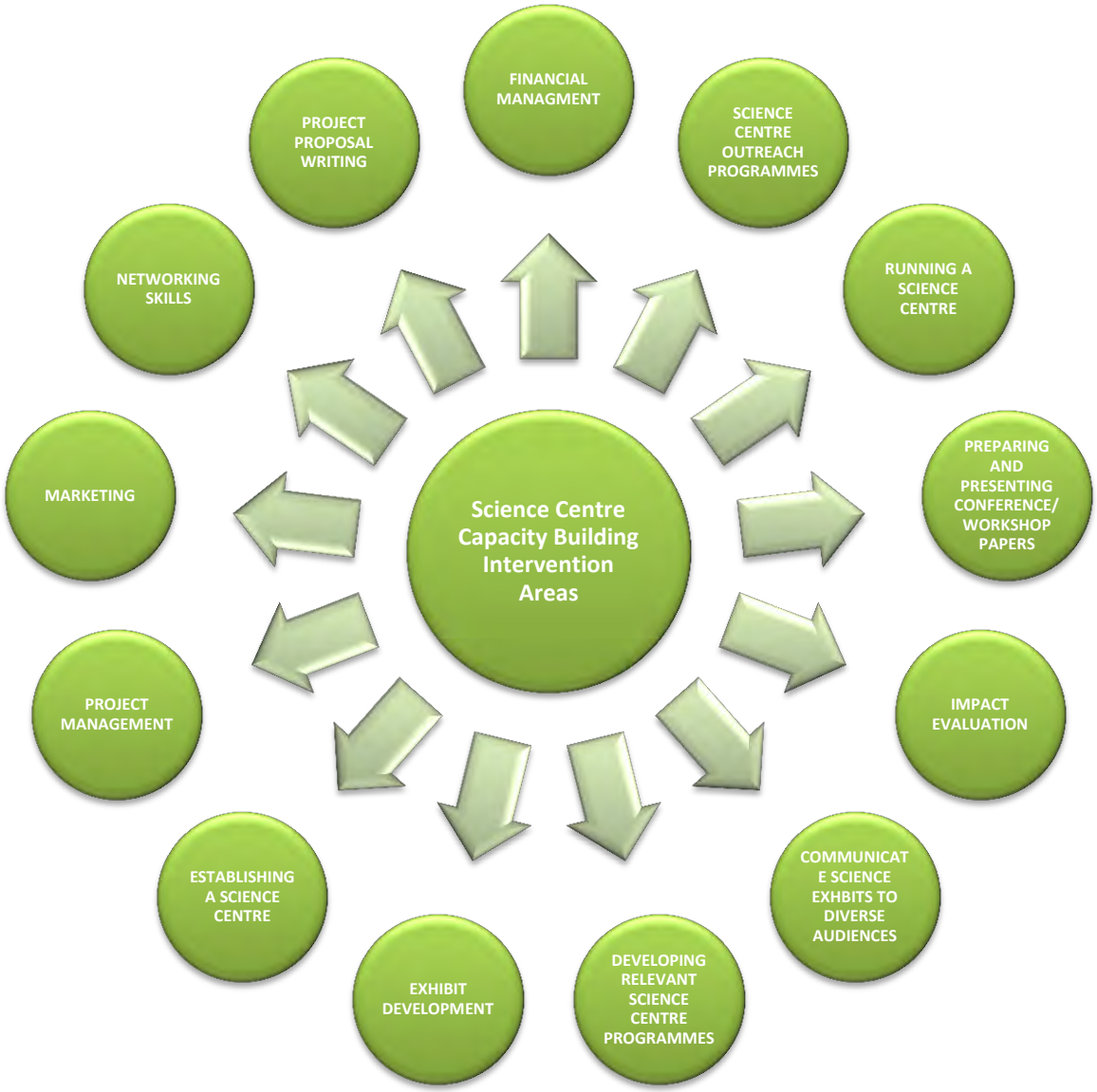
The expected outcomes of the SCCB project are:

- Developed and enhanced core skills of participants
- Developed exhibit prototypes
- Improved programmes at science centres
- Increased networking amongst science centres
- Increased local and international networking opportunities for participants from science centres

(SAASTA, 2009a).

Thirteen intervention areas were identified for the SCCB training to focus on in order to achieve a number of defined outcomes. These areas were initially determined based on the findings of a 2004 feasibility study on science centres. Following this, informal discussions took place with the science centre community and the leadership of the Southern African Association of Science and Technology Centres (SAASTEC). Shortcomings which DST identified in its interaction with the centres were also incorporated. A 2007 internal implementation evaluation of the SCCB Programme by DST reconfirmed and expanded these areas for skills enhancement (DST, n.d.). The intended intervention areas are shown in Figure 3 below.

Figure 3: The thirteen intended intervention areas of the SCCB training



(DST, n.d.).

2.2. SCCB Training

The training which is provided through the SCCB project is determined based on the requirements of science centre staff members in terms of their personal development plans. Skills gaps at the science centres are identified in order to determine what training is required, following which, staff members who require training in these particular skills are identified. Thereafter, a panel is responsible for the selection of some of these staff members to be involved in the training workshops. The process of identifying skills gaps is therefore a highly collaborative one between the science centres and SAASTA.

2.3. SCCB Funding

Funding for the SCCB project is provided by the DST, and has increased from R450 000 for the 2009/2010 financial year to R1 075 000 for the 2015/2016 financial year. Table 2 shows the amount which has been allocated to the SCCB project annually from 2009-2016.

Table 2: Funding for the SCCB project: 2009-2016

Financial Year	Amount
2009/2010	R450 000
2010/2011	R450 000
2011/2012	R500 000
2012/2013	R500 000
2013/2014	R600 000
2014/2015	R800 000
2015/2016	R1 075 000

Part three of the report presents the research questions which informed the focus of the study, and the methodology which was used to answer these questions.

Part Three: Research Questions and Methodology

3.1. Key research questions

The broad research objective was to evaluate the impact of the capacity building training on South African Science Centres. The key research questions were:

1. What training occurred in 2015?
2. Has the training which occurred had an impact on the capacity of the science centre staff?
3. Has the training which occurred had an impact on the capacity of the science centres?
4. How can the SCCB training be improved?

3.2. Methodology

This study used a summative evaluation approach to assess the quality and success of the SCCB project in reaching its stated goals. It focused on the evaluation of training which was conducted as part of the Science Centre Capacity Building project within South African Science Centres, in 2015. "Science centres" was used to encompass the science centres, National Facilities and the Institutions of Higher Learning (outreach) which have participated in the training. The focus was on the impact of the training on staff members.

Data collection occurred in three phases. Data on the training workshops which took place, including the number of participants, were initially collected. In addition, SAASTA provided information on each of the 2015 workshops, as well as the job shadowing programme.

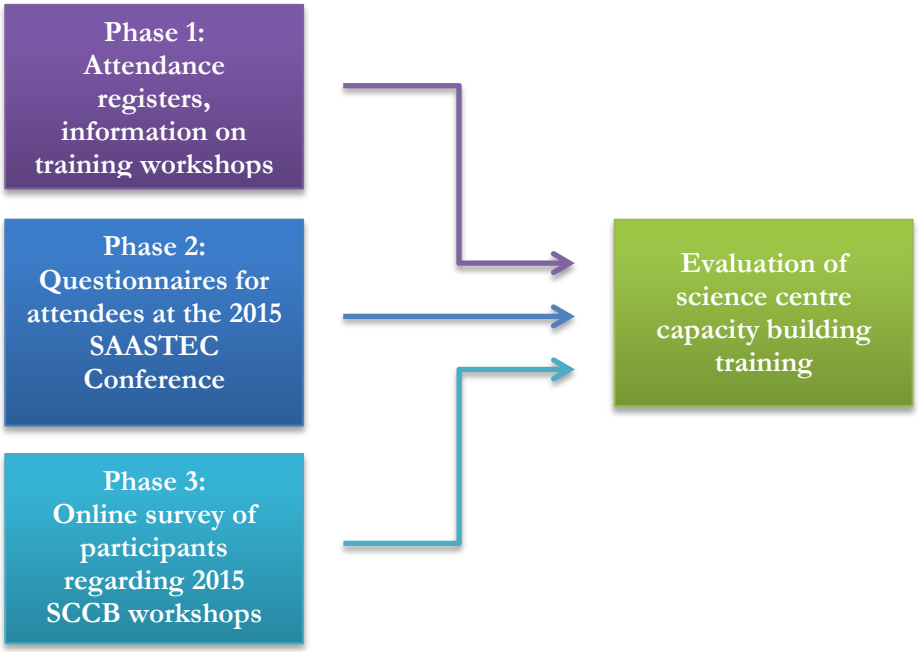
The second phase of data collection involved attendance of the 2015 South African Association of Science and Technology Centres (SAASTEC) Conference held in Mahikeng in the North West Province in November 2015. Attendees were asked to complete a questionnaire regarding their experience at the conference, and responses were received from 76 participants. In addition, an interview was conducted with Shadrack Mkansi, the manager of SAASTA's Science Awareness Platform in order to gain an insight into the annual conference.

In the third phase of the data collection, a survey was developed using an online survey programme. A link to the survey was sent to the participants of the 2015 training workshops. Contact details for the participants were available in the attendance registers which were provided by SAASTA. From the registers, 126 science centre staff members were identified. Of these, 22 had incorrect or illegible e-mail addresses, or did not provide contact information; and 2 had left the centres and contact information was not available. The sample therefore consisted of 102 participants, from which 65 responses were received (64% response rate). Of these, one respondent that was contacted said they did not remember attending the workshop.

The questions which were asked sought to gain a more in depth perspective of the training and the impact which it had on the capacity of participants. Figure 4 provides an outline of the phases of data collection.

Much of the data used in this study are self-reported data, which the researcher obtains self-directly from the participants (Gonyea, 2005). Respondents were asked to report on their attendance (factual) and opinions (attitudinal) of the SCCB training interventions. Self-reported data have been criticised as providing unreliable information in some instances (Gonyea, 2005). However, for the purposes of this study, self-reported data was deemed the best way to gauge the impact which the SCCB training is having on participants and the science centre community as it allows an investigation of the capacity which participants feel they have gained through participation.

