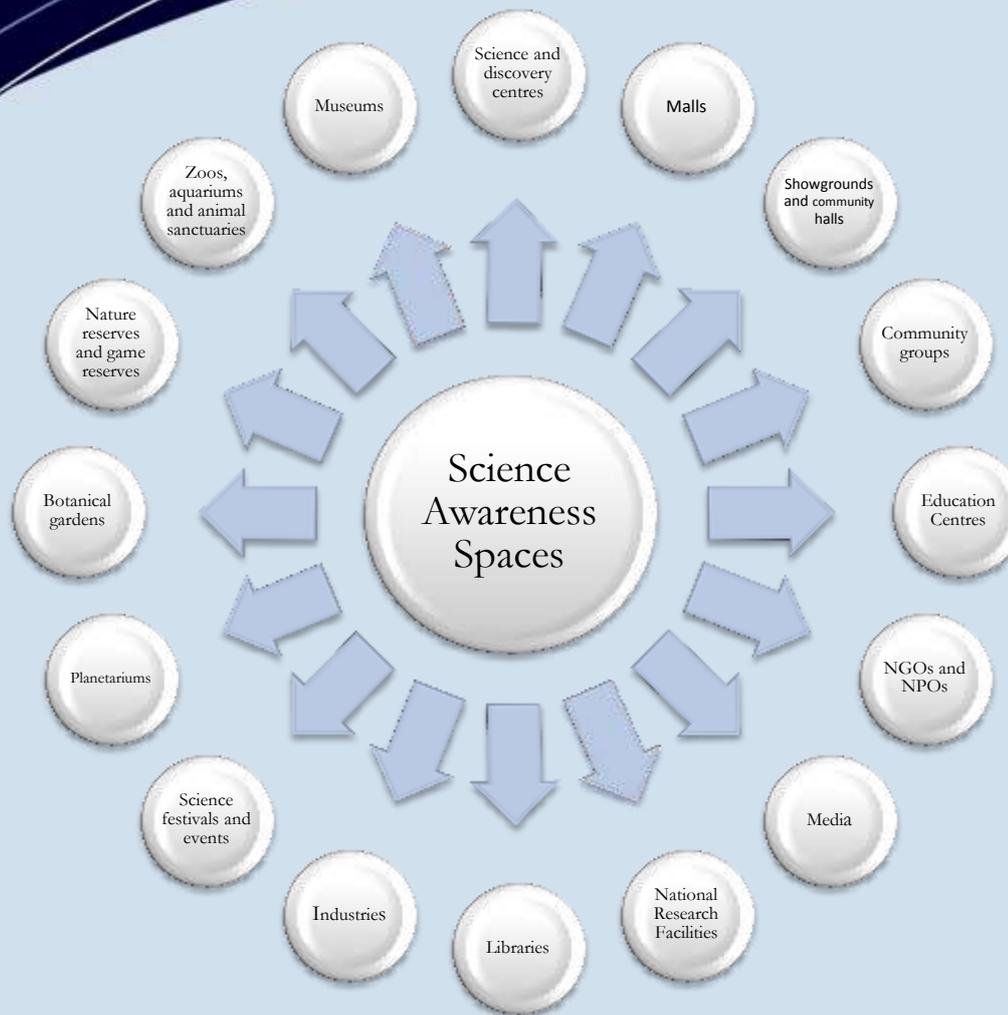


# Education and Skills Development

## Science Engagement Framework and Youth into Science Strategy: Science Awareness Spaces in South Africa



Report prepared for the Department of Science and Technology

March 2016



Science Engagement Framework and Youth into  
Science Strategy:  
Science Awareness Spaces in South Africa

March 2016

Sylvia Hannan  
Vijay Reddy  
Andrea Juan

## Table of Contents

Abbreviations .....	i
List of Tables.....	ii
Part 1: The promotion of science in South Africa: spaces for science awareness .....	1
1.1. Introduction.....	1
1.2. Spaces for non-formal and informal learning .....	2
Part 2: Research questions and methodology .....	3
2.1. Key research questions.....	3
2.2. Methodology .....	3
Part 3: A typology of science awareness spaces in South Africa.....	5
3.1. Categories of science awareness spaces in South Africa .....	5
3.1.1. Science and discovery centres.....	6
3.1.2. Museums .....	7
3.1.3. Zoos, aquariums and animal sanctuaries .....	7
3.1.4. Nature reserves and game reserves.....	7
3.1.5. Botanical gardens .....	8
3.1.6. Planetariums and observatories.....	8
3.1.7. Science festivals and events .....	8
3.1.8. Industries .....	9
3.1.9. Libraries .....	9
3.1.10. National Research Facilities and science councils .....	9
3.1.11. Media.....	10
3.1.13. Education centres.....	10
3.1.14. Community groups .....	10
3.1.15. Showgrounds and community halls .....	10
3.1.16. Malls .....	11
3.2. Characteristics of science awareness spaces .....	11
Part 4: Potential for increased science awareness in these spaces .....	16
4.1. Points of intervention.....	16
4.2. Conclusion .....	18
References.....	19
Appendix A: Science Awareness Spaces and their characteristics .....	21

