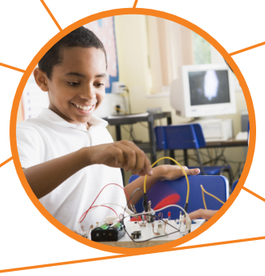
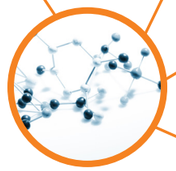
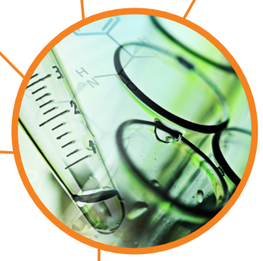
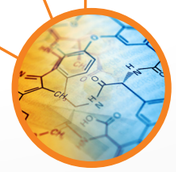








HIGHLIGHTS of the

YOUTH INTO SCIENCE and SCIENCE ENGAGEMENT PROGRAMMES

2015

HSRC Contact Details

Pretoria
Private Bag X41
Pretoria
0001
012 302 2024

Cape Town
Private Bag X9183
Cape Town
8000
021 466 8001

Durban
Private Bag X07
Dalbridge, Durban
4014
031 2425400

HSRC Human Sciences Research Council

science & technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

WHAT IS THE YOUTH INTO SCIENCE STRATEGY?

The Department of Science and Technology launched the Youth into Science Strategy: Nurturing Youth Talent for a Stronger National System of Innovation (YiSS) in 2006 to enhance participation, performance and awareness of science and science based careers of school-going youth and undergraduates in science, technology, engineering and mathematics (STEM). YiSS was expanded in 2010 to include programmes which facilitated work place experience and work placements for post-school youth (near and undergraduates) in the areas of STEM.

The YiSS initiative responds to key government priorities and strategies:

- Presidential Priority Outcome 1 to improve the quality of education, and Presidential Priority Outcome 5 for a skilled, capable and inclusive workforce;
- The National Development Plan which recognises that education, training and innovation are central to South Africa's long-term development; and the
- DST Strategic Plan which aims to build a science, engineering and technology (SET) human capital pipeline to ensure increased availability of researchers and innovators for South Africa's competitiveness.

KEY OBJECTIVES OF YiSS

YiSS aims to increase the quality and quantity of SET graduates from the schooling system by improving science and technology awareness and literacy, and to recruit more school-going youth and undergraduates to pursue careers in STEM. YiSS also aims to attract young people to STEM-based studies at tertiary institutions; and to facilitate the completion of tertiary studies and entry into appropriate jobs in the labour market. More recently, the focus has shifted to include public awareness and institution-based programmes.

- The **school-focused programme**, the Talent Development Programme, aims to improve participation and performance in mathematics and science at the Grade 10-12 levels, and to increase the interest and career orientation in STEM.
- The **post-school programme**, the National Youth Service, aims to provide workplace opportunities for unemployed STEM graduates.
- The **public awareness programme**, the National Science Week, aims to improve science awareness and interest.
- The **institutional development programmes**, the Science Centre Capacity Building and Science Awareness Spaces programmes, aim to build the human and institutional capacity of science promotion institutions, as well as to compile an inventory of spaces with potential to expand.

RESEARCH METHODOLOGY AND TRACKING APPROACH

The DST commissioned the HSRC (Education and Skills Development programme) to undertake the tracking of participants in YiSS programmes, and to map out their educational and employment trajectories. We will assess the outcomes of YiSS interventions in improving knowledge, attitudes and career choices towards SET, and assisting unemployed graduates to acquire skills, capabilities and opportunities to enter the labour market or proceed with further studies.

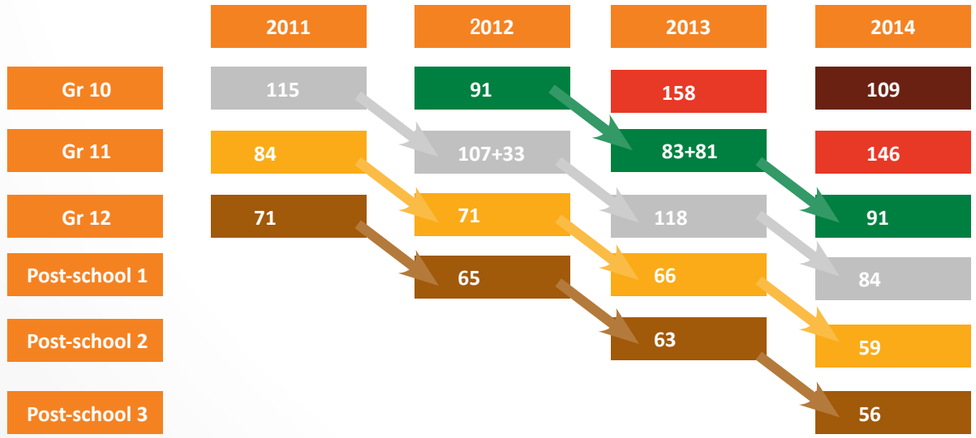
TALENT DEVELOPMENT PROGRAMME

The Talent Development Programme (TDP) is a residential, enrichment and additional academic contact time programme for Grade 10, 11 and 12 high performing students selected from the 18 DST-Adopted Dinaledi schools, the 9 pilot schools of the Historic Schools Restoration Project and 50 top performing Dinaledi schools in each province. Where a province has less than 50 Dinaledi Schools, performing schools outside the Dinaledi schools project were considered for participation.

The TDP provides participants with an opportunity to engage in challenging academic work; offers social experience, and exposure to strategies to manage university life; as well as providing an environment that enables students to formulate SET career directions. Since 2011, the programme has been managed by the Umthonjeni Centre at Wits University, and students are recruited to attend three week-long contact sessions each year. According to the Umthonjeni Centre's records, the total number of TDP enrolments has been: 2011 – 257, 2012 – 149, 2013 – 258, and 2014 – 218. In 2011, the first intake of participants included Grade 10, 11 and 12, and in subsequent years new intakes only constituted Grade 10 and 11 students.

Methodology and tracking plan

We collected baseline information on appropriate indicators, and continued to follow up with participants in each of the subsequent years to collect information on their educational and labour market trajectories. The key research questions are: (i) Who attends the Talent Development Programme (Cohort 2011, 2012, 2013 & 2014); (ii) What are the attitudes of participants towards mathematics and science; (iii) What are the educational aspirations of participants and (iv) What are their career destinations?



Who participates in TDP (2011, 2012, 2013, 2014)

Our analysis of Cohorts 2011, 2012, 2013 and 2014 baseline information indicates that the TDP population comes from a total of 53 schools, and that the majority of participating schools are from Gauteng (13), KwaZulu-Natal (12), and Limpopo (11). Forty five of the schools are classified as Public Ordinary Schools and 8 as Independent Ordinary Schools. Two thirds of the schools are in urban areas normally linked to better performance and resources than rural areas.

The majority of TDP students are black Africans (79%) and female (70%). Approximately 90% of TDP students attend Public Ordinary Schools, and of these, 80% attend Quintile 4 and 5 schools. Ten percent of the TDP students attend Independent Ordinary Schools, and of these, 85% attend schools with annual student fees of R12 000,00 and lower. The average age of Grade 10, 11 and 12 TDP students is 16, 17 and 18 years of age respectively.

We requested that learners provide their mathematics and science examination results of the previous academic year. The 2013 end-of-the-year results of students who attended the 2014 TDP contact sessions are provided in the table below. In most cases, more than 80% of students achieved a C-symbol or higher, and more students achieved an A-symbol in mathematics than in science. The results indicate that the TDP is reaching students who perform well in mathematics and science.

Students' mathematics and science achievement: 2014 participants

Symbol Attained Previous Year	Mathematics				Physical Science			
	Gr 10 Baseline	Gr 11 Baseline	Gr 11 Follow-Up	Gr 12 Follow-Up	Gr 10 Baseline	Gr 11 Baseline	Gr 11 Follow-Up	Gr 12 Follow-Up
A. 80-100%	56%	15%	41%	32%	53%	8%	28%	23%
B. 70-79%	24%	31%	25%	29%	33%	25%	28%	27%
C. 60-69%	16%	37%	20%	27%	12%	43%	25%	33%
D. 50-59%	3%	18%	10%	11%	2%	13%	13%	11%
E. 40-49%	1%		2%	2%	1%	12%	4%	6%
F. 30-39%			1%				1%	
G. 0-29%			2%					

The table below shows the socio-economic status (SES) distribution of TDP students. The SES was generated from students' responses to assets listed in the student questionnaire. Students were asked to indicate whether each of the listed assets was present in their homes. A variable was generated by calculating the sum of all assets. This variable was used as a proxy for the SES of the home of the student (where 1 equals poor/low and 3 equals affluent/high).