Figure 4: Phases of the data collection



Phase 1 of the data collection addressed the first research question regarding what training has occurred. Phase 2 and phase 3 covered the rest of the research questions, focusing on the training which occurred in 2015 and the impact it had on the capacity of participants.

The findings of the study are presented in parts four, five and six of the report. Part four provides an overview of the training which occurred in 2015, part five presents the findings of the online survey which asked questions relating to the 2015 workshops, and part six discusses the findings from the 2015 SAASTEC Conference.

Part Four: 2015 SCCB training

This section presents information about the SCCB training which occurred in 2015 in terms of the workshops which were held, the annual SAASTEC Conference and the job shadowing programme.

4.1. What capacity building training has occurred?

Six workshops were held as part of the SCCB training in 2015, including a pre-conference and a post-conference workshop before and after the SAASTEC Conference. The job shadowing programme saw science centre staff members being hosted at 7 science centres 8 times during the year[5]. The annual SAASTEC Conference provides valuable knowledge and skills to participants, as well as networking opportunities, and is therefore also considered an important part of capacity building within science centres. In addition, the workshops which are often held before and after the conference are some of the most well attended workshops as staff from the science centres attend the SAASTEC Conference. The training interventions which took place in 2015 are shown in Table 3.

Table 3: 2015 SCCB training

Workshop	Date	Participants
Crystallography Workshop	25 & 26 February 2015	21
Train the Trainer Workshop	30 May 2015	43
Japanese Overseas Cooperation Volunteers (JOCV) Workshop	12 & 13 August	37
Advanced Biotechnology Workshop	21 & 22 September 2015	34
Nanotechnology Workshop (Pre-conference)	15 & 16 November 2015	57
Financial Management Workshop (Post-conference)	20 November 2015	42
2015 SAASTEC Conference	17-19 November	
Job shadowing	Various dates	39

4.1.1. Crystallography Workshop

2014 was declared as the International Year of Crystallography (IYC) by the United Nations Educational, Scientific, and Cultural Organisation (UNESCO). South Africa, as a member of UNESCO, was therefore expected to host various activities relating to crystallography. The objective of these activities was to educate high school learners about crystallography and to attract youth to study science subjects that will lead into science centres. As the lead department in observing the IYC, the DST asked a service provider to design a science kit that was distributed to science centres to demonstrate simple crystallography experiments to General Education and Training (GET) and Further Education and Training (FET) students.

[5] Sci-Bono hosted job shadowing at their science centre twice in 2015.

Eleven science centres from six provinces received science kits from DST, and a workshop was held on the 25 and 26 February at the DST to provide training to a group of facilitators from science centres.

4.1.2. Train the Trainer Workshop

Africa Code Week, endorsed by SAASTEC, is an emerging continent-wide initiative implemented by an international delegation to promote coding (computer programming) to youth using freely available software. A total of 43 science centre staff attended the complimentary pilot programme 'Train the Trainer' in preparation for the Africa Code Week on 30 May 2015 at Sci-Bono Discovery Centre. These sessions focused on literacy, mathematics and problem solving skills in the classroom.

The training included aspects related to the importance of coding/computer programming for young learners, how to teach coding using a free software (SCRATCH), and how to organise coding/computer programming workshops for learners. Resources and Certificates of Attendance were issued to each participant.

4.1.3. Japanese Overseas Cooperation Volunteers (JOCV) Workshop

The DST and NRF|SAASTA embarked on the JOCV short programme road show in partnership with the Japan International Cooperation Agency (JICA) from 2 to 13 August 2015. Two sets of workshops were conducted by a representative of JICA, and focused on using readily available inexpensive teaching and learning materials to provide everyone with the opportunity to enjoy science. The first intervention was aimed at learners and was conducted at science centres in Mpumalanga, Limpopo and the North West Province.

A three day workshop was then held for science centre staff at the National Zoological Gardens in Gauteng from 11 to 13 August 2015. The focus was on how these science centres can acquire skills for developing similar science related activities using locally available materials. The inexpensive teaching and learning materials used during the workshop enabled science centre staff to conduct interesting science lessons through group or individual activities. A total of 37 science centre staff attended the workshop.

4.1.4. Advanced Biotechnology Genetic Engineering Workshop

This workshop was held on the 21 and 22 September, and was attended by 34 participants. It was a follow on from the Basic Biotechnology workshop which was held in 2014. The workshop focused on Genetic Modification (GM), covering micro-organisms, plants, animals and humans.

Implicit in the brief was that it would build on the science knowledge shared in 2014. The workshop also focused on DNA science, definitions of biotechnology and genetic modification, and the technologies that have driven new wave biotechnology, as well as subjects such as bioinformatics, Bio-Ethics and cloning.

4.1.5. Nanotechnology Workshop (Pre-conference)

The Nanotechnology Workshop was held before the start of the 2015 SAASTEC Conference in November 2015. Fifty seven people attended the workshop, being the highest number of

workshop participants in 2015. The workshop focused on how to develop a nanotechnology workshop and appropriate resources for creating awareness of nanotechnology among youth and the public at science centres. This provided participants with ideas about the types of activities which they can introduce at their science centres to highlight basic nanotechnology concepts.

4.1.6. Financial Management Workshop (Post-conference)

The Financial Management Workshop was conducted after the 2015 SAASTEC Conference and was attended by 42 participants. The workshop focused on internal grant processes to be followed at SAASTA. The aims of the workshop included addressing challenges experienced by science centres as grant holders/recipients at the time of reconciliation, providing clarity on supporting documents to be submitted for reconciliation, providing clarity on the difference between proof of payment and proof of expenditure, indicating acceptable proof of payment at SAASTA, as well as highlighting the importance of Supply Chain Management and adherence to Treasury Regulations.

4.1.7. 2015 SAASTEC Conference

The 2015 SAASTEC Conference was hosted by the North-West University Mafikeng Science Centre and took place at Mmabatho Palms Hotel from the 17-19 November. The theme for the conference was "Science Centres and the Science Engagement Framework". The conference also had a number of sub-themes:

- Promoting science awareness among the youth and general public
- Identifying and nurturing talent and potential
- Providing mathematics, science and technology support
- Providing SET career education

The conference provided attendees with the opportunity to engage with presentations covering a diverse range of topics and to present to their colleagues based on their experience and ideas. It also provided networking opportunities with staff from other South African science centres, as well as from a number of other organisations.

4.1.8. Job shadowing

Seven science centres hosted participants from other science centres between June and October 2015, including Sci-Bono Discovery Centre that provided job shadowing twice. Each of the science centres offered exposure to an array of areas, and the details of the job shadowing at each centre are shown in Table 4.

Table 4: Job shadowing in 2015

Host Centre	Dates	Areas of exposure
Sci-Bono Discovery Centre	29 June to 3 July 2015	Science Centre Programmes; School Support Programmes; Teacher Development; Exhibitory; Corporate Services
The KZN Science Centre	18 - 22 August 2015	Start-up development of a sustainable NGO model; Writing of proposals and identification of potential corporate/government funders; Use of marketing and public relations; Science Practical Training for educators; Mobile science programmes using outreach vehicles; Financial governance and audit compliance
Giyani Science Centre	7 - 11 September 2015	Career awareness programme; Running and managing a rural science centre; Collaborations with government; Accessing funding from government and private sector; Reporting to funders; Managing a mobile science lab; Conceptualising external science exhibitions; Science practical training for educators
FOSST Discovery Centre	7 - 11 September 2015	Personality test and proposal writing; Visits to Art Gallery, University Library, Solar House and Dairy Farm; In-house: Davidson Primary School (Robotics & Alarms); Outreach: John Holland (Careers and Eureka); Conflict Management; Research writing skills; Teambuilding; Project Management and Presentations; Feedback Forms
Unizulu Science Centre	7 - 11 September 2015	Science Centre Philosophy; Educational theories; Science Shows (development, presentation and evaluation); Science Exhibits (development, prototyping, building and evaluation); Early childhood exhibits and programmes; Science Centre Research and Evaluation; Outreach programmes and curriculum interventions; Productive relationships with industries
ArcelorMittal Vanderbijlpark Science Centre	5 - 9 October 2015	Skills Development; Institutional Stakeholder Engagement; Education Facilitation; Community Engagement and Development; Creating Science and Maths Excellence for Learners; Addressing the five Strategic Drivers by conducting ongoing Maths and Science classes for grades 10 to 12: ECD classes; Teacher training; High school practicals; Computer classes; Primary school outreach
Cape Town Science Centre	12 - 16 October 2015	Marketing; Tenants; Bookings; Events; Heart Museum; Aquarium; Operations and Projects; Government fundraising and international collaborations; Green Point Eco Park
Sci-Bono Discovery Centre	12 - 16 October 2015	Science Centre Programmes; School Support Programmes; Teacher Development; Exhibitory; Corporate Services

The following section of the report presents the findings from the 2015 SAASTEC Conference.

Part Five: Findings from the SAASTEC Conference

This section presents the findings from the questionnaires which were administered to the attendees of the 2015 SAASTEC Conference. The profile of respondents is firstly presented. Conference participants' rating of their experience at the conference is then provided, followed by an evaluation of the knowledge and skills which they gained in relation to the intervention areas and a number of aspects of their jobs. Thereafter, the ways in which those who presented prepared are discussed, and their feelings about presenting are explored.

5.1. Who were the respondents?

The questionnaire was administered to all attendees who were present at lunch time on the final day of the conference. This was done in order to be able to evaluate as much of the conference experience as possible. There were 76 respondents, consisting of 58 staff members from South African science centres and 18 people from other organisations including: Botswana International University of Science and Technology (BIUST); Durban Natural Science Museum; Evolutionary Studies Institute at the University of Witwatersrand; Hamakgale Primary School; Moipone Academy; the National Commission on research, science and technology; the Palabora Foundation, Play Africa, SAASTA and SAASTEC. Table 5 provides a summary of the demographic characteristics of the respondents.