## Abbreviations

DST	-	Department of Science and Technology
MST	-	Mathematics, science and technology
NGO	-	Non-governmental organisation
NPO	-	Non-profit organisation
NRF	-	National Research Foundation
PPP	-	Public-private partnership
SANBI	-	South African National Biodiversity Institute

## List of Figures

Figure 1: The process followed in the study.....	4
Figure 2: Typology of the categories of science awareness spaces.....	6

## List of Tables

Table 1: Characteristics of science awareness spaces .....	12
Table 2: The categories of science awareness spaces and their associated characteristics .....	13

## **Part 1: The promotion of science in South Africa: spaces for science awareness**

### **1.1. Introduction**

Science and technology play a crucial role in the development of any country, and it is consequently important for the public to have an understanding and knowledge of science issues. It is therefore necessary to ensure that the public is properly informed about the benefits and impacts of science and technology, particularly with regard to the role which these can play in their everyday lives. This requires an investment in the creation of a passion for learning and innovation in science and technology. Consequently it is vital to foster communication between the scientific community, policy-makers and the public.

The South African government would like to encourage a public that has greater science and technology awareness and literacy, and the promotion of science awareness has therefore become a central focus in the country. In order to cultivate a more aware and scientifically literate population, there is a need for spaces where people can experience and interact with science and technology, thereby playing a role in infusing science into the lives of the public. There are a range of spaces that exist which can contribute to the advancement of science, including the science centres in the country. The focus has previously been on these 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. With the DST having adopted the Science Engagement Framework in January 2015, it is consequently important to identify and categorise the spaces which may be able to contribute to science awareness, thereby enhancing the public's understanding of science and the infrastructure capacity to deliver the Framework.

This report explores the spaces which exist for the promotion of science awareness in South Africa. Many of the identified spaces also provide informal and non-formal mathematics, science and technology (MST) education. These spaces are examined in terms of their characteristics, and the potential of such spaces for increased participation in promoting science awareness. These spaces are referred to as science awareness spaces. Points of intervention which may assist in the increase of science awareness promotion by these various spaces are also presented.

The first part of the report highlights theory on informal learning, and the spaces within which this learning can occur, as this forms the basis for the identification of the science awareness spaces in South Africa. The key research questions and methodology for the study are then presented. The next part of the report focuses on the categorisation of the science awareness spaces into a typology, and then identifies a number of characteristics which can be used to explore the role which these spaces play in promoting science awareness. The report concludes with a number of recommendations regarding ways in which these spaces can be assisted in improving their science awareness promotion.

## 1.2. Spaces for non-formal and informal learning

Learning does not cease after leaving school or university, but is rather a life-long process which people engage in in various contexts. In contrast to formal learning, which is intentional, organised and structured; non-formal and informal learning provide opportunities for learning through a range of programmes, activities and experiences which exist outside of the classroom (Colardyn and Bjornavold, 2004; Eaton, 2010). These can play an important role in the lives of children and adults, as they result in increased knowledge, as well as providing possible motivation for other similar experiences and consequently further learning (Dorsen *et al*, 2006; Falk, 2005).

Non-formal learning consists of planned activities, which encompass an element of learning, although their main goal is not learning (Colardyn and Bjornavold, 2004). It therefore occurs in a planned and structured manner, but is highly adaptable to the specific situation. Non-formal learning may therefore occur in organisations or institutions, where it is mediated, but the motivation to learn is intrinsic to the participants (Esbach, 2007; Eaton, 2010).

Informal learning occurs outside of organised activities, and is a result of gaining knowledge through daily life activities related to work, family, or leisure. It is unstructured, unmediated and occurs without specific learning objectives. Experiences which contribute to informal learning are therefore related to what a person reads, sees or listens to, as well as knowledge which stems from their hobbies and social life. Informal learning may occur intentionally, but in most cases it is unintentional (Colardyn and Bjornavold, 2004; Esbach, 2007; Eaton, 2010). This type of learning has also been referred to as a form of free choice learning, whereby the person who is engaged in learning has a large degree of choice and control over what, when, where and why they learn. This type of learning is voluntary, and occurs throughout peoples' lives in a personalised manner which is based on their needs, interests and past experiences (Dorsen *et al*, 2006; Falk, 2005).

Spaces which foster non-formal and informal learning include science and technology centres, museums, zoos and aquaria, planetariums, botanical gardens and arboreta, parks, nature centres and environmental education centres, scientific research laboratories; various forms of media; and community-based organisations and projects (NSTA 1999; Bell *et al*, 2009; McCallie *et al*, 2009). These spaces provide the opportunity for the public to see new and interesting things, to satisfy their intellectual curiosity, experience relaxation and enjoyment, and gain knowledge on various topics; depending on the motivations and expectations of individuals (Falk, 2005; Falk and Adelman, 2003). 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 (McCallie *et al*, 2009). 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 (McCallie *et al*, 2009).

These types of spaces for non-formal and informal learning provide an opportunity for promoting science awareness in South Africa, and categories of these spaces were therefore identified in this study.