The highest proportion of TDP students had a high socio-economic status, and a quarter of students had a low SES. Even though the majority of TDP students achieved a D-average or higher, students with low SES had slightly lower achievement scores than students from medium or higher SES.

New entrant students' socio-economic status: 2011 to 2014

	2011			2012		2013		2014	
SES	Gr 10	Gr 11	Gr 12	Gr 10	Gr 11	Gr 10	Gr 11	Gr 10	Gr 11
Low	22%	25%	28%	27%	24%	20%	29%	23%	30%
Medium	27%	35%	32%	38%	30%	31%	23%	35%	13%
High	51%	40%	39%	36%	45%	48%	48%	42%	57%

Even though the majority of TDP students achieved a D-average or higher, students with low SES had slightly lower achievement scores than students from medium or higher SES.

Attitudes of enjoyment, confidence and valuing of mathematics and science

Developing positive attitudes towards mathematics and science is an important goal of the curriculum. The HSRC investigated TDP students' attitudes (enjoyment, confidence and valuing) towards mathematics and science. We created an index of attitudes towards science and mathematics, and the tables below reflect the percentages of students with positive attitudes[1].

Grade 10, 11 & 12 students' attitudes towards mathematics and science: 2011 to 2014

Grade 10	Mathematics			Science		
Year	Enjoy	Confidence	Value	Enjoy	Confidence	Value
2011	92%	97%	87%	93%	96%	87%
2012	90%	100%	86%	82%	96%	79%
2013	87%	97%	73%	91%	89%	78%
2014	89%	72%	93%	95%	77%	90%
Grade 11						
2011	92%	96%	88%	88%	85%	64%
2012	94%	97%	91%	72%	85%	64%
2013	90%	91%	73%	83%	84%	69%
2014	95%	92%	80%	95%	77%	92%
Grade 12						
2011	93%	87%	100%	99%	85%	85%
2012	97%	89%	94%	88%	77%	80%
2013	95%	87%	93%	94%	81%	84%
2014	98%	80%	94%	95%	72%	90%

In general, the students participating in the TDP programme from 2011 to 2014 enjoyed mathematics and science, were confident in their ability towards the subjects and valued the importance of these subjects. One anomaly is that in 2014 the confidence levels in mathematics and science were at their lowest. The confidence levels of Grade 12 participants have generally been lower, from 2011 to 2014, than the other attitude indices in both subjects.

In general, the students participating in the TDP programme from 2011 to 2014 enjoyed mathematics and science, were confident in their ability towards the subjects and valued the importance of these subjects.

[1] Enjoyment refers to the intrinsic value or interest students have in a subject, for example whether the subject is interesting or enjoyable. Confidence assesses students' self-confidence or self-concept in their ability to learn mathematics or science. Value refers to extrinsic or external motivation, because it leads to a desirable outcome, for example being accepted into a good university or having a successful career.

We calculated the relationships (correlation) between the students' reported achievement levels and attitudes. These relationships were calculated using data we collected from students who attended the TDP contact sessions during 2014. Only the relationships which are statistically significant are provided below:

2014 Grade 10, 11 and 12 students: relationship between attitudes and achievement

Mathematics			
Grade	Variable	N	F
Gr 10 Baseline	Enjoyment	101	0.021**
	Confidence	101	9.623 *
Gr 11 Baseline	Confidence	62	6.279**
Gr 11 Follow Up	Confidence	126	10.479**
Gr 12 Follow Up	Confidence	85	9.652**

Science			
Grade	Variable	N	F
Gr 11 Baseline	Enjoyment	61	3.678 *
	Confidence	61	3.319 *
	Value	61	4.211 *
Gr 11 Follow Up	Enjoyment	120	3.654 *
	Confidence	120	5.011**

**. Correlation is significant at the 0,01 level. *. Correlation is significant at the 0,05 level.

Student achievement in mathematics is positively related to the confidence they have in mathematics (see discussion above). In the previous section we detected that students were generally more confident in mathematics than in science.

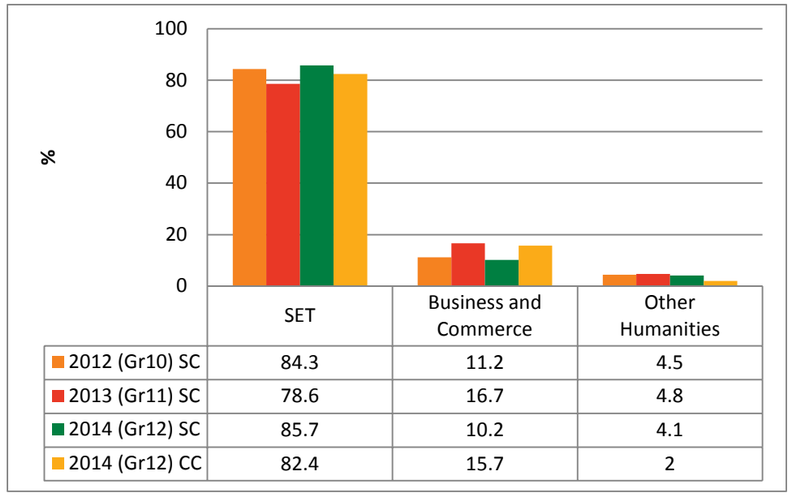
Educational and career aspirations of participants[2]

We followed the 2012 Grade 10 and 11 cohorts from 2012 to 2014, in order to gauge their educational and career aspirations. The following question was asked to determine their educational aspirations while at school ("What do you think you might study after grade 12?"). We also asked participants to indicate their career aspirations at the age of 30 ("What work do you think you will be doing when you are 30 years old?"), and those who matriculated in 2013 were requested to provide their subject choices (destination) in post-secondary institutions.

The following two graphs provide an analysis of student responses (SC: Aspirational Study Choice; AS: Actual Studies/ Destination; CC: Career Choice at 30). We recoded students' responses into the following broader categories: the Natural Sciences or Science, Engineering and Technology (SET), and the Human Sciences which are further disaggregated into Business and Commerce, and Other Humanities including Education.

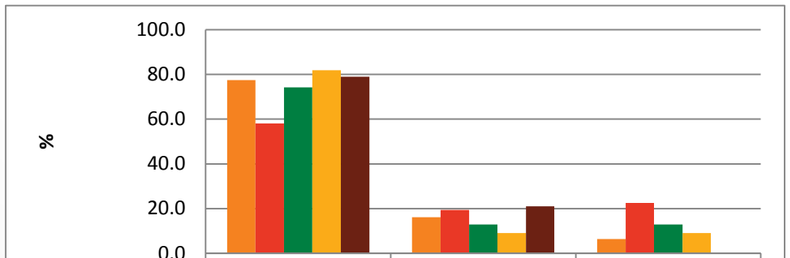
[2] We used the 2012 cohort in this section as an example to show the educational and career aspirations of TDP students. The reason is that the students participating in TDP show similar trends in their educational and career choices.

Grade 10 cohort 2012: educational aspirations (2012, 2013, 2014), and career choice at 30 (2014)



	SET	Business and Commerce	Other Humanities
2012 (Gr10) SC	84.3	11.2	4.5
2013 (Gr11) SC	78.6	16.7	4.8
2014 (Gr12) SC	85.7	10.2	4.1
2014 (Gr12) CC	82.4	15.7	2

Grade 11 cohort 2012: educational aspirations (2012, 2013), career choice at 30 (2012, 2013), and post-secondary disciplinary choice/ destination (2014)



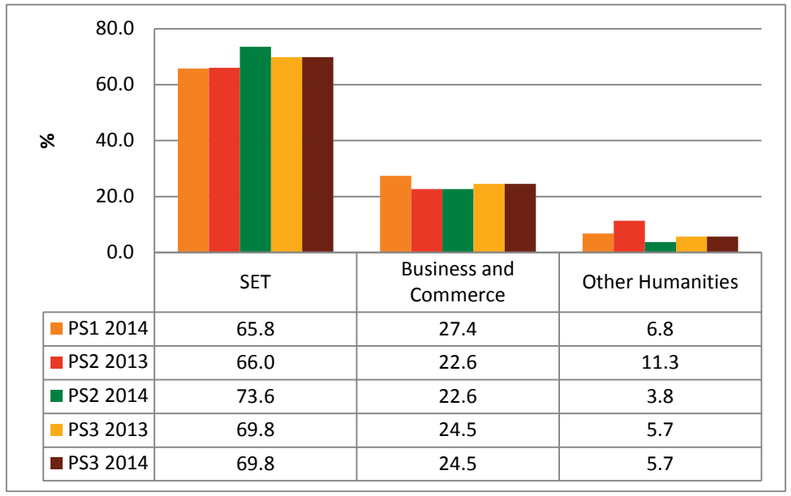
	SET	Business and Commerce	Other Humanities
2012 (Gr11) SC	77.4	16.1	6.5
2012 (Gr11) CC	58.1	19.4	22.6
2013 (Gr12) SC	74.2	12.9	12.9
2013 (Gr12) CC	81.8	9.1	9.1
2014 (PS1) AS	78.9	21.1	

The most popular educational aspirations and post-school subject choices of the 2012 TDP cohort were in the SET fields which include engineering, medicine, and the health sciences.