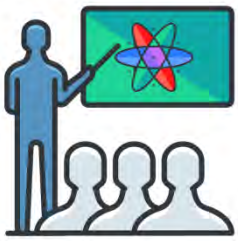
Table 5: Profile of respondents at the SAASTEC Conference

Race	**Percentage of respondents**
Black	**80%**
Coloured	0%
Indian	5%
White	9%
Other	5%
Sex	
Male	49%
Female	**51%**
Age	
Under 25	16%
25-35	**40%**
35-45	18%
45-55	21%
55-65	4%
65 and over	1%
Number of years at the science centre/organisation	
Less than 1 year	21%
1-3 years	**29%**
4-6 years	14%
7-9 years	16%
10-15 years	15%
16-20 years	3%
More than 20 years	3%
Full Time/Part Time/Volunteer	
Full Time	**67%**
Part Time	7%

Volunteer	26%
Position	
Management (manager/ deputy manager/ CEO/COO/ Director/ Executive manager/ Executive chairperson)	**24%**
Co-ordinator/programme manager/supervisor	20%
Volunteer/intern	18%
Technical (Lab, electronics)	9%
Education officer (including environmental education specialist and assistant outreach officer)	9%
Science communicator	4%
Administrator	4%
Subject tutor/ subject facilitator/ teacher	5%
Programme officer	3%
Post doc fellow	1%
Audience analyst	1%

5.2. Attendance of conferences

In order for the SAASTEC Conference to br effecitve in building capacity within science centres, and promoting science engagement, it is necessary for as many people as possibe to benefit from attendance. Respondents were therefore asked whether they had attended a SAASTEC Conference previously. Fifty one percent stated that they had not attended a SAASTEC Conference before. Therefore, half of the repsondents were attending their first conference which indcates that new staff members are given the opportunity to attend and consequently more people are able to benefit from the capacity building.



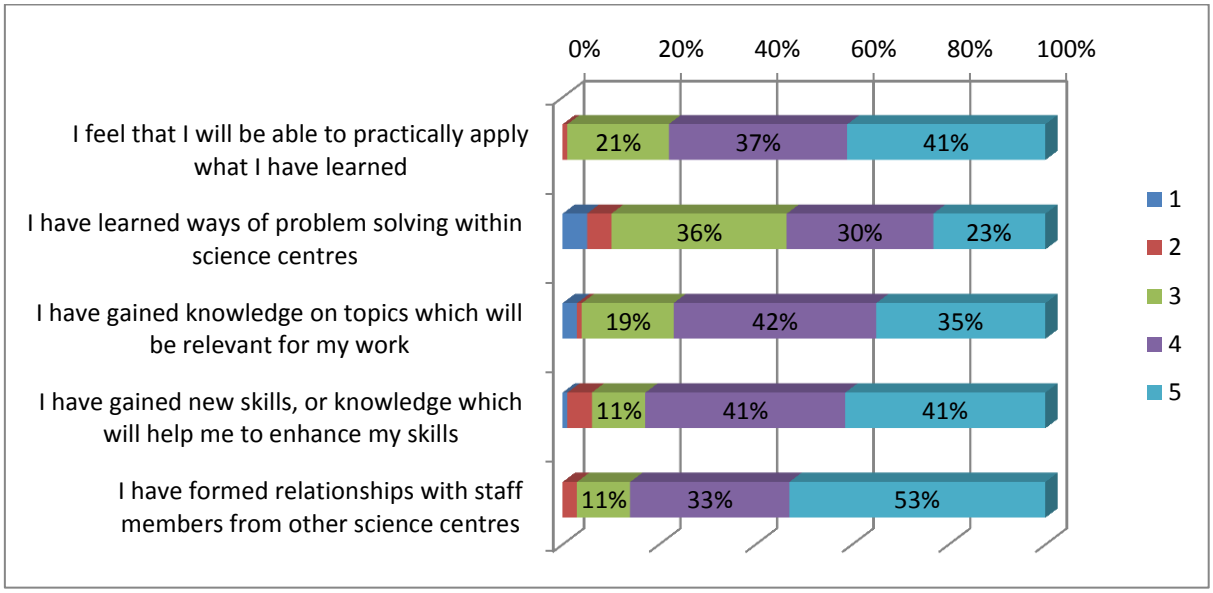
51%
of respondents had not attended a SAASTEC Conference before

Of the 51% who had not attended a SAASTEC conference before, two thirds had been at their science centres or organisations for 1 year or less. Of the ramining one third who had been at their science centre or organisation for a longer period, many of the repsondents were from newer science centres, from other organisations, or were in technical or administarive positions. These participants may therefore not previsously had the opportuniy to attend a SAASTEC Conference.

5.3. Participants' experience of the conference

It was important to evaluate the experience of the attendees at the SAASTEC Conference, in terms of what they learned, whether they gained knowledge and skills, and whether they were able to network with people from other science centres and organisations. Figure 5 provides the respondents' rating of their expereince on a scale from 1 (lowest) to 5 (highest).

Figure 5: Participants rating of their experience at the conference



In terms of the practical application of knowledge, 78% of repsondents felt strongly that they will be able to practically apply what they learned (rated as 4 or 5). Seventy seven precent rated the gaining of knwoledge which is relevant to their work in the top two categories, and 82% rated their acquisitoon of skills, or knowledge to enhance their skills as 4 or 5. Positive netwokring experiences seem to have occurred as 86% rated the formation of relationships as 4 or 5. Problem solving is one of the lowest rated, with just over half of repsondetns (53%) rating it in the top two categories.

In addition, 98% of respondents agreed strongly (4-33% and 5-65%) that attending the conference was worthwhile, and 97% of the respondents rated the statement "I will participate in future conferences" in the top two categories, with 74% rating it as a 5.

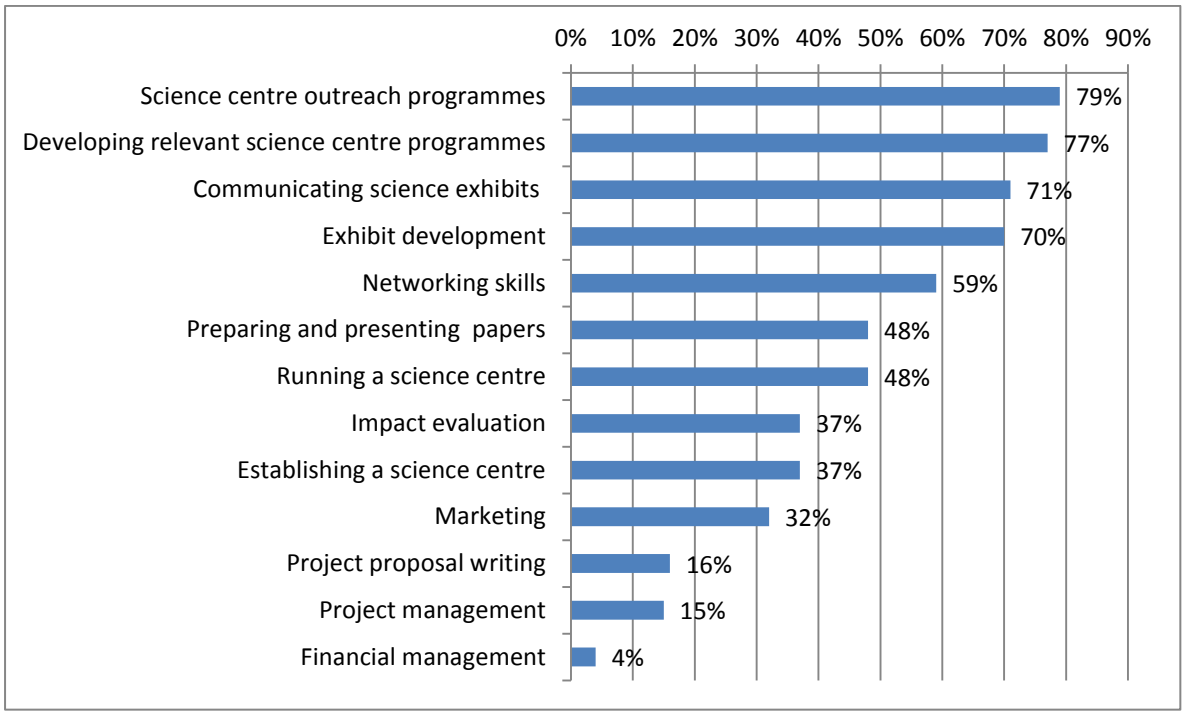
5.4. Knowledge and skills gained from the conference

The respondents were asked questions about the intervention areas in which they felt they had gained knowledge from the conference, and the extent to which they felt they had gained knowledge and skills which would enable them to improve a number of specific areas of their jobs.

5.4.1. Intervention areas which participants gained knowledge in from the conference

Respondents were asked which of the thirteen intended intervention areas identified within the SCCB project they felt they had gained knowledge in. Figure 6 illustrates the results.