## Part 2: Research questions and methodology

### 2.1. Key research questions

The broad research objective is to create an inventory of spaces which play or may play a role in the promotion of science awareness in South Africa.

The key research questions are:

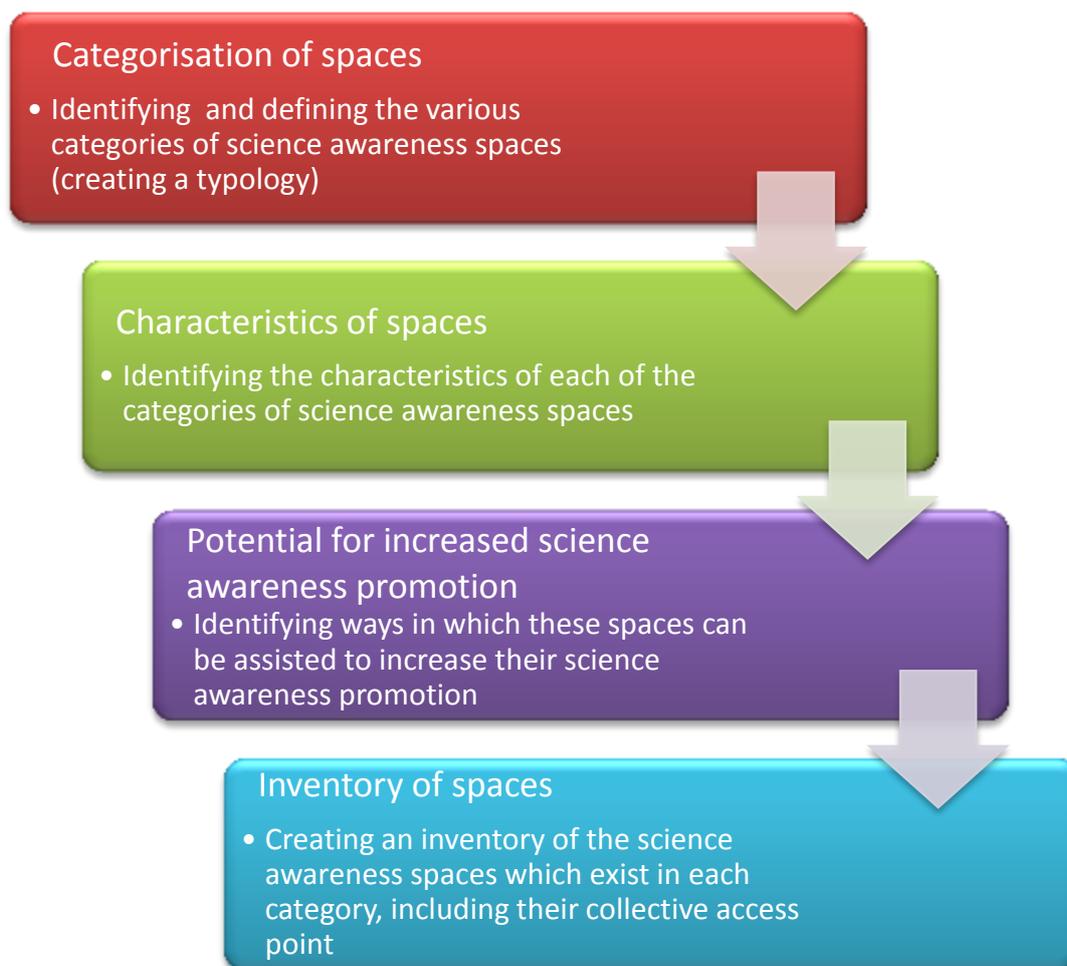
- 1) What are the different types of spaces that are available for the promotion of science awareness, in the form of informal and non-formal learning?
- 2) How do we categorise these science awareness spaces into a typology?
- 3) What are the characteristics of these spaces, including their role in the promotion of science awareness?
- 4) What is their potential for increased science awareness promotion?
- 5) What is their geographic spread?
- 6) What is their collective access point/structure?

### 2.2. Methodology

This study focuses on the spaces which exist in South Africa for the promotion of science awareness. It is important to understand what each of these terms refers to for the purposes of this study. “Science awareness spaces” were defined as any space which provides a platform for science awareness and education. “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 process followed in the study is depicted in Figure 1, which shows the various stages involved.

**Figure 1: The process followed in the study**



The initial stage of the study involved the identification of the various categories of spaces which are involved in science awareness in South Africa, thereby creating a typology of science awareness spaces. This was achieved through internet searches, drawing on the knowledge of the researchers and discussions with other researchers who have worked on science awareness. 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 science awareness spaces were then identified in order to understand the role these spaces play in the promotion of science awareness, the areas of science they focus on, their target audiences, the reach which they have and the types of activities which they are involved in.

Following this, a number of recommendations were made concerning how the DST can assist these spaces in strengthening and increasing their role in the promotion of science awareness in the country.

The next phase of the study will involve the creation of an inventory of the range of science awareness spaces which exist in each category in South Africa.