The choice and emphases of the TDP is based on those wanting to follow a science career, as is reflected in the discussion below.

In 2014, more than two-thirds of the post-secondary students who actively participated in TDP during the 2011 to 2013 academic years were enrolled in a SET discipline at a Higher Education Institution. Less than one third of post-secondary students were enrolled in engineering, one fifth in medicine and one fifth in natural and health sciences. A substantial percentage of students, one-quarter, opted to study a business and commerce discipline.

Post-secondary students 2014: disciplinary choices



	SET	Business and Commerce	Other Humanities
PS1 2014	65.8	27.4	6.8
PS2 2013	66.0	22.6	11.3
PS2 2014	73.6	22.6	3.8
PS3 2013	69.8	24.5	5.7
PS3 2014	69.8	24.5	5.7

Conclusion

With regard to the TDP objectives, these findings have shown that there is continuity of learners into higher education, and most of the learners have chosen fields which advance SET careers. The selection criteria of the learners participating in the TDP prioritise excellence. Therefore, the interpretation could be that because the learners perform well they are included in TDP, proceed to Grade 12 and pass their National Senior Certificate final examination well. Finally, it is important to note that the study in general observes similar patterns from different cohorts.

Thus the outcomes are unlikely to change as long as the selection method is maintained. Unfortunately with this methodology we cannot say what the value-add of the TDP programme has been – would this have been their trajectory irrespective of the programme? If we want to answer the value-add question we need a different design.

There is continuity of learners into higher education, and most of the learners have chosen fields which advance SET careers.

WORK EXPERIENCE FOR UNEMPLOYED SCIENCE GRADUATES: THE NATIONAL YOUTH SERVICE II

As part of the Presidency's initiative to encourage volunteerism among youth, and amid the concerns about the numbers of unemployed science graduates, the DST embarked on a programme to provide first workplace experiences to unemployed STEM graduates. In this programme, participants are employed at science centres where they gain work experience related to science awareness and attend additional training. A stipend is paid to participants to cover costs incurred by participation. The first phase of the NYS was implemented across all nine provinces between 2007 and 2011 and was co-ordinated by the National Science and Technology Forum (NSTF). The second phase which began in 2012 (NYSII) was co-ordinated by the South African Agency for Science and Technology Advancement (SAASTA).

Research Questions

The key research questions are: (i) Who participated in the NYSII? (ii) What are the educational related pathways of the NYS participants into the work experience programme? (iii) What are the pathways out of the work experience programme? (iv) What are the outcomes of participation in the NYS?

Methodology and Tracking Plan

This study used a pathways framework to map the transitions in and out of education, through the NYS programme and into the labour market. We collected baseline information for Phase 1 (Cohorts 2008-2011), and Phase 2 (Cohorts 2012, 2013 and 2014).

Tracking plan for each cohort

YEAR 1

- Contact information and genreal demographic information provided by SAASTA
- Participants are contacted in December of the year that they joined the NYS
- Baseline information on pathways into NYS is collected

YEAR 2

- Respondents are contacted in December of the year after exiting the NYS.
- Information on the pathways out of the NYS is collected

YEAR 3

- Respondents are contacted in December two years after exiting the NYS
- Information on labour market trajectories, outcomes of the NYS, and attitudes to volunteerism is collected.

The participants were tracked into the subsequent years to map their educational and labour market trajectories. The tracking of Phase 1 participants has been concluded (see previous highlights document), and this section reports on Phase 2 of the NYS. The table below sets out the number of participants of each of the 2012, 2013 and 2014 cohorts. The table includes the number of respondents successfully tracked in subsequent years.

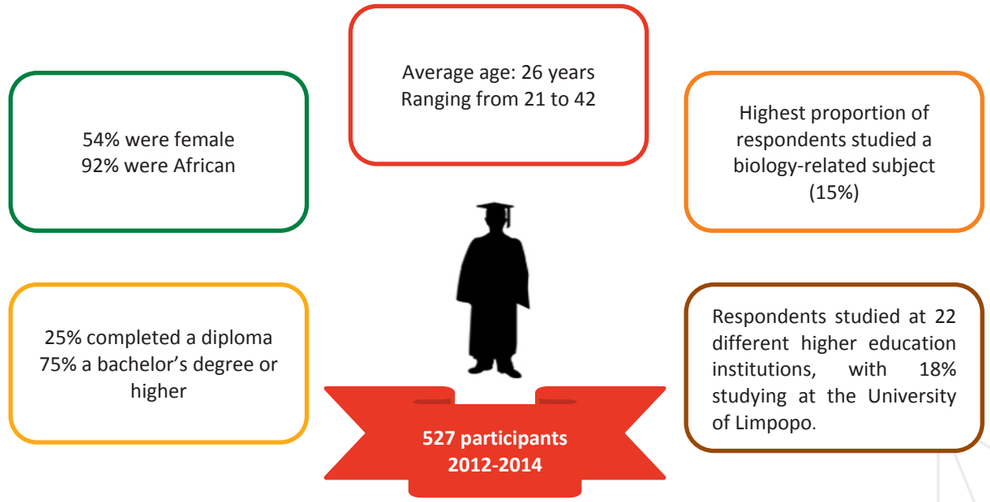
Participants[3] and respondents[4] in each NYS phase

Cohort	Participants	Year 1	Year 2	Year 3
2012	245[5]	173 (2012)	110 (2013)	67 (2014)
2013	46[6]	38 (2013)	36 (2014)	Data to be collected in 2015
2014	236	173 (2014)	Data to be collected in 2015	Data to be collected in 2016
Total	527	384	146	67

[3] Analysis of databases supplied by SAASTA
[4] Those we reached for telephonic interviews
[5] The final sample was 218 as 8 participants did not provide contact information and a further 19 resigned before starting the NYS programme
[6] According to SAASTA this number is anomalously low due to budgetary constraints and non-renewal of contracts.

Who participated in the NYSII?

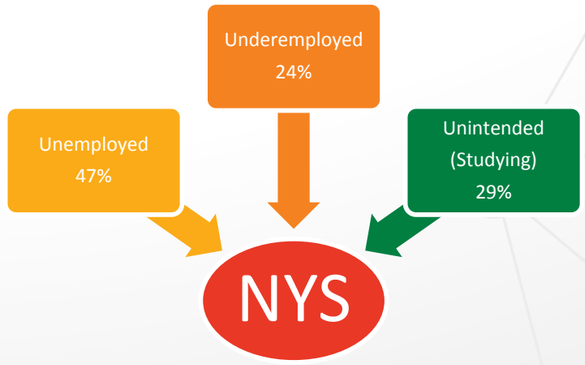
The 527 participants of the NYS were mostly female (54%) and African (92%). The highest qualification profile of NYSII participants was: 25% completed a diploma, 75% a bachelor's degree or higher degree. It is noteworthy and concerning that the 2014 Cohort had only five master's degrees and one PhD. Most participants graduated with qualifications in areas of biology (15%), chemistry (13%), engineering (12%) and environmental sciences (11%).



What are the educational-related pathways of the NYS participants into the programme?

We were able to analyse 378 of the 384 student pathways for the 2012, 2013 and 2014 cohorts. Across the three cohorts, respondents accessing the NYS followed three distinct pathways into the programme: (i) respondents who were unemployed, (ii) respondents who were underemployed as they were working part-time or were working in fields not related to STEM, and (iii) respondents who proceeded directly from a higher education institution into the programme. We have categorised the last group of pathways as "unintended" as the intention of the programme is to provide work experience for those STEM graduates who are experiencing barriers in gaining relevant work experience. The figure below illustrates the proportion of respondents falling into each category.