Figure 6: Intervention areas in which the participants gained knowledge from the conference

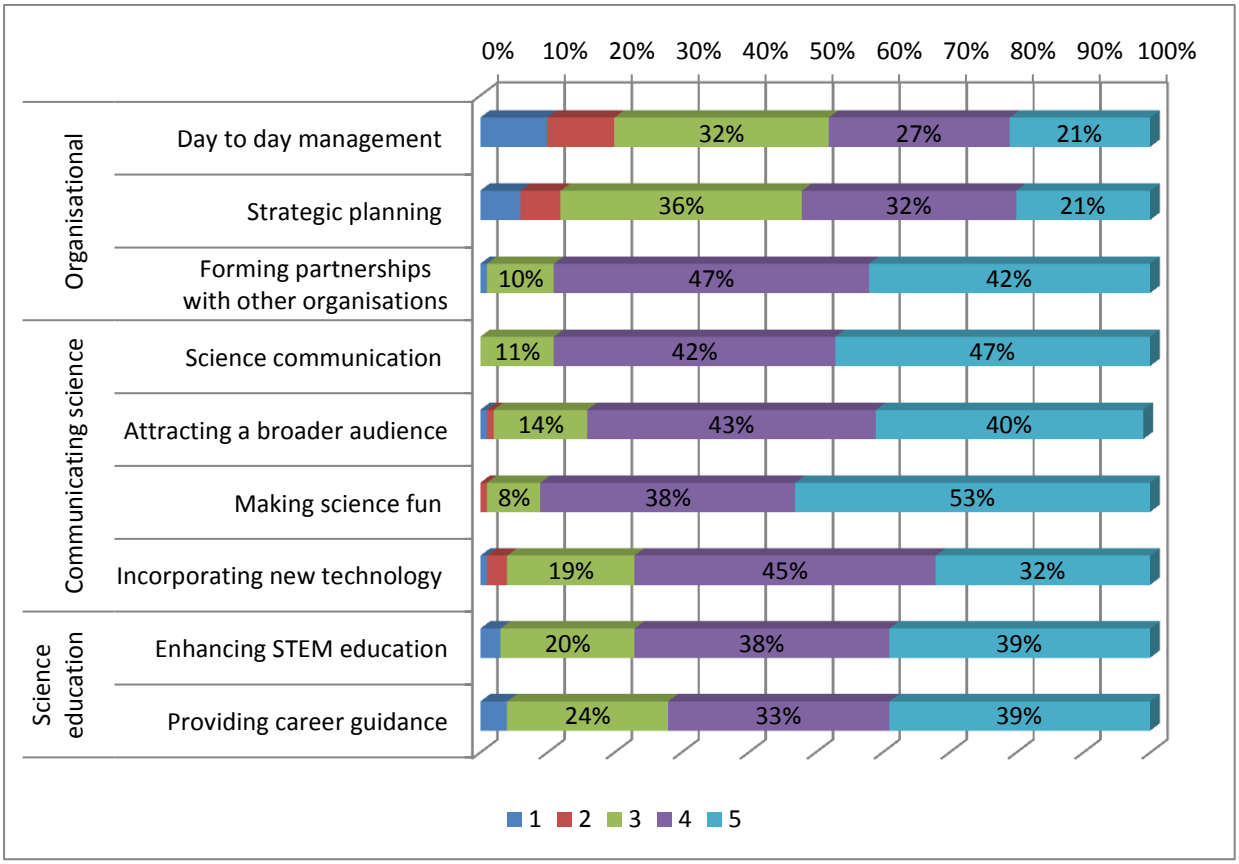


The intervention areas which the most participants felt they had gained knowledge in from the conference were science centre outreach programmes (79%), developing relevant science centre programmes (77%),, communicating science exhibits to diverse audiences (71%) and exhibit development (70%). These are all core functions of science centres and are important in terms of science engagement, awareness and education. In addition, 59% felt that they had gained knowledge in networking skills, which is an important element of the SAASTEC Conference. Less than 20% of respondents felt they had gained knowledge in financial management, project management and establishing a science centre. These are however not topics that are explicitly covered through the conference, and a one day financial management workshop was held after the conference. In addition, these topics would only be relevant to particular staff members who are responsible for these areas at their science centres or organisations.

5.4.2. Extent to which the conference provided capacity in areas of participants' jobs

Respondents were also asked the extent to which they felt the conference had provided them with the knowledge and skills to improve a number of areas of their jobs. The results are shown in Figure 7.

Figure 7: Extent to which the conference provided participants with knowledge and skills to improve areas of their job



Respondents felt the most strongly that they had gained knowledge and skills to enhance the following areas of their jobs: science communication (89% rated 4 or 5), attracting a broader audience (83% rated 4 or 5), forming partnerships with other organisations (84% rated 4 or 5) and making science fun (90% rated 4 or 5). Two of the lowest rated areas were day to day management and strategic planning. Although day to day management and strategic planning are not topics which would require significant emphasis at a conference, they are both important areas which would be beneficial to incorporate into the SCCB training, particularly for staff in management positions.

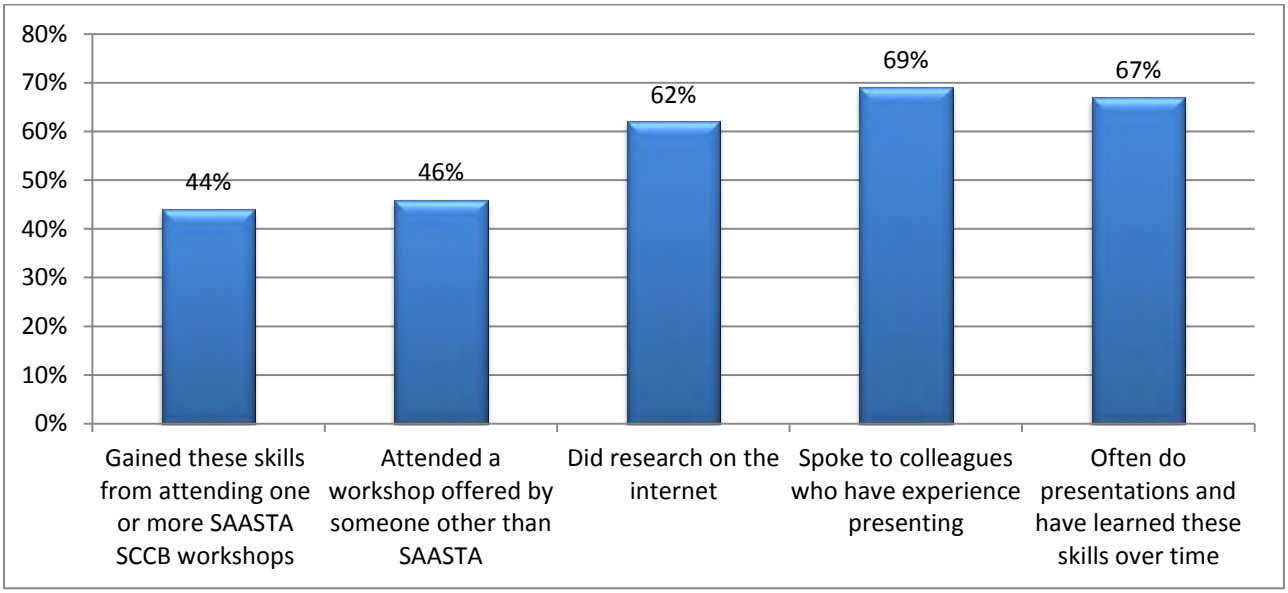
5.5. Presenting at the conference

An important aspect of the conference is the presentations which take place. Presenting at the conference is a key aspect of science communication and engagement. Those who presented at the conference were therefore asked how they had prepared for presenting and how they felt about presenting. These results show responses from those who had already presented when the questionnaires were administered on the last day of the conference.

5.5.1. Preparing for presentations

The preparation which takes place ahead of a presentation is important as it requires a certain set of activities and skills, including doing research, becoming familiar with the content, writing a conference paper, and public speaking. Respondents were asked which of the methods shown in Figure 8 they had used to prepare for their presentations.

Figure 8: Preparation by presenters

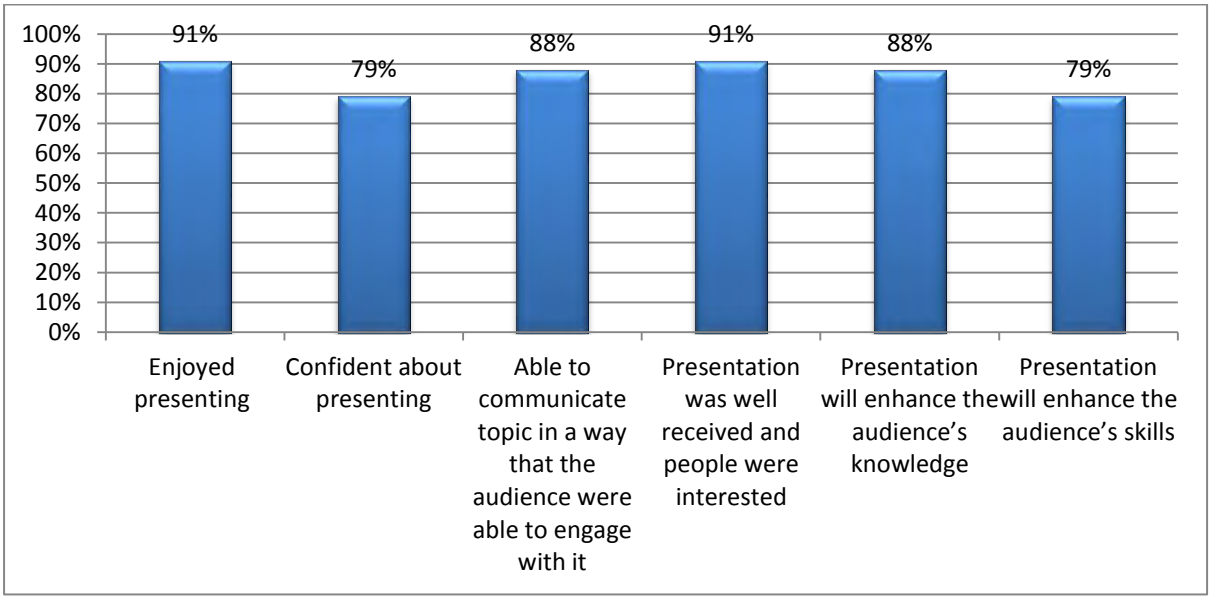


Just over two thirds of those who had presented stated that they often do presentations and have therefore learned these skills over time. This is positive as it indicates that many of the presenters are equipped with presentation skills, which is important in the context of science centres. In addition, 69% noted that they had spoken to colleagues who have experience presenting, This highlights that knowledge and skills are being transferred among colleagues, allowing the opportunity for less experienced staff members to learn from those with more experience. The internet also proved to be a powerful resource as 62% of respondents had used this source to prepare for their presentations. Just under half of the respondents indicated that they had gained the necessary skills from attending a workshop offered either by SAASTA or another organisation. This highlights the importance of such workshops for capacity building within science centres and other organisations.