## **Part 3: A typology of science awareness spaces in South Africa**

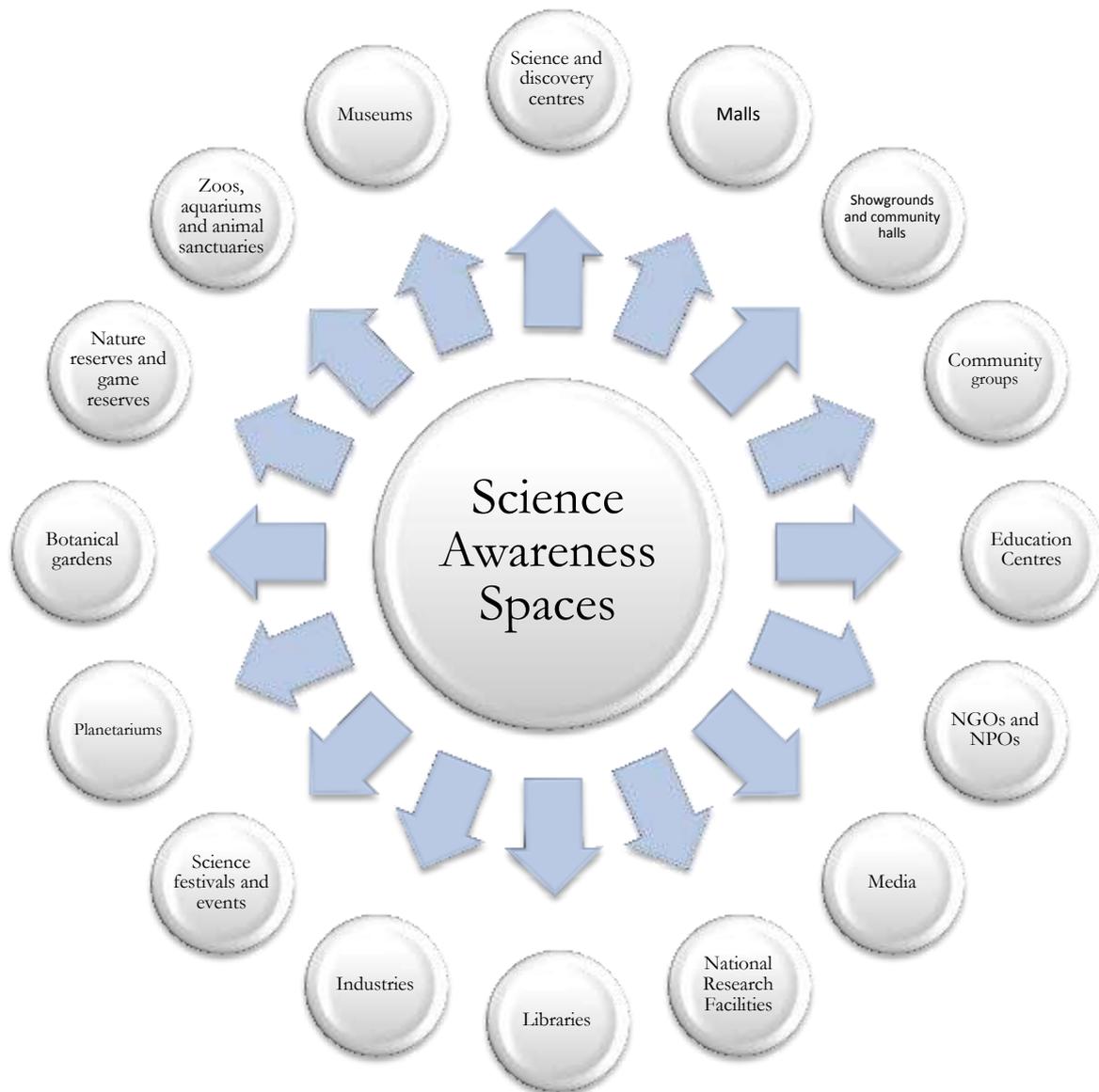
In order to understand the network of science awareness spaces which exist in the country, it was important to create a typology which examines the various categories of spaces. Following this, a range of characteristics relating to each type of space, which highlight the role they play in the promotion of science awareness, were determined.

### **3.1. 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 for the public. Figure 2 presents the typology of the categories of spaces which were identified. Thereafter each space is briefly explained in order to highlight why they were categorised as spaces which play a role in science awareness in South Africa.

Due to the number of different spaces which are involved in the promotion of science awareness, a range of broad categories were defined. It is important to note that some individual spaces may fit into more than one category, but most can be identified as belonging to one of the identified categories.

Figure 2: Typology of the categories of science awareness spaces



### 3.1.1. Science and discovery centres

South Africa has 34 science centres, with at least one located in each province. Science centres play an important role in exposing school learners and members of the public to various aspects of science and technology. These centres have science and technology exhibits, and develop programmes which explore these areas within the context of the four strategic goals as jointly adopted by the science centre community and the DST in 2004. Many science centres also undertake outreach programmes which focus on creating awareness and teaching those in disadvantaged areas about science and technology. These centres are currently the dominant spaces which are focused on in terms of science awareness promotion in the country.