Pathways into the NYS programme for cohorts 2012, 2013 and 2014



The majority of NYS respondents did not proceed straight from university education to the NYS programme. Rather, they were involved in a number of other activities, experiencing interrupted pathways into the programme. Our analysis of the respondents' pathways into the programme shows that:

(a) 8 respondents (2%) made a smooth transition from Grade 12 to a tertiary education institution, and then into the NYS. It is however concerning that these respondents went to the NYS rather than the labour market;

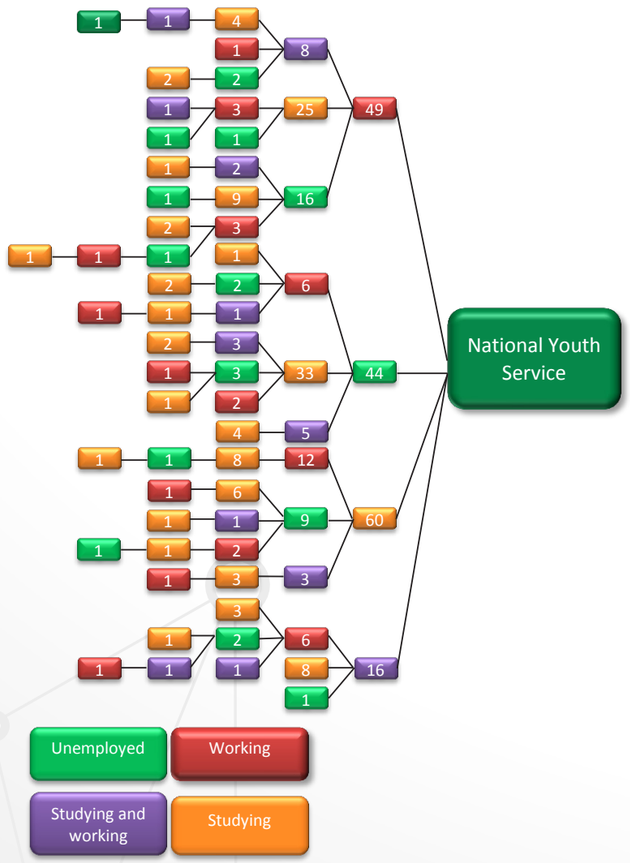
(b) 373 respondents experienced longer, interrupted pathways into the NYS;

(c) On average, respondents who completed a bachelor's degree or diploma took 7 years (rather than the expected three) from matriculation to entering the NYS;

(d) 62 respondents (18,5%) who completed a bachelor's degree or diploma took at least 10 years from matriculation to entering the NYS;

(e) The pathways were unpredictable and are indicative of the social and economic barriers that the respondents have encountered. This is illustrated by the figure below, which indicates the pathways of the 2012 cohort into the NYS.

Transitions into the NYS programme (Cohort 2012)



What are the pathways out of the programme?

The majority of the 2012 cohort respondents that were tracked one and two years post-programme were either working and/or studying. However, as is evident in the table below, close to 1 in 5 still do not have a job. For the 2013 cohort, after participation in the programme, 47% of respondents went directly into work; 3% into work and studying and 22% into further studies.

Labour market trajectories after exiting the NYS

Cohort	Years since existing NYS	% Working	% Studying	% Working and studying	% Unemployed
2012	1	64	17	1	18
	2	64	9	9	18
2013	1	47	22	3	28

It is a concern that in a landscape of skills shortages, 18% and 28% of the 2012 and 2013 cohort respondents, respectively, were unable to join the labour market one year after exiting the programme. The reasons offered for the inability to find employment vary. Some respondents felt that they still did not have the experience required by employers, while others felt that there were no suitable jobs available where they live, or that the jobs available were not in line with their studies. These respondents have, however, not been idle as a majority of the unemployed respondents have been applying for employment without success.

What are the outcomes of participation in the NYSII?

To date, the respondents of cohorts 2012 and 2013 have been tracked after the completion of the NYS programme. We are thus able to assess the outcomes of participating which are displayed in the figure below.

Outcomes of NYS for respondents who were working

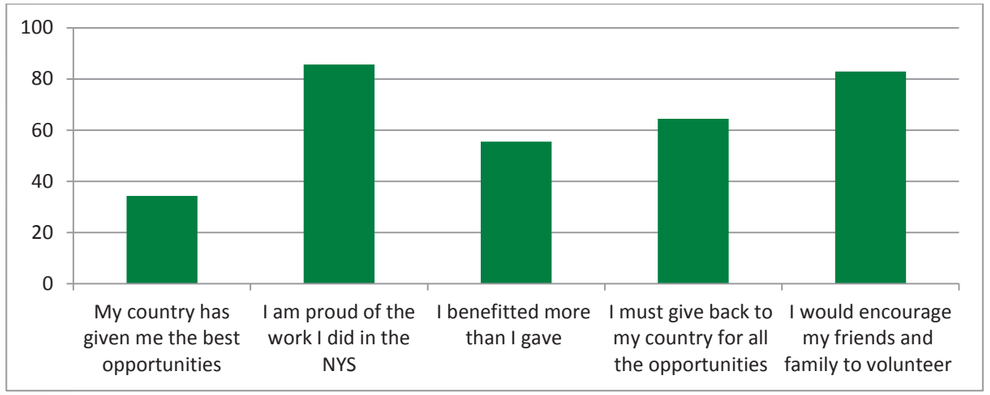
87 respondents working
(69 for 2012; 18 for 2013)

Most respondents in the 2012 and 2013 cohorts reported that their skills in communicating science, knowing how to manage the activities of the workplace and handling more responsibility in the workplace were enhanced by participating in the NYS programme. The NYS thus succeeded in providing the opportunity for workplace experiences and interactions which extended from their knowledge base.

Attitudes to volunteerism

The NYS programme has a strong patriotic, volunteerism focus. The hope is that a spirit of civic volunteerism will be inculcated within the participants. To this end, respondents were asked about their attitudes to volunteerism, and the effect that the experience in the NYS has had on these attitudes.

Respondents' attitudes to volunteerism



On average, the respondents had positive attitudes regarding their participation in the NYS. More than half of the respondents felt that they had benefitted from the programme and were proud of the work that they had done. The most negative attitudes were expressed toward the statement: 'My country has given me the best opportunities', which highlights the disillusionment of the respondents. These respondents are faced with reports of a shortage of skills in STEM areas, while concurrently being unable to easily find employment.

Conclusion and policy implications

South Africa experiences both skills shortages and graduate unemployment in STEM areas, where the workplace requires first time employees to demonstrate work experience. Programmes like the state-funded NYS are important in bridging the divide between graduates and the workplace. In the current phase of the NYS, 527 graduates have benefitted from this active labour market intervention. The majority of these are from the intended target group: those unemployed and underemployed. The interrupted pathways which the respondents experienced before entering the NYS highlight the social and economic barriers which are faced when disadvantaged groups attempt to enter the labour market. The NYS does promote mechanisms which allow the most disadvantaged groups - with the least social capital - access to labour market networks to gain this experience, and thereafter hopefully access the appropriate job opportunities. From a policy standpoint, it is important that such strategies continue.

The findings of this study point to an unsupportive labour market for some STEM graduates. This is further substantiated by the proportion of respondents who have left the NYS programme but are still unable to find employment. In South Africa, education continues to receive the biggest share of the national budget, underlining the country's developmental priorities. How, then, can the educational outcomes of unemployment for these graduates be justified? More research is required into understanding the complex nature of STEM skills uptake into the labour market.

NATIONAL SCIENCE WEEK

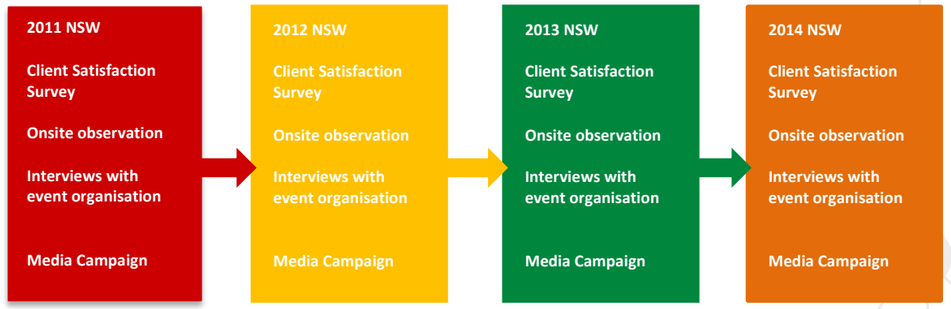
The National Science Week is an annual countrywide celebration of science, technology, engineering, mathematics and innovation (STEMI), led by the DST and managed by the South African Agency for Science and Technology Advancement (SAASTA), where various stakeholders, role players and interest groups collectively conduct activities that promote general awareness of the value of STEMI to peoples' daily lives. National Science Week (NSW) is run in all nine provinces in August, simultaneously at multiple sites per province. In addition to contributing to science, engineering and technology awareness among various sections of the population, the NSW is intended to expose the public, educators and students to science-based careers, particularly amongst the disadvantaged sections of the population.