5.5.2. Attitudes towards presenting

In addition to the preparation which took place beforehand, it was important to gain insight into how presenters felt about their presentations afterwards. Figure 9 shows the percentage of respondents who agreed to each of the statements regarding the presentations.

Figure 9: How participants felt about presenting



The presenters were very positive about their presentations. Ninety one percent of those who had presented said they enjoyed presenting, and felt that their presentations were well received. Eighty eight percent felt that they were able to communicate their topic to the audience in a way that allowed them to engage with it. The majority of respondents also felt that their presentations would enhance the audience's skills (79%) and even more so, their knowledge (88%). A smaller proportion, seventy nine percent of respondents, were confident about presenting, however some of them were volunteers and may have had limited experience in presenting. Nearly all of those who had presented also felt their presentations were relevant to the conference's theme (96%) and said they would submit presentations for future conferences (96%).

The experience of the attendees at the conference is positive, and participants are gaining valuable knowledge and skills, such as those related to the intervention areas highlighted in Figure 6, through taking part in the conference, both as attendees and as presenters. The SAASTEC Conference provides important opportunities for science centre staff members, as well as those from other organisations to learn from the experiences of others in their field and to enhance the knowledge and skills which they have. It therefore provides a key platform for science engagement with both local, and to a limited extent, international scientific role players.

5.6. The importance of the conference: capacity building, science communication and programme impact

As part of the evaluation of the SAASTEC Conference, an interview was conducted with Shadrack Mkansi, the manager of SAASTA's Science Awareness Platform. He highlighted that the conference provided a platform for capacity building, and that the incorporation of workshops before and after the conference ensured that many of those who attended the conference also attended the workshops. Capacity building was also enhanced as some of the presenters had little or no previous experience in presenting their work.

Mkhansi stated that the conference is also important in terms of science communication as, in addition to covering science communication as a topic, it provides a platform which brings together practitioners, such as science communicators and researchers, who are also responsible for communicating science. The conference also provides an opportunity for those who would like to be science communicators to learn from those who are already involved in science communication[6].

He also noted that the conference allows attendees to share their experiences related to the programmes at their science centres. They are therefore able to learn from others in terms of how they can change and improve their programmes, as well as getting ideas about new programmes they can introduce. It also serves as a "barometer" for science centres to check how they are doing in relation to other science centres. The emphasis at the conference on the impact which programmes are having was further highlighted by Mkhansi, as it is important for science centres to understand the impact of their programmes and to be able to evaluate this impact in order to ensure that they are attaining their goals.

In part six of the report the results from the online survey are presented.

[6] Science communication is an important skill within science centres. Science communicators need to have a good grasp of the content which they are communicating, and be able to interact with their audience, transferring this knowledge in a way that makes it interesting and easy to understand.

Part Six: Evaluation of the 2015 training workshops

This section explores the findings from phase 3 of the data collection, which evaluated the 2015 training workshops (Table 3, Page 11). The involvement of the participants in the training workshops is presented, as well as their profiles. The participants' rating of their experience at the workshops is discussed, and the extent to which the training has impacted on various aspects of their knowledge and skills is highlighted. The existence of enabling environments for the transfer of knowledge at the science centres is then examined, followed by details of the career paths of those who have left the science centres. Part six concludes with recommendations concerning the ways in which the communication, organisation and content of the training can be improved.

6.1. Who were the respondents?

The online survey was sent to all of the participants who attended at least one of the 2015 SCCB workshops. Table 6 provides a summary of the demographic characteristics of the 65 respondents.

Table 6: Profile of respondents for the online survey

Race	**Percentage of respondents**
Black	**88%**
Coloured	2%
Indian	5%
White	2%
Other	4%
Sex	
Male	46%
Female	**54%**
Age	
Under 25	14%
25-35	**64%**
35-45	11%
45-55	5%
55-65	4%
65 and over	2%
Number of years at the science centre	
Less than 1 year	25%
1-3 years	**37%**
4-6 years	21%
7-9 years	7%
10-15 years	11%
Full Time/Part Time/Volunteer	
Full Time	**48%**
Part Time	6%
Volunteer	46%
Position at the time of training	
Volunteer/intern	**24%**
Co-ordinator/ team leader	16%
Management (Centre manager/ founder and programme administrator)	14%

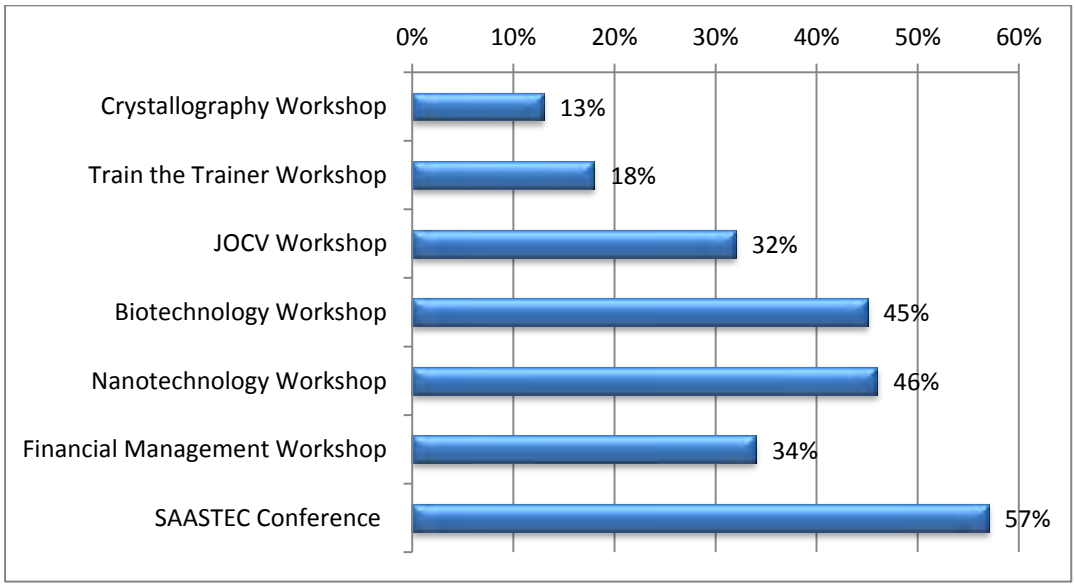
Science communicator	10%
Education officer/educator/ environmental education specialist	10%
Technical (Lab/ electronics technologist/exhibits officer)	10%
Facilitator/supervisor	8%
Assistant (ICT, outreach)/ junior	6%
Maths tutor	2%

In order to determine the impact which attending the 2015 workshops had on the participants and the science centres as a whole, questions were asked relating to the experience of participants, the areas which they felt they had gained knowledge or skills in, and the extent to which the knowledge and skills they gained were able to be transferred within the science centres.

6.2. Attendance of the SCCB workshops

Figure 10 shows the percentage of respondents who attended each of the workshops, as well as the 2015 SAASTEC Conference. The online survey was sent to those who had attended at least one of the 6 workshops offered in 2015. Therefore, 57% of those who participated in at least one workshop also attended the SAASTEC Conference. The workshops with the highest number of participants in the respondent sample were the Biotechnology Workshop (45%) and the Nanotechnology Workshop (46%)[7].

Figure 10: Attendance of workshops (% of respondents in sample)



6.3. Participants experience at the workshops

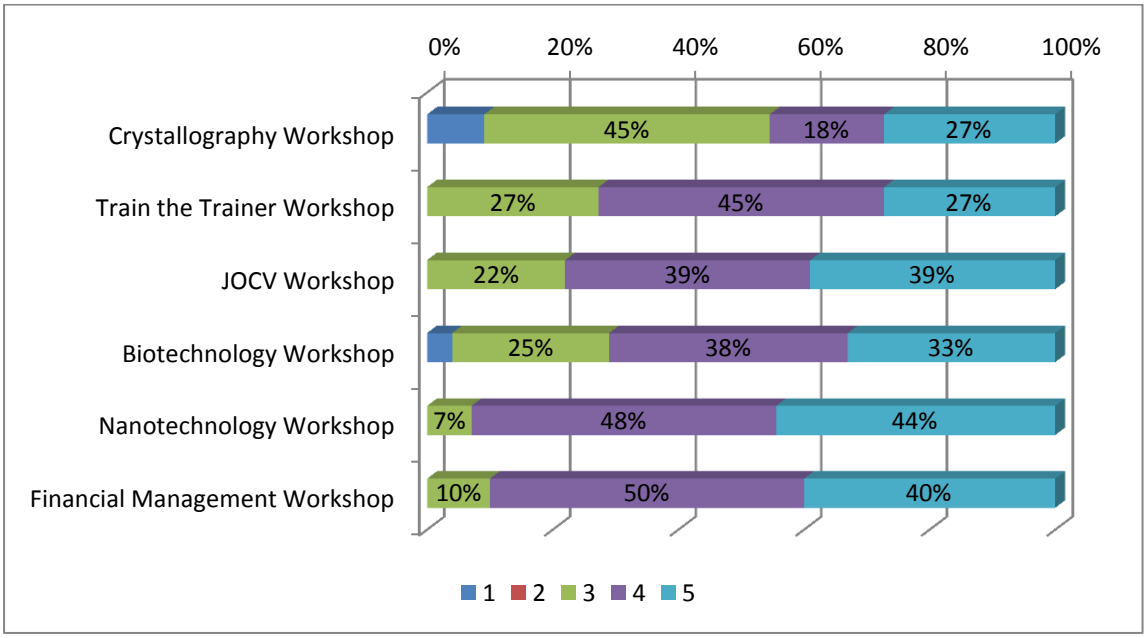
The experience of participants at the workshops is an important aspect of understanding the impact these workshops have. If the participants rate their experience as low, the impact of these workshops on their capacity is limited.

[7] The total numbers of participants for each workshop were indicated in Table 5.