### **3.1.2. Museums**

There are over 300 museums across the country, and some of these museums conserve collections of artefacts and other objects which have scientific, cultural or historical significance ([www.southafrica.info](http://www.southafrica.info)). These artefacts and objects are then made available for the public to view through the creation of a range of exhibits. People are therefore able to learn about various artefacts and where they originated. Cultural museums provide insight into the history of areas, and the people who lived there; while science and natural history museums provide information about the earth, its history, and life on earth, past and present. These museums have a range of exhibits which incorporate aspects such as natural history, palaeontology, geology, and various forms of wildlife, which allows people to gain an understanding of the world within which they live. Some museums also have outreach programmes and mobile museums, which enable those in rural or disadvantaged areas, who do not have access to a museum, to learn more about aspects of science. This is a strategy which makes scientific knowledge more accessible to the public.

In terms of the promotion of science awareness, it may be more pertinent to focus on those museums which incorporate aspects of natural science, as well as human or social science.

### **3.1.3. Zoos, aquariums and animal sanctuaries**

Zoos, aquariums and animal sanctuaries are involved in research, as well as the conservation and rehabilitation of wildlife. These spaces provide the opportunity for the public to observe, and in some cases interact with, a variety of animals. They also provide educational opportunities whereby the public and school learners can learn more about wildlife and the environment in which they live.

South Africa is home to a number of these spaces, with the National Zoological Gardens and Johannesburg Zoo housing 2000-3000 animals each. The Two Oceans Aquarium, uShaka Marine World and the East London Aquarium are amongst the most well-known aquariums in the country. There are also a range of smaller privately run zoos, aquariums and animal sanctuaries all around the country ([www.southafrica.net](http://www.southafrica.net) a).

The countries' animal sanctuaries play an important role in protecting and rehabilitating South Africa's wildlife. Some of these animal sanctuaries provide protection to a variety of different animals, such as the SanWild Wildlife Rehabilitation Centre and Sanctuary in Limpopo, and the Centre for the Rehabilitation of Wildlife in KwaZulu-Natal; while others are responsible for particular animals. These include sanctuaries which focus on birds (eg. Marloth Park Bird Sanctuary in Mpumalanga), primates (eg. Monkeyland Primate Sanctuary in the Western Cape), elephants (Kwantu Elephant Sanctuary in the Eastern Cape), lions (Lion Park in Gauteng), cheetahs (eg. Ann van Dyk Cheetah Centre in the North West), and reptiles (eg. Addo Raptor and Reptile Centre in the Eastern Cape), among other animals.

### **3.1.4. Nature reserves and game reserves**

There are a couple of hundred nature reserves and game reserves situated throughout the country, with a variety of ownership and management arrangements. South Africa also has approximately

21 national parks which are managed by South Africa National Parks (SANParks), and represent the indigenous flora, fauna, landscapes and cultural heritage of the country. ([www.gov.za](http://www.gov.za); [www.sanparks.co.za](http://www.sanparks.co.za)).

These spaces allow people to experience the natural environment, and observe wildlife in its natural habitat. Many of these reserves offer activities such as bird watching, game viewing, fishing, and hiking. Many game reserves also offer game drives with a tour guide where the public can learn about the wildlife and environment of the reserve, as well as aspects of conservation. Some reserves also have interactive centres where visitors can learn more about the natural environment and the history of the area.

### **3.1.5. Botanical gardens**

South Africa has ten National Botanical Gardens which are managed by the South African National Biodiversity Institute (SANBI) ([www.sanbi.org](http://www.sanbi.org)). The focus of these botanical gardens is growing and conserving plants which are indigenous to South Africa, as well as promoting environmental awareness. There are also a range of other botanical gardens across the country which vary in size, and focus on a variety of areas including biodiversity, education, heritage, research and green innovation. Some of these botanical gardens have education programmes and guides who can teach the public about the environment, as well as the heritage of the gardens.

### **3.1.6. Planetariums and observatories**

The two main planetariums in South Africa, located in Cape Town and Johannesburg, are Africa's biggest planetariums ([www.southafrica.net](http://www.southafrica.net) b). These theatres are used for presenting educational and entertaining shows about astronomy and the night sky, or for training in celestial navigation. These planetariums therefore teach school learners and the public about astronomy, space, and the stars. In addition, the first digital planetarium in Sub-Saharan Africa, the Naval Hill Planetarium, was opened in Bloemfontein in 2013. There are also a number of inflatable mobile planetariums in the country which are used to educate school learners about astronomy.

South Africa also has a handful of observatories, including the South African Astronomical Observatory (SAAO), which is the country's national centre for optical and infrared astronomy; and the Hartebeesthoek Radio Astronomy Observatory, which was originally built in 1961. These observatories are responsible for research in areas such as astronomy, astrophysics and space geodesy (geodesy is a scientific discipline that deals with the measurement and representation of the Earth). They also host education and outreach programmes to inform learners and the public about astronomy and related subjects, and therefore play an important role in promoting awareness of science ([www.hartrao.ac.za](http://www.hartrao.ac.za); [www.sao.ac.za](http://www.sao.ac.za)).