Research and evaluation methodology

The key areas of the evaluation are: (i) who the participants of the NSW were; (ii) the Human Sciences Research Council's (HSRC) Client Satisfaction Survey, including the career intentions of participants; (iii) SAASTA's Event Impact Study; (iv) who the NSW 2014 service providers were; (v) the NSW 2014 Media Campaign; (vi) what the challenges were, and (vii) positive aspects of NSW 2014.

In 2011, the HSRC purposely observed 9 sites (Gauteng, Western Cape and KwaZulu-Natal) from the 88 grantholders. In 2012, we observed 11 grantholder sites in the Eastern Cape, Gauteng, Western Cape, KwaZulu-Natal and North West provinces. In 2013, we observed 20 grantholder sites from the 64 service providers in Gauteng, KwaZulu-Natal, Mpumalanga, Limpopo and the Eastern Cape. In 2014, we observed 18 grantholder sites from 90 service providers in Gauteng, KwaZulu-Natal, Western Cape and the Eastern Cape.

These data were supplemented with data from the 2014 SAASTA NSW reports which include: a Monitoring Report; a Media Report, an Event Impact Report and a Service Provider Feedback Report.



Participants in the National Science Week: 2009-2014

NSW participation has continued to increase, and has quadrupled over the last 6 years, with numbers increasing from 204 174 in 2009 to 811 114[7] in 2014, an increase of 297%. Up to 2012, the majority of the participants were school students, but this changed in 2013 when the Department of Science and Technology (DST) embarked on an awareness and marketing campaign to attract the general public, i.e. NSW activities now include events at malls and places which attract the general public. In 2013, 55% of the participants at NSW activities were the general public.

Overall participation increased from 558 003 in 2013 to 811 1147 in 2014, an increase of 45%. The number of public participants more than doubled from 2013 to 2014, constituting 79% of overall participation. 2014 also had the lowest participation of students.

[7] *Science centres attracted the public in the following ways: teacher conferences and workshops; invitations to communities, churches and parents; encouraging children and especially ECD learners to be accompanied by their parents; lunch hour programmes for organisations; public exhibitions and quizzes aimed at adults; book reading in public libraries; organised outreach in malls and exhibits; radio interviews, newspaper articles and word-of-mouth marketing; inclusion of adults in talks and demonstrations; and free museum entrance during NSW 2014.*

Public, student and educator participation from 2009 to 2014

	2009	2010	2011	2012	2013	2014
Students	172 471	196 876	292 397	273 812	244 289	162 143
Educators	10 706	7 659	13 997	14 171	5 828	5 930
Public	20 997	48 240	32 231	108 900	307 886	643 041
Total	**204 174**	**252 775**	**338 625**	**396 883**	**558 003**	**811 114**

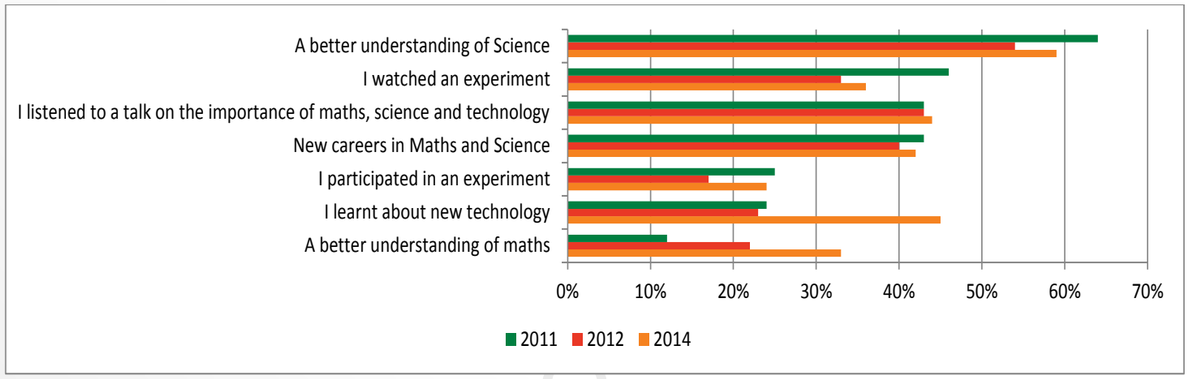
Public participation from 2013 to 2014 increased the most in the following provinces: KwaZulu-Natal, Western Cape, Mpumalanga and the Northern Cape.

HSRC Client Satisfaction Survey : 2011-2014

The Client Satisfaction Survey was administered to 2 066 visitors at the 18 grantholder sites monitored by the HSRC in 2014. The participants were Grade 7 to 9 learners (56%), Grade 10 to 12 learners (28%), and adults (12%). The majority of questionnaires were completed by female participants (55%). Participants rated their satisfaction with NSW 2014 very high, with 68% satisfied with their overall experience, 71% enjoying the event, and 81% reporting that they have learned something new.

The graph below shows the responses of participants regarding what they have learned.

What participants have learned at NSW: 2011, 2012 and 2014



Note: (Participants in 2014 were limited to only one career choice. The first career choices for 2011 and 2012 participants were selected)

In 2014, 45% and 33% of participants respectively reported that they learned about new technologies and a better understanding of mathematics. This is a substantial percentage increase over previous years. The increase in mathematics activities can be attributed to the South African Mathematics Foundation (SAMF) combining its annual National Mathematics Week (NMW) with NSW.

In 2012 and 2014, about 50% and 60% of participants respectively, reported this as their first visit to a science centre. In 2012 just over a quarter reported it as their second visit, while in 2014 a fifth reported it as their second visit. In the areas where these sites are located there still could be a large number of people not aware of the NSW or of the location of science centres or museums in the area.

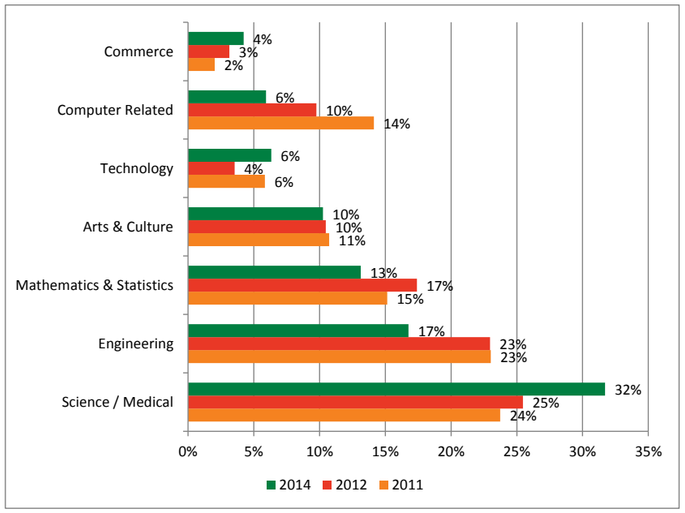
Around two thirds of participants surveyed had heard about the NSW from their schools. As mentioned above, the majority of participants were learners who attended the activities accompanied by teachers. Approximately 90% of participants were willing to tell others to attend NSW activities. Schools are important sites to organise NSW activities, and the DST should not lose the schools focus.

Career intentions of NSW participants (2014)

Participants were requested to select the career they were most interested in, if they were students; or their current careers, if they were adults. In the 2014 Client Satisfaction Survey, participants were limited to selecting one career option, but in previous years participants were not limited in selecting a career. The career choices of participants in 2011 and 2012 show a similar trend to those of 2014, see figure below.

The majority of the participants in 2014 were considering future careers in STEMI disciplines: science- 32%, engineering – 17%, and mathematics and statistics- 13%.

Career intentions of NSW participants: 2011, 2012 and 2014



Note: (Participants in 2014 were limited to only one career choice. The first career choices for 2011 and 2012 participants were selected)

The analysis of responses from the general public (127 participants) regarding their actual careers are: Computer-related- 20%; Engineering- 17%; Arts & Culture- 10%; Science/Medical- 7%; and 27% in a career not indicated on the questionnaire. A small number of higher education students, 33, completed questionnaires, and about half of them were enrolled in a Science/Medical field and less than one fifth in Engineering.

SAASTA: Event Impact Study (2014)

SAASTA conducted an Event Impact Study with 192 participants from various provinces to investigate the perceptions of the impact of NSW events presented by different service providers. Forty eight per cent of participants were Grade 10, 11 and 12 learners, 5% were students, and 47% the general public. The majority of participants (58%) were female.

Most of the participants (98%) rated the preparedness of presenters above average or excellent, and felt that they had learned useful information. Seventy two per cent of participants indicated that they were introduced to new careers.