6.3.1. Rating of experience at each workshop

Participants of the workshops were asked to rate their experience for each of the workshops which they had attended, on a rating scale ranging from 1 (very poor) to 5 (very good). Figure 11 illustrates the rating of each of the workshops.

Figure 11: Participants' rating of their experience at each workshop

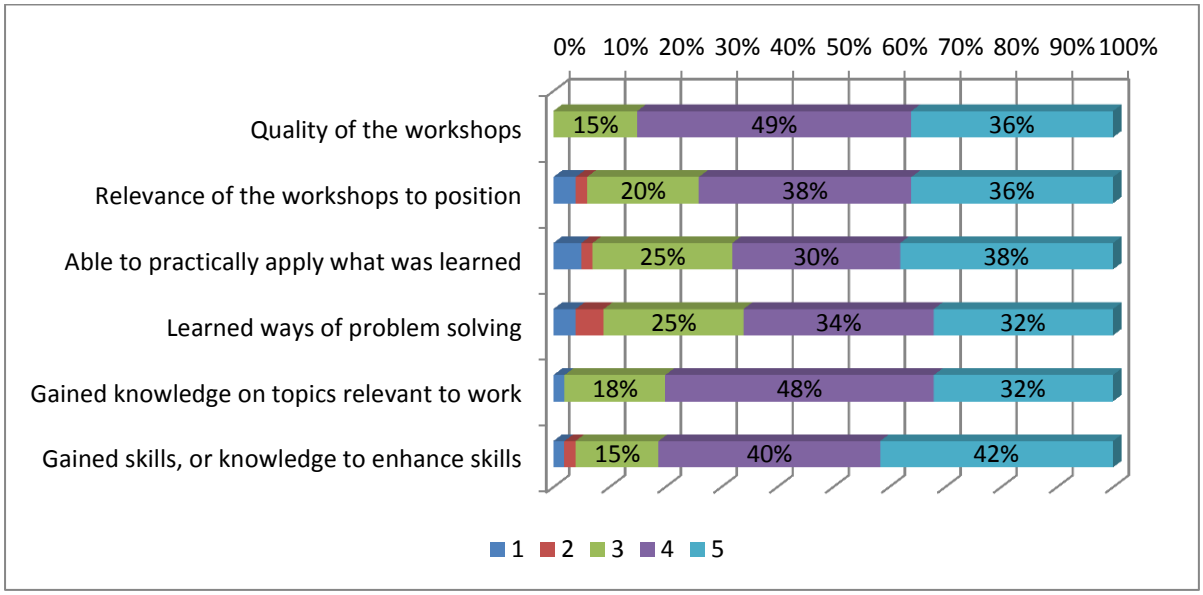


Most of the workshops were rated quite highly by participants, with only the Crystallography and Biotechnology workshops receiving ratings below 3. Both of these workshops focused on highly specialised topics, which may have contributed to the low rating. The highest rated workshops were the Nanotechnology and Financial Management workshops, with 92% and 90% of participants respectively rating them as either 4 or 5. Less than half of the participants of the Crystallography Workshop rated it in the top two categories. This may be due to the subject matter of the workshop, as it was focused on providing training on the use of a science kit, and therefore had a limited scope.

6.3.2. Rating of overall experience of the SCCB workshops

Respondents were then asked to rate their experiences at the workshops they had attended based on a number of aspects. The rating scale ranged from 1 to 5. Figure 12 shows the rating of each of these aspects of respondents' experience at the 2015 workshops.

Figure 12: Participants' overall experience of the SCCB workshops



All of the aspects were rated as either 4 or 5 by two thirds of the respondents. In addition, 82% rated the gaining of skills, or knowledge to enhance their skills as 4 or 5. This is significant, as these contribute to the capacity of staff members. The least highly rated aspects were "able to practically apply what was learned" (68% rated 4 or 5) and "learned ways of problem solving in science centres" (66% rated 4 or 5). The practical application of what is learned at these workshops is another critical element of capacity building, and it is therefore important that participants are equipped to practically apply what they learn. Problem solving is a further important aspect, however this may be difficult to focus on specifically in these workshops as problems which arise at science centres will be varied.

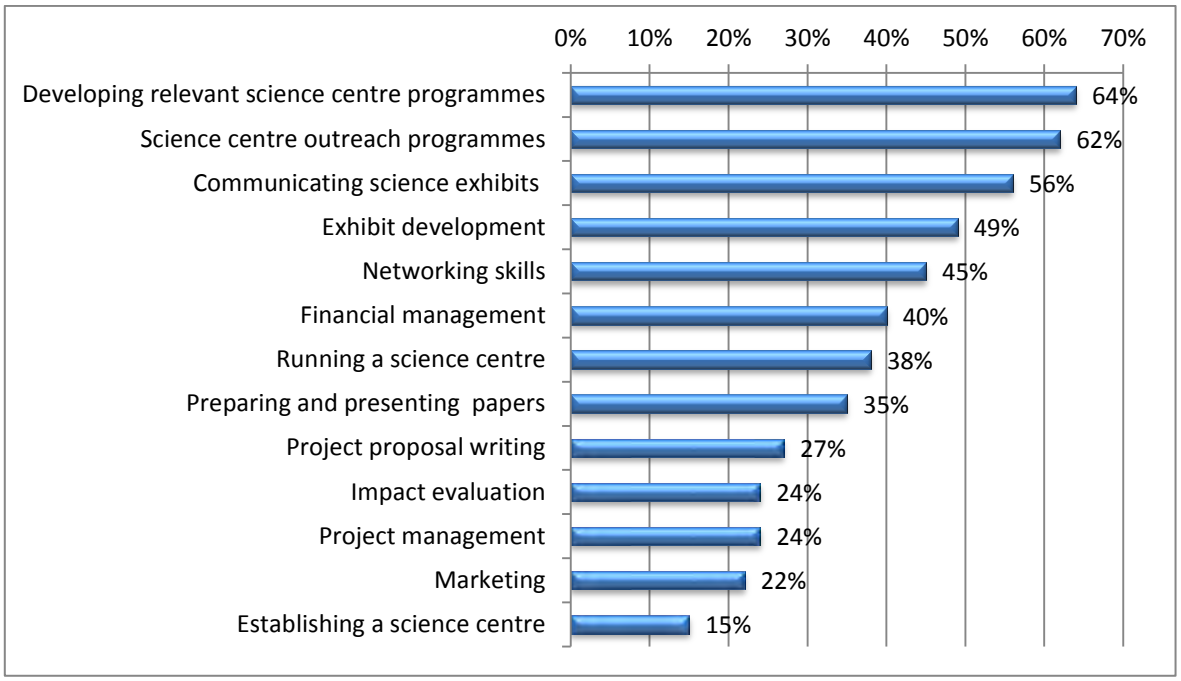
6.4. Knowledge and skills gained from the workshops

The next two questions focused on the areas in which participants felt they had gained knowledge from the workshops, and the extent to which they felt they had gained knowledge and skills which would enable them to improve a number of specific areas of their jobs.

6.4.1. Intervention areas which participants gained knowledge in from the workshops

Participants were asked to indicate which of the thirteen intervention areas they had gained knowledge in from the workshops they attended. The results are shown in Figure 13.

Figure 13: Intervention areas in which participants gained knowledge from the workshops