### **3.1.7. Science festivals and events**

Science festivals and events are mass participation events, which aim to make science and technology interesting and entertaining for learners and the public, as well as engaging with scientists. People are able to participate in interactive activities, and learn about various aspects of

science and technology. This promotes the recognition of the value of science and technology in our everyday lives, as well as an enjoyment of these, which may lead learners to pursue science and technology, or encourage the public to engage with related issues. They also provide career guidance and opportunities for scientists to network and share their work.

Science week, which takes place around the country every year, has predominantly been aimed at school learners; however in 2014 the focus broadened to attract members of the public as well. Science week aims to teach learners and the public about various aspects of science and technology, through presentations, lectures, exhibits and interactive activities. Learners are thereby encouraged to pursue science after Grade 9, as well as in higher education. They are also provided with career guidance on various science and technology related disciplines.

### **3.1.8. Industries**

A number of industries in South Africa offer the opportunity for school learners to visit them on fieldtrips, where they are given a tour of the industry or shown some of the processes which are involved. Learners are consequently able to learn about what the industry does, as well as some of the science and technology which may be involved in their operation. This also provides learners with a chance to explore various career opportunities which they may like to pursue.

### **3.1.9. Libraries**

Libraries are an important resource for educating the public about science and technology. They provide access to a wide variety of books, articles and magazines which supply information on science related topics, and house a wealth of information for research purposes. Some libraries also have facilities which provide internet access, thereby allowing further access to information.

### **3.1.10. National Research Facilities and science councils**

South Africa's seven National Research Facilities are supported by the National Research Foundation (NRF), which aims to "facilitate the creation of knowledge, innovation and development in all fields of science and technology" ([www.nrf.ac.za](http://www.nrf.ac.za)). These spaces are therefore involved in research regarding various areas of science and technology, including space science, particle and nuclear research, medical treatments, the environment, conservation, and biodiversity. Some of the national facilities allow opportunities for the public to visit them, and some undertake educational outreach and science awareness programmes aimed at the general public and school learners.

Science councils, which are partly government-funded, are important spaces as they are able to promote the awareness of science, both in terms of physical science (eg. the Council for Scientific and Industrial Research and the South African Medical Research Council) and human or social science (eg. the Human Sciences Research Council) through the dissemination of research, as well as through undertaking projects which are related to science awareness. These spaces were critical in establishing the science, engineering and technology (SET) base that exists in South Africa (Scholes *et al*, 2008).

### **3.1.11. Media**

Various forms of media inform the public about an array of scientific topics, as well as advances which are made in science and technology. These forms of media include television, newspapers, magazines, radio and the internet, which has become more widely used due to increased access to it. The internet provides the opportunity for users to learn about science through social media channels, such as Facebook and Twitter; scientific blogs and forums; as well as internet sites which address science and technology topics. Many of the spaces on the internet also allow people to engage in discussions and debates about various scientific topics. The media may present specific science related news stories, or may include sections or programmes which are dedicated to science and creating awareness.

### **3.1.12. NGOs and NPOs**

Various non-governmental organisations (NGOs) and non-profit organisations (NPOs) across South Africa are involved in creating awareness around scientific issues, such as the prevention of diseases, the protection of the environment, as well as the preservation of indigenous knowledge. These spaces have an important role to play in their communities through creating awareness, and educating local inhabitants. They may also have an impact at a larger scale depending on their focus and resources.

### **3.1.13. Education centres**

There are a number of education centres throughout the country which are involved in research, teaching, outreach programmes and creating awareness about science related topics, as well as providing support to teachers and learners. These include centres such as the Environmental Learning Research Centre at Rhodes University, Marang Centre for Mathematics and Science Education at the University of Witwatersrand, and the Science Learning Centre for Africa at the University of the Western Cape. These centres therefore play an important role in creating awareness of science, as well as enhancing science education.

### **3.1.14. Community groups**

Community groups, such as conservancies and environmental groups, exist all over the country at the local level, and play an important role in promoting science awareness within their local communities. This is crucial as it allows people to relate science to their everyday lives, which helps them to understand science related topics, and may lead to their involvement in related issues in their communities.

### **3.1.15. Showgrounds and community halls**

Showgrounds and community halls are spaces which are not permanently involved in the promotion of science awareness, however they are able to provide the physical space for hosting events and activities which focus on science awareness and MST education.

Community halls are ideally situated for hosting small events and activities which are aimed at local communities and those who live in close proximity to the area. In contrast, showgrounds, such as the Royal Agricultural Showgrounds in KwaZulu-Natal, provide the opportunity to host large scale events and activities, which are aimed at a wider audience on a larger scale.

### **3.1.16. Malls**

Malls are focused predominantly on retail and entertainment. They are however physical spaces which are visited by large numbers of people on a daily basis. These visitors come from diverse demographic backgrounds, as they are of all ages, race groups, educational backgrounds and socio-economic statuses. Consequently, malls are spaces which provide the opportunity to reach a large diverse audience through science awareness activities. These spaces range in size from smaller malls which are aimed at attracting local people to large malls such as Gateway Theatre of Shopping in KwaZulu Natal, which is currently the largest mall in Africa.