A large portion of the SAASTA questionnaire was dedicated to evaluating the mathematics activities due to SAMF incorporating its annual National Mathematics Week into NSW. Three quarters of participants reported enjoying the mathematics activities, and found it fun, but challenging. Those who did not enjoy the mathematics activities also found them challenging.

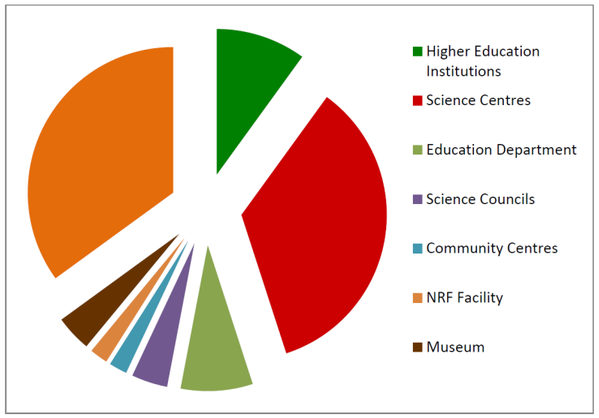
Three-quarters (71%) of participants were inspired to do better in mathematics[8]. Although 61% of participants indicated that they understand how mathematics is applied in science, the reasons they provided were unconvincing. Only 17 of the 192 participants commented on their understanding of the importance of mathematics in science, and only 7 of these comments were considered relevant and indicated only some understanding. Participants do not understand the relationship between mathematics and science.

[8] Some of the impacts reached through the mathematics activities were: maths was demystified; participants realised that they had the ability to do mathematics; mathematics was portrayed as being fun; mathematics is understood as a "door opener"; the importance of mathematics as a discipline was highlighted; the importance of basic mathematical concepts were highlighted; the participants were shown that there is more than one method of solving mathematical problems; and mathematics needs to be practised.

NSW 2014 service providers

The figure below provides a breakdown of the types of service providers responsible for NSW 2014 events. The majority of service providers (59%) had 10 or less staff members, and 65% reported employing more staff members to implement their activities.

NSW 2014 service providers



SAASTA monitored the venues of approximately 90 service providers and rated 52% of the sites as Very Good, 46% Good and 2% Poor. In terms of the infrastructure of the venues, most of the sites could accommodate the number of visitors (96%); were generally clean (100%); allowed for smooth flow of visitors (100%); had proper signage considered to be excellent or good; had sufficient ventilation in closed halls and rooms (93%); could accommodate people with disabilities (77%); and had adequate ablution facilities (98%). What was a cause for concern was that only 57% of the sites had security and medical support.

Most of the sites (57%) did not have programmes available, which made it difficult for monitors (HSRC and SAASTA) to attend all relevant activities. Less than 50% of service providers had role modelling activities, career exhibits, public talks and learner workshops; and 63% of service providers used science shows. All of these activities were rated by monitors to be of a very high standard. Twelve per cent of service providers provided educator workshops which were rated as being of a low standard. More in depth evaluation will be done to determine the reasons for this.

NSW 2014 media campaign

As in previous years, different media platforms were utilised to market NSW 2014 and to inform the broader public of upcoming events. The media coverage was almost equally divided between print (31%), online (37%) and broadcast (32%) media.

- NSW 2014 was covered in the print media 62 times, mainly in English (71%), Afrikaans (9%), IsiZulu (2%), and 18% in a range of local languages. The following print media types were utilised: local rural newspapers (41%), daily newspapers (34%), local urban newspapers (21%), and government inserts and business to business 2% each.
- During 2014, the NSW was covered 19 times in television broadcasts, mostly on SABC 2 during the launch of the event.
- On the radio, NSW 2014 was covered 33 times to a national audience in 8 of the official languages. The following radio broadcast types were utilised: national (42%), community (22%), regional (22%), and regional commercial (14%).
- NSW 2014 was profiled 56 times in online media in a variety of online forums such as IOL.co.za, Durbanite.co.za, Polity.org, UJ.co.za, Georgeherald.co.za, Gov.za, and many more.
- Overall, NSW 2014 was covered 170 times in the media, across all provinces and in all the official languages.

Not all science centre managers we interviewed were aware of SAASTA's national media campaign, and many of them could not elaborate on how it was of benefit to them or the area they serviced. Grantholders focused more on their own media campaigns in their respective areas, and focused on strategies to attract higher levels of the adult public. The media campaigns included interviews on local radio stations, advertisements and/or articles in local newspapers, e-mail campaigns to community organisations including schools, faxes, posters in and around the venue, and social media such as Facebook, and to a lesser extent Twitter.

NSW 2014 challenges

The concerns from service providers have not changed much over the years.

- The most frequent concerns are that the payment of grants does not happen on time, and timelines set by SAASTA are too tight. Concerns from SAASTA's side are that the finalisation of grants is problematic, and not all payments can be done because of outstanding SBD and other compliance issues.
- Service providers also consider the procurement process as complicated, and the documentation not user friendly.
- The print and radio media campaign should be conducted in more local languages, which will increase the dissemination of information and awareness of NSW.
- Less than half the sites visited by HSRC researchers incorporated Indigenous Knowledge Systems exhibits or presentations in the activities. SAASTA monitors reported only 14% of sites using traditional games, and some of these were not relevant.

Positive aspects of NSW 2014

Even taking into account the challenges mentioned above, the overall feedback from service providers and visitors regarding NSW 2014 was positive.

- Exhibits were rated by grantholder site managers as of good quality and diverse. This was largely corroborated by the HSRC's and SAASTA's monitors.
- Service provider staff, in general, were well organised, enthusiastic, very engaging and interacted with visitors.
- Although there were concerns with late payment and timely communication, grantholders received adequate funding and appropriate materials. The assistance provided by SAASTA was rated as good to excellent.
- The HSRC's and SAASTA's participant evaluation studies showed that participants have positive attitudes towards mathematics and science, and STEMI careers. The SAASTA study showed that participants felt more inspired after attending NSW and intended focusing more on maths at school. This was corroborated by the 2014 HSRC study which showed an increase in participants claiming to have a better understanding of maths.
- Visitors were aware of the importance of mathematics and science in everyday life.
- The HSRC and SAASTA studies show that visitors rated the success and quality of events as very high, and are willing to communicate about, and recommend NSW events, to other people.

The overall success of NSW 2014 can be attributed to the experience that grantholder staff have gained over the years and applied to the planning, organisation and management of NSW activities.

Policy implications

The HSRC's 2013 South African Social Attitudes Survey showed that 11% of participants had knowledge of a science centre in their area, and 9% and 18% of participants respectively visited a science centre or museum during the year prior to the survey. Even with the increase in public participation over the last five years, more marketing needs to be done, specifically in rural areas, to create awareness of NSW, and science centres and museums located in these areas.

Closer cooperation with grantholder sites should be established to determine how the DST/SAASTA media campaign will benefit them.

The incorporation of National Mathematics Week into NSW is an excellent initiative and an opportunity to introduce and increase mathematics activities. More practical activities are required during NSW to make participants aware of the relationship between mathematics and science, or the underlying importance of mathematics to science and technology.

Schools are important sites to organise NSW activities including outreach programmes, and in the quest for greater public participation DST should not lose the schools' focus.

POTENTIAL SCIENCE AWARENESS SPACES

Science and technology play a critical role in the development of any country, and it is important for the public to have an understanding and knowledge of various aspects of science. It is therefore necessary to ensure that the public is properly informed about the benefits and impacts of science and technology. The focus has so far been on the country's science centres and the key institutions that the Department of Science and Technology (DST) works through to influence the public and science agenda; however there are a range of other spaces which also promote science for the public agenda. The science awareness spaces study sought to initially identify and categorise the various informal spaces which exist around the country for science awareness promotion. It is important to identify ways to expand access to these spaces and improve their capacity for the promotion of science awareness.

These spaces provide the opportunity for informal education or free choice learning, whereby individuals have a high degree of control over what, when, where and why they learn. Individuals gain knowledge, and this in turn has the potential to lead to increased interest and awareness of science, as well as participation in areas of science and technology by the public. These spaces are therefore able to play a role in increasing scientific literacy, making science more accessible, inspiring people to enter into science and technology-related careers and promoting awareness of the importance of science to society as a whole, and in an individual's everyday life.

Methodology

In this study, science awareness spaces were defined as any space which provides a platform for science awareness. Science awareness was considered to encompass the creation of awareness, understanding and education concerning science and technology. The conception of science was deemed to include "hard" science topics such as biological science and physical science, as well as what is referred to as the "soft" science, which covers social science topics such as anthropology and indigenous knowledge.