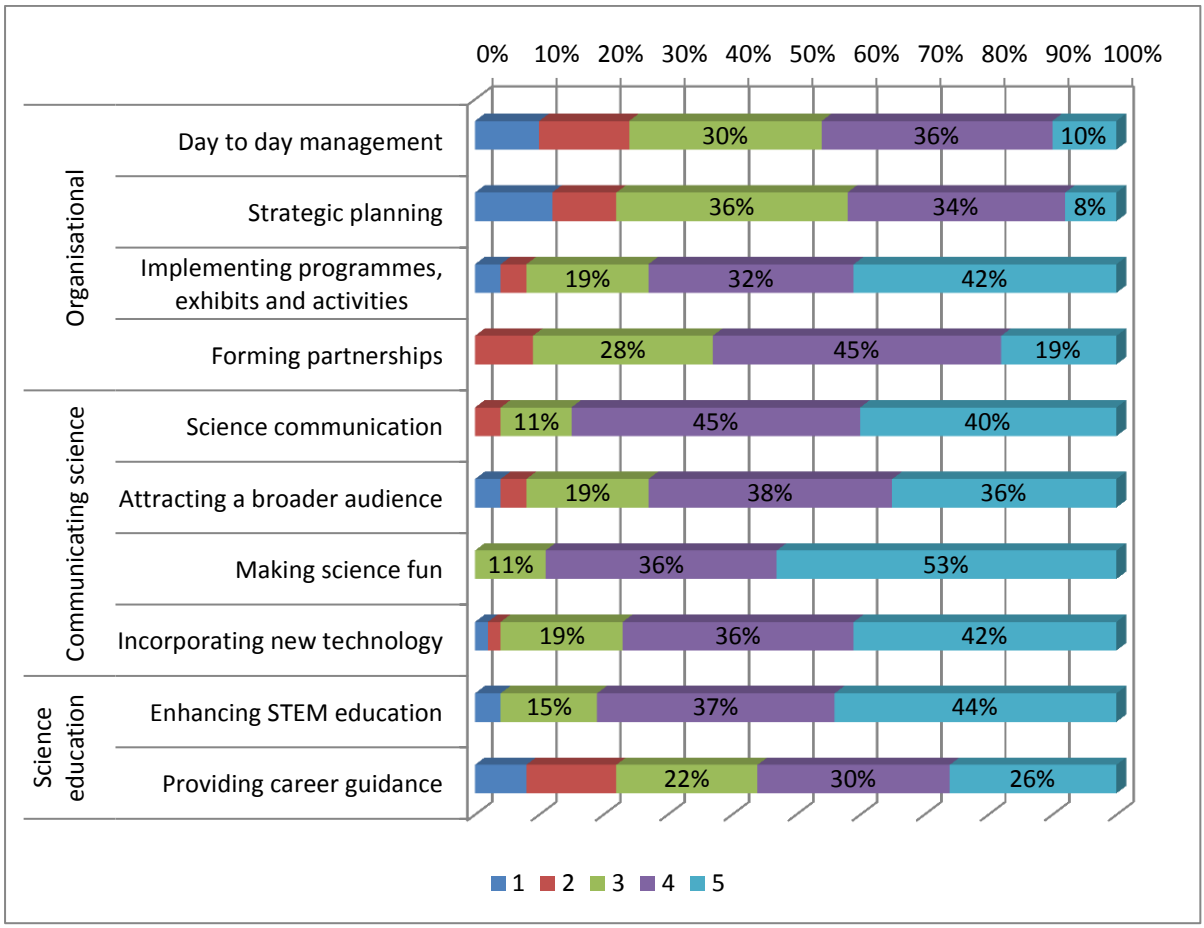


The intervention areas which the most respondents felt they had gained knowledge in from the workshops were developing relevant science centre programmes (64%), science centre outreach programmes (62%), and communicating science exhibits to diverse audiences (56%). Nearly half of the respondents also felt that they had gained knowledge in exhibit development. These are all core functions of science centres and are important in terms of promoting science engagement, awareness and education. Forty five percent of the respondents felt that they gained knowledge in networking skills, which is vital in enhancing science engagement across organisations. Less than 30% of respondents indicated that they had gained knowledge in project proposal writing, marketing, establishing a science centre and impact evaluation. These are areas which are most relevant for those staff members who are in management positions or positions where their key responsibilities are related to these areas (such as marketing). Workshops have previously been held focusing on impact evaluation and proposal writing.

6.4.2. Extent to which the training provided capacity in areas of participants' jobs

The next question asked respondents to what extent they felt that attending the workshops had provided them with the knowledge and skills to improve a number of areas of their job. They were again asked to rate the extent form 1 (very little) to 5 (very high). Figure 14 provides the results from this question.

Figure 14: Areas in which the training provided the participants with knowledge and skills to improve their performance



The areas which received the most ratings in the top two categories were making science fun (89%), science communication (85%) and enhancing STEM education (81%). These were followed by incorporating new technology (78%), attracting a broader audience (74%) and implementing programmes, exhibits and activities (74%). All of these contribute to the core functions of science centres, and it is encouraging that participants are acquiring the necessary knowledge and skills to address these areas of their jobs. Day to day management, strategic planning and providing career guidance received the least ratings as 4 or 5. Although these are important aspects, they are not areas which would have been specifically covered within the workshops. Furthermore, they are areas for which skills are required for certain staff members, rather than being relevant for all staff members.

6.5. Enabling environment at the science centres

In order for the training to be able to enhance the capacity of science centres, it is important that an enabling environment exists which provides the opportunity for staff members to apply and share the knowledge and skills gained from the training. This is an important indicator of the extent to which the transfer of knowledge can occur within the science centres. Respondents were therefore asked questions regarding the environment of their science centre, and the extent to which they were encouraged to share their knowledge or put it into practice.

6.5.1. Encouragement from managers and co-workers

In order to gauge the extent to which the knowledge and skills which participants gain from the workshops are transferred within the science centres, respondents were asked to what extent they were encouraged by their managers and co-workers to share what they had learned from the workshops. Figures 15 and 16 show the extent to which respondents felt they were encouraged to share their experience.

Figure 15: Encouragement by managers

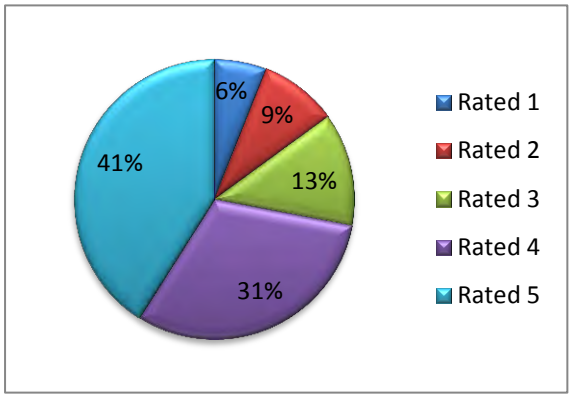
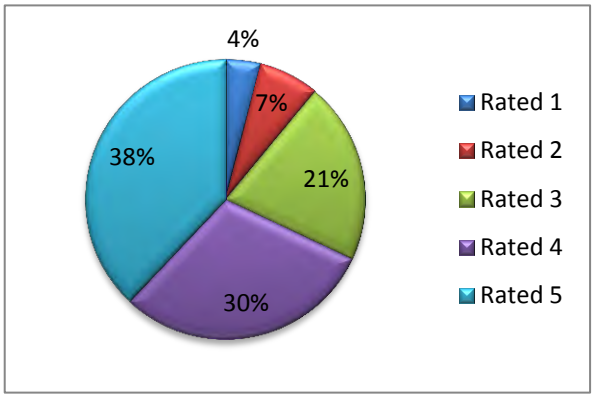


Figure 16: Encouragement by co-workers

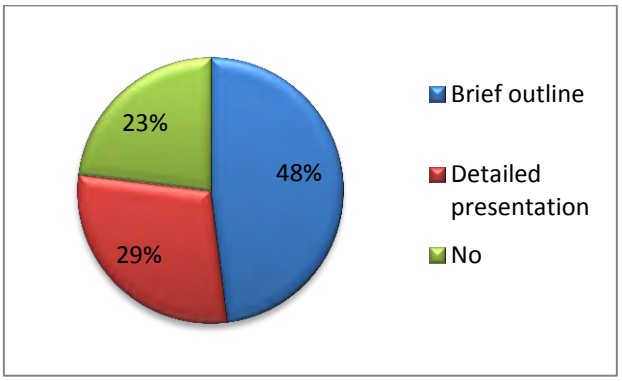


Seventy two percent of respondents rated the encouragement from their managers as either 4 or 5, and 68% rated encouragement from their co-workers in the top two categories. The transfer of knowledge and skills gained from participants of the training to other colleagues is an important step if the impact of the training is to be extended beyond the individual level.

6.5.2. Transfer of knowledge within the science centres

Respondents were then asked whether they were required to present what they had learned to others at their science centres. Figure 17 shows the percentage of responders who were required to present a brief outline or give a detailed presentation of what they had learned to others.

Figure 17: Presentation of what participants had learned



The results are encouraging, as nearly half of the respondents indicated that they were required to provide a brief outline of what they had learned to others, while 29% were asked to give a detailed presentation. In some cases, the knowledge gained may only have been relevant for the person who attended training and it therefore would not be necessary for them to share it with

others. It is important that those who attend the workshops share their experience with others at their respective science centres in some form in order to ensure that the knowledge gained from the workshops is distributed as widely as possible.

6.5.3. The practical application of the knowledge gained from training

Another way to ensure that knowledge and skills which participants gain is used to enhance the capacity of the broader science centre is to give the participants new responsibilities or encourage them to use what they have learned to implement new programmes or strategies. Fifty two percent of workshop participants said they had been given new responsibilities and 60% had been asked to implement new strategies or programmes. This highlights the impact of the training workshops.

Many of the science centres and institutions have therefore provided an environment which encourages the transfer of knowledge from those who have attended the training to other staff members, as well as promoting the practical implementation of this knowledge.

6.6. Impact of the training on science centres' capacity

The impact of the training on the capacity of science centres is extremely important, as the training should go beyond the individual level and be used to enhance the ability of science centres to promote science awareness and education. Respondents were therefore asked to what extent they felt the SCCB workshops have a positive impact on the capacity of science centres. Figure 18 highlights that half of the respondents said that they felt that the training has an extensive impact on the capacity of science centres, while 39% felt that it had some impact. Eleven percent felt that it had limited to no impact.

Figure 18: Extent to which the SCCB workshops have a positive impact on science centre capacity

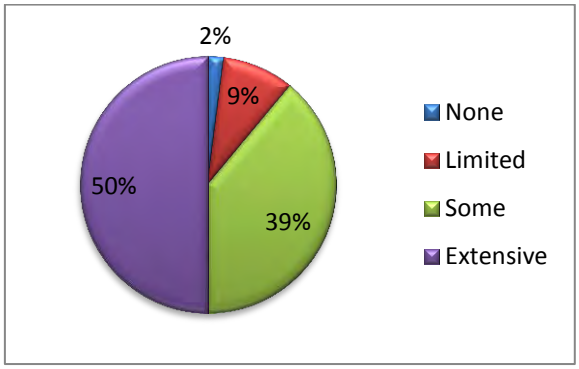


Figure 19 shows some of the comments which were made by the participants about the SCCB training workshops. These comments show that many of the participants valued and enjoyed the training which they participated in during 2015.

Figure 19: Comments from the SCCB participants

6.7. Where are they now?

An important finding of the online survey was that 82% of respondents have remained at the science centres since they attended the training In addition, three of the participants who have since left indicated that they have been able to use the knowledge which they gained from the training in their new jobs. Table 7 shows where the ten respondents who have left the science centres have moved to, by organisation and the positions they have occupied. Of the ten who have left the science centres, at least six of them were unemployed at the time of completing the survey[8]. Of these six, five were volunteers at their respective science centres. In addition, another volunteer who has since left the science centre is working at Vodacom, and one of them has moved to another science centre.

It is important to bear in mind that those who have left the science centres would have been less likely to respond to the survey.

Table 7: The labour market trajectories of those participants who have left the centres

Number	Organisation	Position	Position when at science centre
1	Arcelor Mittal SC Newcastle	Project co-ordinator	Project co-ordinator
2	NA	NA	Science communicator
3	Unemployed	-	Volunteer

[8] One of the other respondents said "not applicable" for where they are now which could indicate that they are also unemployed.