In 2015, National Science Week which takes place every year around the country, included exhibitions at shopping centres and malls to raise awareness about science among the general public ([www.saasta.ac.za](http://www.saasta.ac.za), accessed 05/01/2016). This highlights the potential which these spaces have to play a role in creating science awareness through hosting exhibits and activities.

In order to maximise the promotion of science awareness in these spaces, focus should be placed on larger malls. Larger malls offer more space which could be used for exhibits and activities, and will ensure that a larger and more diverse audience is reached. Larger malls also contain more activities such as movies, restaurants and game areas, and visitors to these malls are therefore more likely to have more leisure time available to engage with science awareness activities.

## **3.2. Characteristics of science awareness spaces**

A number of characteristics for the spaces were therefore identified which highlight the role they play in the promotion of science awareness. These characteristics are shown in Table 1. A database was then created in Excel illustrating the characteristics for each of the categories of science awareness spaces, and an overview of this is shown in Table 2. This table includes science and discovery centres which are currently the dominant spaces for science awareness promotion in South Africa. The more detailed table is provided in Appendix A.

**Table 1: Characteristics of science awareness spaces**

Characteristic	Options	Explanation
<b>Type of space</b>	Physical Notional	Some science awareness spaces have a physical location, while others are not located in a physical space
<b>Science focus</b>	Various science topics	The type of science focused on ranges from “hard” science such as biological science and the environment, to social science topics which incorporate areas such as anthropology and indigenous knowledge
<b>Main function</b>	Education Recreation Research	Some science awareness spaces focus mainly on education, some provide recreational opportunities, while others are also involved in research
<b>Main goals</b>	Education Awareness Profit Career guidance	The main goals of these spaces differ depending on their functions and what they aim to achieve
<b>Target groups</b>	Schools General public Families Scientists	Science awareness spaces have different groups which they target for their activities
<b>Reach</b>	Local Provincial National International	The reach of the space concerns the area which they are able to impact, ranging from the local scale to the international scale
<b>Type of engagement</b>	Seeking Receiving	The type of engagement within these spaces was classified as “seeking”, whereby individuals seek the information provided by these spaces; or “receiving”, which occurs when individuals are provided with this information without specifically looking for it
<b>Type of activities</b>	Passive Interactive	The type of activities which science awareness spaces are involved in may be passive, where visitors observe activities, exhibits and so on; or interactive, which involves participation from visitors
<b>Access</b>	Limited Intermediate Extensive	The level of access is determined by the extent to which people are able to access the science awareness space. This is based on the location of the space, the entrance fee charged, the transport costs involved to get to these spaces, access to technology and so on
<b>Management</b>	Public Private Public private partnership (PPP)	Science awareness spaces may be managed by a public organisation, a private institution or a combination of the two, which is known as a public private partnership (PPP).

**Table 2: 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
<b>Science and discovery centres</b>	Physical	Biological science Physical science Environment Indigenous knowledge Anthropology	Education Recreation	Education Awareness Career guidance	Schools General public	Local to provincial	Seeking (individuals seek information from the spaces) Receiving (individuals are provided with information)	Passive (visitors observe) Interactive (visitors are required to participate)	Intermediate	Public Private PPP
<b>Museums</b>	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
<b>Zoos, aquariums and animal sanctuaries</b>	Physical	Biological science Environment	Education Recreation	Education Awareness Profit	Schools General public Families	Local to provincial	Seeking	Passive Interactive	Limited	Public Private PPP
<b>Nature reserves and game reserves</b>	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
<b>Botanical gardens</b>	Physical	Biological science Environment	Education Recreation	Education Awareness	Schools General public Families	Local to national	Seeking	Passive Interactive	Intermediate	Public Private PPP
<b>Planetariums</b>	Physical	Astronomy	Education Recreation	Education Awareness Profit	Schools General public	Provincial to national	Seeking Receiving	Passive Interactive	Limited	Public Private PPP

					Families					
<b>Science festivals and events</b>	Physical	Various	Education Recreation	Education Awareness Career guidance	Schools General public Families Scientists	Local to national	Seeking Receiving	Passive Interactive	Intermediate	Public Private PPP
<b>Industries</b>	Physical	Scientific processes Technology	Education	Education Awareness Career guidance	Schools	Local	Seeking	Passive Interactive	Limited	Public Private PPP
<b>Libraries</b>	Physical	Various	Education Recreation	Education Awareness	Schools General public Families	Local	Seeking	Passive Interactive	Intermediate	Public PPP
<b>National Research Facilities and science councils</b>	Physical	Various	Education Research	Education Awareness	Schools General public Scientists	National to international	Seeking Receiving	Passive Interactive	Intermediate	Public PPP
<b>Media (TV, radio, newspapers, magazines, internet)</b>	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
<b>NGOs and NPOs</b>	Physical	Various	Education	Education Awareness	Schools General public Families	Local to national	Seeking Receiving	Passive Interactive	Wide	Public Private PPP
<b>Education centres</b>	Physical	Various	Education	Education Awareness	Schools General public	Local to national	Seeking Receiving	Passive Interactive	Intermediate	Public Private PPP
<b>Community groups</b>	Physical Notional	Various	Education	Education Awareness	General public Families	Local to provincial	Seeking Receiving	Passive Interactive	Intermediate	Private PPP