The initial phase of the study, which has been completed, focused on the identification of the various categories of spaces which are involved in science awareness in South Africa, thereby creating a typology of these spaces. The spaces identified were both physical spaces which people can visit, as well as notional spaces, which are those platforms that provide science awareness without being located in a physical space. Various characteristics of each of the categories of spaces were then identified to understand the role these spaces play in the promotion of science awareness. A number of recommendations were subsequently made concerning how the DST can assist these spaces in increasing their promotion of science awareness in the country. The next phase of the study will involve the creation of an inventory of the spaces which exist in each category in South Africa.

Science awareness was considered to encompass the creation of awareness, understanding and education concerning science and technology.

These spaces are therefore able to play a role in increasing scientific literacy, making science more accessible, inspiring people to enter into science and technology-related careers and promoting awareness of the importance of science to society as a whole, and in an individual's everyday life.

Categories of science awareness spaces in South Africa

The various science awareness spaces were categorised based on their main functions and goals, and the role they play in the promotion of science awareness amongst the public. The figure below presents the categories of spaces which were identified. Due to the number of different spaces which are involved in the promotion of science awareness, a range of broad categories were defined.

Characteristics of science awareness spaces

A number of characteristics for the spaces were then identified which highlight the role these spaces play in the promotion of science awareness. The following table provides the categories of spaces and their identified characteristics. This table includes science and discovery centres which are currently the dominant spaces for science awareness promotion in South Africa.

The categories of science awareness spaces and their associated characteristics

Category	Type of space	Science focus	Main function	Main goals	Target groups	Reach	Type of engagement	Type of activities	Access	Management
Science and discovery centres	Physical	Biological science Physical science Environment Indigenous knowledge Anthropology	Education Recreation	Education Awareness Career guidance	Schools General public	Local to provincial	Seeking (individuals seek the information provided by these spaces) Receiving (individuals are provided with this information)	Passive (observation by visitors) Interactive (participation required)	Intermediate	Public Private PPP
Museums	Physical	Biological science Environment Indigenous knowledge Anthropology	Education Recreation	Education Awareness	Schools General public Families	Local to provincial	Seeking Receiving	Passive Interactive	Intermediate	Public Private PPP
Zoos, aquariums and animal sanctuaries	Physical	Biological science Environment	Education Recreation	Education Awareness Profit	Schools General public Families	Local to provincial	Seeking	Passive Interactive	Limited	Public Private PPP
Nature reserves and game reserves	Physical	Biological science Environment Indigenous knowledge Anthropology	Education Recreation	Education Awareness Profit	Schools General public Families	Local to international	Seeking	Passive Interactive	Limited	Public Private PPP
Botanical gardens	Physical	Biological science Environment	Education Recreation	Education Awareness	Schools General public Families	Local to national	Seeking	Passive Interactive	Intermediate	Public Private PPP
Planetariums	Physical	Astronomy	Education Recreation	Education Awareness Profit	Schools General public Families	Provincial to national	Seeking Receiving	Passive Interactive	Limited	Public Private PPP
Science festivals and events	Physical	Various	Education Recreation	Education Awareness Career guidance	Schools General public Families Scientists	Local to national	Seeking	Passive Interactive	Intermediate	Public Private PPP
Industries	Physical	Scientific processes Technology	Education	Education Awareness Career guidance	School	Local	Seeking	Passive Interactive	Limited	Public Private PPP
Libraries	Physical	Various	Education Recreation	Education Awareness	Schools General public Families	Local	Seeking	Passive	Intermediate	Public PPP
National research facilities	Physical	Astronomy Biological science Physical science Environment	Education Research	Education Awareness	Schools General public Scientists	National to international	Seeking Receiving	Passive Interactive	Limited	Public Private PPP
Media (TV, radio, newspapers, magazines, internet)	Notional	Various	Education Recreation	Education Awareness Profit Career guidance	Schools General public Families Scientists	Local to international	Seeking Receiving	Passive Interactive	Wide	Public Private PPP
NGOs and NPOs	Physical	Various	Education	Education Awareness	Schools General public Families	Local to national	Seeking Receiving	Passive Interactive	Wide	Public Private PPP
Education centres	Physical	Various	Education	Education Awareness	Schools General public	Local to national	Seeking Receiving	Various	Intermediate	Public Private PPP
Community groups	Physical Notional	Various	Education	Education Awareness	General public Families	Local to provincial	Seeking Receiving	Passive Interactive	Intermediate	Private PPP

Potential for increased science awareness and points for intervention

The investigation of science awareness spaces revealed a range of spaces which fulfil this role in South Africa. The extent to which these spaces contribute to the promotion of science awareness varies based on their focus, main functions and goals, their target audience, reach, type of engagement and activities, as well as the level of access which people have to them.

In order for these spaces to expand to promote science awareness, they need to be able to identify and attract their target groups, market themselves, and provide an educational and entertaining experience for visitors. This requires that these spaces possess adequate knowledge and expertise, trained staff, appropriate management skills and sufficient funds. The impact of many of these spaces, in terms of science awareness, could therefore be increased through related interventions which would allow them to further engage in science and education. DST would need to support these spaces, to varying degrees, to ensure that they are able to promote science awareness more successfully.

The appropriate interventions would include focusing on areas such as:

1) Funding for these spaces, through partnerships with the public sector,

2) Employing education officers, who have the appropriate skills and knowledge, at these spaces.

3) Capacity building for current staff which will allow spaces to continuously learn, and therefore improve their ability to promote science awareness.

4) The provision of resources, such as information, booklets and pamphlets covering a range of science topics.

5) The creation of guideline documents which outline the types of science awareness programmes and activities that exist, and provide guidance on how these can be implemented.

6) Facilitating mentorships between the more established and experienced spaces and those which are smaller, less experienced and have limited resources. It would also be useful to encourage these spaces to participate in the network of science centres.

7) Promoting these spaces to inform the public of their existence, through websites, articles and other forms of media.

The extent to which each category of space, and each individual space, would require support will vary depending on how established they are, the experience they have, the funding which they currently receive, and their current capacity. Each space would therefore need to be assessed in order to determine the most appropriate interventions.

In order for these spaces to expand to promote science awareness, they need to be able to identify and attract their target groups, market themselves, and provide an educational and entertaining experience for visitors.

SCIENCE CENTRE CAPACITY BUILDING PROJECT

The Science Centre Capacity Building (SCCB) project was introduced in response to the capacity challenge presented by the rapid increase in the number of South African science centres. SAASTA was mandated by the DST 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 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.

Methodology

This study sought to evaluate the extent and impact of the capacity building training on the operations of South African science centres. The study used a summative evaluation approach to assess the quality and success of the SCCB project in reaching its stated goals. Data collection occurred in three phases, and focused on data from 2009-2014. Data on the training workshops which have taken place, including the number of participants, were initially collected. Following this, questionnaires were sent to the 34 managers of the science centres and outreach programmes, as well as two staff members from each of the science centres and institutions. These questionnaires focused on the training which occurred between 2009 and 2013. The questionnaires were completed by 24 science centre managers and 26 staff members.

The third phase of the study involved the creation of an online survey which was sent to some of the participants who had attended the workshops. SAASTA provided registers from a number of the workshops, which contained the names and contact details of the participants. This survey covered the period from 2011 to 2014, and was used to elicit further information regarding the training. The sample consisted of 111 participants in the training; and there was a 66% response rate to the survey.

Training workshops

A number of training workshops were held as part of the SCCB project between 2009 and 2014. The following table indicates the workshops which have been held and the number of participants that took part in each workshop, as well as the total number of participants in the workshops per year. Some participants would have attended more than one workshop each year. The Job Shadowing Programme has also been on-going since 2010, and study visits took place to France in 2011 and Miami, USA in 2012.

SCCB workshops and number of participants per year, 2009-2014

Year	Workshop	Participants for each workshop	Total participants per year
2009	DST/AUSAID Management Training	25	116
	Exhibit Building Workshops	44	
	Proposal and Report Writing Workshop	47	
2010	Presentations and Conference Papers Workshop	37	37
2011	Space Science Workshop	25	25
2012	Educational Toys Workshop	35	111
	Visitor Impact Assessment Workshop	46	
	Writing, Presentation and Publishing Papers at Conferences and in Journals Workshop	30	
2013	Explainers Workshop	38	197
	Framework for the promotion of excellence in science centres	32	
	Science Festival Management Training course	15	
	Science Festivals Organizers Workshop	33	
	Peer Review Workshop	36	
	Science Communication Workshop	43	
2014	Good Governance, Proposal and Report Writing Workshop	33	166
	Public Understanding of Biotechnology Workshop	30	
	Dramatization Workshop (Pre-conference)	55	
	Bloodhound SSC Project Workshop	48	

The involvement of science centres in the training has been highly variable. Some science centres have not been involved in any of the training, while three science centres had participated in all the workshops which took place between 2009 and 2013.