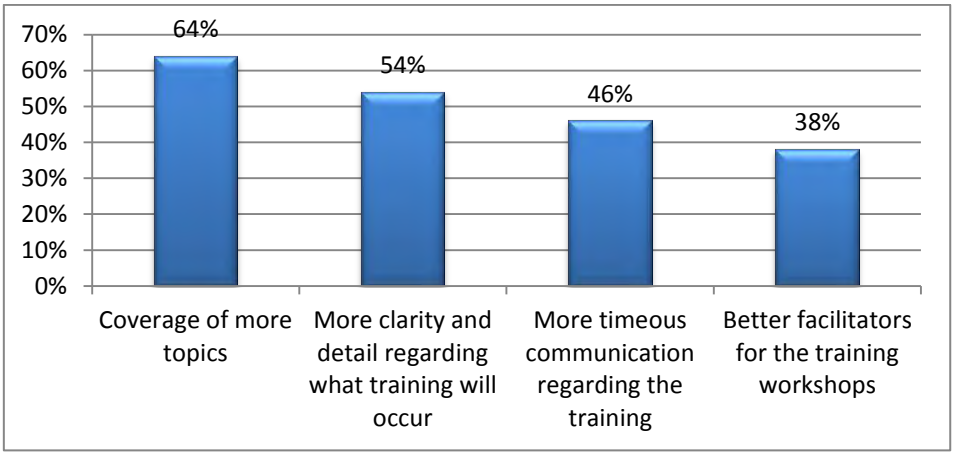
4	Vodacom	Network transmission	Volunteer
5	Unemployed	-	Volunteer
6	Unemployed	-	Volunteer
7	Japan Aerospace Exploration Agency[9]	Not given	Volunteer
8	Unemployed	-	Part time educator
9	Unemployed	-	Volunteer
10	Unemployed	-	Volunteer

6.8. Areas for improvement: communication, organisation and content

In order to ensure that the capacity building training that occurs is of a high quality and provides the best opportunities for science centre staff members to participate and enhance their capacity, it is important to understand areas in which the communication, organisation and content of the training can be improved. Participants were therefore asked to indicate which of the areas shown in Figure 20 improvements were required in. Sixty four percent of respondents said that they would like the training to cover more topics, while just over half requested more clarity and detail regarding the training that will occur.

Just under half of the respondents said they would like more timeous communication regarding the training, while 38% stated that they would like better facilitators for the workshops.

Figure 20: Improvements which can be made to the training



Respondents were asked if there were any other improvements that they would like to suggest. Three suggestions were made, including a request for more hands on activities, indicating that participants would like more opportunities to practice what they are being taught. Another respondent suggested that everything that is learned should be compulsory for those science centres with the appropriate facilities to practice. Finally, it was noted that there is a need for foreign facilitators who have difficulty speaking English to have English translators, as language was a barrier in the JOCV workshop which was held with Japanese facilitators.

[9] This was one of the volunteers from Japan.

6.9. Overall impact of the SCCB workshops

The preceding sections have highlighted the impact which the six workshops have had, in terms of the capacity and skills development of staff members, and in relation to specific aspects of the intervention areas and their jobs. It has also been shown that many of the science centres have provided an environment which encourages the transfer of knowledge from those who attended the training to other staff members, as well as translating this knowledge into practice. This will consequently translate into more efficient management of the centres, their improved functioning and enhanced effectiveness in playing a role in science engagement and the promotion of science and technology in South Africa.

The final part of the report provides a number of recommendations based on the findings of the study.

Part Seven: Recommendations

The SCCB training has had a positive impact on the science centres and institutions that have had the opportunity to participate in the various workshops, the job shadowing programme and the annual SAASTEC Conference. It is important to identify ways in which the impact of the training can be increased in order to enhance capacity building. A number of recommendations can be made in this regard, based on the findings of the study. These are presented in Table 8.

Table 8: Findings and recommendations from the SCCB training evaluation

Findings	Recommendations
The 2015 SCCB workshops covered diverse topics. These workshops have provided participants with valuable experience in a range of areas.	A set of core modules should be identified which cover the most important areas related to the activities carried out in science centres and outreach programmes of the institutions. These core modules should be presented on a regular basis in order to ensure that all science centre staff members acquire the essential knowledge and skills. Alternatively, these modules could be provided in booklets or as online material which provides guidelines and information on these crucial areas This is particularly important as there are often new volunteers that require the basic skills.
However, as the workshops were focused on particular topics, some of the intervention areas received limited focus, particularly project proposal writing, project management, marketing and impact evaluation	It may also be useful to have training which is directed at the different roles at the science centres. Specific workshops or online training courses could therefore be developed which focus on the roles and responsibilities of science communicators, education officers, project co-ordinators and so on. This would ensure that those who attend the training will benefit from training which focuses specifically on their duties. This would be especially beneficial at the middle and senior level with permanent staff members.
Problem solving and strategic planning were two of the lowest rated areas of learning by participants	Problem solving should be emphasised in the training as this is an important aspect in which science centre staff require capacity. Strategic planning is a critical element as it is related to what the science centres should focus on in the short to long term, as well as the areas in which they require further knowledge and skills. This is an area which should be targeted at management level.
These workshops provide participants with valuable knowledge and expertise which will assist them in their jobs	It is important that the workshop facilitators are well trained and able to effectively communicate the subject material. Managers of science centres and experienced science centre staff are a critical source of experience on the science centre environment, and their expertise should be harnessed for these workshops.
A high percentage of science centre staff members that attended the workshops are volunteers.	It is vital to find ways of retaining knowledge and experience within the science centre community. The transfer of knowledge needs to occur from those who have attended the training to other staff members at the science centres. This may be achieved through internal seminars or presentations which provide an opportunity for the sharing of knowledge and experiences. As some of these centres are very small and have limited capacity, it would be beneficial for them to be able to employ more permanent staff members in order to provide a core of people who possess the relevant skills. This will ensure the retention of human capacity. In those cases where it is not possible to employ volunteers once their contract has ended, it is important to prepare them to find ways to use

	their new knowledge and skills within the broader fields of STEM awareness and education.
Training has had an important positive impact in improving the capacity of staff members. Extending the reach of the training would allow more staff members at more science centres and institutions to participate, thereby enhancing capacity in the science centre network	This may be achieved through conducting the same workshops on more than one occasion in order to include a greater number of science centres, or by developing workshops which can accommodate more people at one time. This will also contribute to promoting networking between local science centres. Online databases of the training material which has been presented at the workshops would also ensure that more staff members are able to benefit from the training. The SAASTEC Conference also provides an array of opportunities, and as many staff members as possible should be encouraged to attend the conference, as well as to contribute through presentations.
The findings revealed that enabling environments exist within the science centres which encourage the transfer of knowledge and the use of skills.	The transfer of knowledge from those who attend the training to others at their science centres, and the practical implementation of the knowledge and skills which are learned are crucial aspects of ensuring that the impact of the training extends beyond the individual level. It is therefore important that science centre managers and staff continue to encourage the sharing of knowledge and skills which are gained,. Staff members should be encouraged to implement new strategies/programmes, or to find ways to enhance existing strategies/programmes based on what they have learned.
Many of the respondents indicated the need for a number of improvements to the training in relation to communication, organisation and content	Science centres need to receive training which is timeous and relevant to their needs. In order to ensure that science centres are receiving such training, it is necessary to continue to engage with them on a regular basis to ascertain which intervention areas and aspects they require training to focus on. It is also important to ensure that they are advised of the training in advance, and provided with sufficient details regarding what the training will cover. This will allow science centres to plan their schedules so that they are able to send staff to the training, and will ensure that those who are sent to the training are those who will benefit the most from it. The practical application of what the participants learn is also important, and workshops should therefore include a range of practical components where possible.
Many respondents were young[10], with less experience[11], and volunteers[12]	These staff members are gaining important skills and experience, and require support and training in order to continue to learn. It is important for the science centre network to identify how they can enhance the capacity of these workers and gain the maximum outputs from them.

[10] Sixty percent of respondents from South African science centres at the conference and 78% from the workshops were 35 or younger. Some of the respondents from the conference were however from other organisations.

[11] Forty eight percent of science centre respondents at the conference and 62% at the workshops had been at their science centre for 3 years or less. Some of these respondents may have recently moved from another science centre, but many of them were new to the science centre community.

[12] Thirty four percent of science centre respondents from the conference and 46% from the workshops were volunteers.

The SCCB training has had an important impact on the capacity of science centres and their staff members. This is particularly important within South Africa where science and technology are set to play a crucial role in the country's future development. SAASTA's role in the capacity building of these science centres is therefore central to the development of the South African science centre network and the implementation of the Science Engagement Strategy.

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Appendix: 2015 SAASTEC Conference

17th SAASTEC Conference 2015 Mmbatho Palms Hotel, Mahikeng	
Science Centre	**Presenters**
ArcelorMittal Science Centre	Daniel Motsapi
ArcelorMittal Science Centre Newcastle	Manqoba Ndhlela; Njabulo Mpanza; Mthobisi Mhoni
ArcelorMittal Science Centre Sebokeng	Sanda Soqinase; Onalenna Ernest Mosiane
Cape Town Science Centre	Busi Maqubela
FOSST	NZ Manzi; PM Kwinana; Lindiwe Ngcobo; S Xanga; V Kwinana; Yolanda Jali; Phumzile Nomnga; Mncedi Rani; Nwabisa Takata
HartRao	Nemabaka Khumbudzo; Sebitsiwa Mathipa
Johannesburg City Parks	Kogie Govender
NWU Mafikeng SC	SD Dichabe, LY Molebatsi
NZG	Armstrong Mashakeni
Mothibistad Science Centre	Chrisencia Moatshe
Mondi	Joseph Sibiya
SAAO	Buzani Khumalo; Sivuyile Manxoyi
Sc-Bono	David Kramer; Akash Dusrath; Stuart Hopwood; Myself Mngomezulu
Sci Enza	Rudi Horak; Eaton Shirindza; Mahlatse Mthetwa; Dikeledi Khutsoane; Naledi Nalane
Unizulu Science Centre	Silindile Mthembu; Derek Fish; Mdumiseni Nxumalo; MJ Schwartz; Diloshni Thambaran