Impact of the SCCB training

The questionnaires asked a number of questions concerning the impact of the training on the capacity of staff members. The questionnaires contained questions based on the thirteen intervention areas which the SCCB project focuses on. Managers were therefore asked to complete questions based on the intervention areas which had been addressed in the workshops that they or their staff members had attended. Some of the questions asked about changes that had occurred as a result of the training, and the percentage of respondents (who completed each section) who indicated that these changes had occurred are shown in the figure below. These changes apply to both the managers and their staff members.

Changes within science centres as a result of the training attended

Key[9]			
1	Financial management	7	Developing relevant science centre programmes
2	Project proposal writing	8	Communicating science exhibits to diverse audiences
3	Networking skills	9	Impact evaluation
4	Marketing	10	Preparing and presenting conference/workshop papers
5	Project management	11	Running a science centre
6	Exhibit development	12	Science centre outreach programmes

[9] There were no responses in the section for "establishing a science centre".
[10] For both the questionnaire and the online survey, all of the percentages were calculated out of the number of participants who responded to each question, as some questions were not answered by all.

The SCCB training has had some important positive impacts with regard to many of the intervention areas, with fourteen of the improvements being noted as occurring in 70% or more of the respondent centres. Four of the intervention areas however showed a more limited impact of the training. In terms of "networking" and "exhibit development", just under half of the managers reported increased collaboration with international science centres (44%) and an improvement in the ability of staff members to develop and maintain exhibits (43%). The training has also only resulted in just over a quarter of the respondent centres introducing new outreach programmes, and only 14% introducing new monitoring and evaluation strategies ("running a science centre").

The online survey[10] asked participants to what extent the training had improved their capacity for their jobs, based on a rating scale from "no improvement" to "substantial improvement". Eighty nine percent of the respondents indicated that the training had resulted in a fair (56%) to substantial (33%) improvement in their capacity for their jobs. The capacity of staff members is important in determining the service delivery capacity of science centres.

The existence of an enabling environment which allows participants to apply the knowledge gained from the training is a further important indicator, as it highlights the extent to which the transfer of knowledge takes place within the science centres. Of the respondents to the online survey, 96% stated that their managers had encouraged them to apply the knowledge they gained from the training to their responsibilities, and 84% percent indicated that they had been encouraged by their co-workers to apply or share this knowledge. In addition, over half of the respondents (68%) were asked to present what they had learned, through providing a brief overview or giving a detailed presentation. The practical application of this knowledge was also evident, as 58% of respondents had been given new responsibilities and 77% were asked to implement new strategies or programmes after attending the training. The following figure provides some comments by participants regarding the impact of the SCCB training.

Comments by participants on the impact of the SCCB training

An important finding of the online survey was that 91% of the respondents have remained at the science centres since they attended the training. In the majority of cases, those who had since left the science centres indicated that they have been able to use the knowledge gained from the training in their new jobs. 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, but this does give an indication that the knowledge is retained within the centres to some extent.

Findings and recommendations for increasing the impact of the SCCB training

Findings	Recommendations
A range of workshops covering diverse topics have been offered through the SCCB project.	Core modules should be identified which are presented annually in order to ensure that all science centre staff members acquire the essential knowledge and skills.
A high percentage of staff has remained in the science centre system. However, there is a high turnover at some centres as they rely mainly on volunteers on short-term contracts.	Employing more staff members on a permanent basis would improve the capacity of these centres. The transfer of knowledge needs to occur within the science centres from those who have attended the training to other staff members through internal seminars or presentations.
Many of the participants have a high level of education, holding degrees and higher qualifications.	It is important to ensure career pathing within the science centres to promote the retention of staff members.
Some of the science centres have limited capacity or limited experience. They therefore need to receive training which is timeous and relevant.	Science centres should be consulted on a regular basis to identify areas in which they require training. The expertise of larger and more experienced science centres can be harnessed in training and assisting other centres. Science centres should be advised of the training in advance and provided with sufficient details.
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 to participate. Online databases and science centre handbooks would allow those who do not attend training to gain the relevant knowledge.

RECOMMENDATIONS

The YiSS presents a multi-pronged strategy to promote science in the country. The level of intervention has varied depending on the target group: school-goers, tertiary graduates, the general public and institutions. Our studies have found many positive impacts of these programmes. However, in order to further strengthen these programmes, we recommend the following:

SCHOOL: Talent Development Programme

1. The DST focuses on Research, Development and Innovation and the high-end skills in the skills pipeline. Its contribution, through the TDP, is to enrich and nurture the top performing learners in the school system and attract them to STEM tertiary education choices. We would recommend that this agenda to nurture excellence should be extended, and each province (with a university as the site of delivery) should undertake such a programme.

2. The TDP selection criteria prioritise excellence. Two thirds of the schools which these learners attend are in urban areas, normally linked to better performance and resources than rural areas. We recommend that an equity agenda be followed along with that of excellence. The programme should also benefit students from low resourced environments. It would therefore be useful for half of the places on the TDP programme to be filled by better performing students from non-fee paying schools.

POST-SCHOOL: National Youth Service

3. The National Youth Service (NYS), which focuses on unemployed science graduates, is an active labour market strategy from the development-oriented state to provide workplace experience and first job opportunities to new graduates. Given the contradiction of skills shortages and graduate unemployment, and an unsupportive labour market, it is important that such strategies continue. For the NYS, job opportunities are provided in public sector institutions. It is important that the private sector also provides these first-job workplace opportunities.

4. For the most marginalised groups, who have overcome a number of obstacles to access and qualify at tertiary institutions, such state interventions are an important modality to access the labour market. The proportion of NYS participants who are unemployed suggests that further investigation is required to address the unsupportive labour market conditions for STEM graduates without social networks to access the labour market.

INSTITUTIONAL: Science Centre Capacity Building

5. The Science Centre Capacity Building project provides an opportunity for science centre staff and staff from various institutions' outreach programmes to gain important skills which assist them in promoting the education and awareness of science. At least 18 workshops and training opportunities have taken place between 2009 and 2014 covering a variety of topics. We recommend identifying core modules which are presented to staff annually in order for staff to acquire essential knowledge and skills. It is further recommended that this programme is expanded in terms of the number of participants, where possible.

PUBLIC: National Science Week and Science Awareness Spaces

6. The National Science Week promotes the "Science for All" agenda and contributes to the improvement of public attitudes to science. The NSW programme also provides an opportunity for school students to visit a science centre, and for many under-resourced schools, this is the only opportunity for learners to participate in science experiments and use equipment which is not available at schools. The DST must continue promoting the network of science centres and advocating the National Science Week (NSW). We recommend that the DST uses findings on the attitudes of the public towards science to inform the "Science for All" agenda.

7. The identification of Spaces for Science Awareness will allow the opportunity to create an expanded network of spaces which promote science and technology beyond the science centre network in the country. Implementing interventions which assist these spaces in increasing their science awareness promotion is therefore recommended.

HIGHLIGHTS of the YOUTH into SCIENCE STRATEGY

The Department of Science and Technology's Youth into Science and Science Engagement programmes aim to promote science awareness and understanding among the youth, encourage more young people to study in the sciences and engineering, and to pursue careers in those fields. The suite of programmes that promotes these aims target school and post school youth as well as science institutions and spaces. These programmes are:

- Talent Development Programme;
- National Science Week;
- Adopted Dinaledi Schools Project;
- National Youth Service: Unemployed Science Graduates;
- Potential Science Awareness Spaces; and
- Science Centre Capacity Building Project.

This highlights document provides the broad findings of tracking and evaluative studies on these programmes.

Publications

Reddy V, Visser M and Bantwini B (2010). Youth into science strategy tracking studies report.

Reddy V, Juan A, Janse van Rensburg D and Ngazimbi X (2013). Youth into Science Strategy. Assessment of Post-School Interventions.

Arends F, Mthetwa M, Juan A, Feza N and Reddy V (2013). Youth into Science Strategy. Assessment of School Interventions.

Juan A (2014). Work Experience for Unemployed Science Graduates: The National Youth Service: Phase II.

Hannan S (2015). Science Centre Capacity Building Project.

Hannan S (2015). Science Awareness Spaces.

Arends F (2014). National Science Week.

Arends F (2014). Talent Development Programme.

HSRC Team

Vijay Reddy | Fabian Arends | Andrea Juan | Maria Ngema | Sylvia Hannan

DST Team

Isaac Ramovha | Mokgadi Madiga | Bersan Lesch | Tebogo Gule | Koki Selepe