<b>Show grounds and community halls<sup>1</sup></b>	Physical	Various	Education Recreation	Education Awareness Career guidance Profit	Schools General public Families Scientists	Local to national	Seeking	Passive Interactive	Wide	Public Private PPP
<b>Malls<sup>2</sup></b>	Physical	Other, including retail and entertainment	Recreation	Profit	General public Families	Local to provincial	Seeking	Passive Interactive	Wide	Private PPP

---

<sup>1</sup> Some of the characteristics of the showgrounds and community halls will be dependent on the type of events or activities which they are used for. Some of the characteristics, such as the main functions, main goals, target groups and type of activities may therefore vary.

<sup>2</sup> The main focus of malls is retail, and they are not involved in promoting science awareness. They do however provide a location where large groups of people can be reached.

## **Part 4: Potential for increased science awareness in these spaces**

The investigation of science awareness spaces revealed a range of spaces which play a role in promoting science awareness and MST education 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.

It is evident, based on their identified characteristics highlighted in Table 2, that many of these spaces currently play a crucial role in the promotion of science awareness in the country. From examining their characteristics, it also becomes apparent that the impact of some of these spaces, in terms of science awareness, could be increased through interventions which would allow them to further engage with science promotion and education.

In order to ensure that these science awareness spaces are able to promote science awareness to their full potential, it is important to identify ways in which they can be assisted in increasing their impact. The following section therefore presents a range of recommendations concerning ways in which the DST can contribute to the optimal performance of these spaces with regard to the promotion of science awareness.

### **4.1. Points of intervention**

In order for these spaces to effectively promote science awareness, they need to be able to attract their target groups, market themselves, and provide an educational and entertaining experience for visitors. This requires that these science awareness spaces possess adequate knowledge and expertise, trained staff, appropriate management skills and sufficient funds. There are consequently a number of interventions which would allow these spaces to more successfully promote science awareness, including:

#### **a. Funding**

Funding is one of the most critical resources required by science awareness spaces, as it is necessary for them to be able to function and undertake their daily activities. The provision of additional funding for these spaces would therefore contribute to the improvement of their promotion of science awareness. Partnerships with the public sector, in terms of the provision of additional funding, are therefore necessary.

#### **b. Capacity**

Some of these science awareness spaces including museums; zoos, aquariums and animal sanctuaries; and nature reserves require staff members, such as education officers, who are trained and have a high level of knowledge regarding the various topics which are covered at each of these spaces. The allocation of an education officer to those spaces which need them would therefore be beneficial, particularly for those spaces with limited resources. Training for these education officers could also be provided, which addresses the topics which are presented at their respective

spaces, as well as presentation and communication skills in order to allow them to effectively communicate with the public.

c. Capacity building

Capacity building is an important area to focus on as this will allow these spaces to continuously learn, and therefore be able to promote science awareness more successfully. Training, covering a variety of topics, could be provided for the staff members working in these spaces, such as management skills, marketing, and developing science awareness programmes and materials. This would ensure that these science awareness spaces are continuously improving their capacity. Due to the variety and number of these spaces which exist, it may be more feasible for this training to occur through training manuals or booklets provided in hard copy or online, and dedicated to the activities which occur at each type of space.

d. Provision of resources

The provision of information on various scientific topics would also be beneficial, particularly for smaller science awareness spaces which have a limited number of staff members, and therefore cannot employ experts in each area or develop appropriate materials for distribution to the public. The information provided could therefore be in the form of information packages which assist education officers to communicate a range of science topics to the public, as well as in the form of pamphlets or booklets highlighting science topics, which can be given to the public.

e. Guideline document

The development of a guideline document outlining the types of science awareness programmes and activities that exist, and providing guidance on how these can be implemented, would assist some of these spaces to implement innovative strategies and improve the way in which they create science awareness. This could be provided in hard copy or online, and updated periodically in order to ensure that the information provided is current and relevant.

f. Mentorships

Some of these science awareness spaces have more experience, capacity and resources than others. It would therefore be beneficial for these spaces to form a partnership with those spaces which are smaller, less experienced and with limited resources. This could be in the form of mentorships whereby spaces provide advice, share ideas or provide the opportunity for job shadowing, as is being done within the country's science centres. In this way, these spaces can gain valuable knowledge and experience which will allow them to improve their capacity for the promotion of science awareness. The DST could play an important role in encouraging and facilitating such partnerships. Participation in the country's Network of Science Centres should also be encouraged.

g. Promotion of spaces

In order for these spaces to be able to promote science awareness, the public needs to first be aware of their existence and what they do. It is therefore important to promote these science awareness spaces through websites, newspaper articles, blogs and other forms of media. The DST could play an important role in promoting these spaces and making people aware of the activities

which they offer. This could occur through a dedicated website which introduces and explores the various science awareness spaces, or through the DST website. This could include featuring a category of science awareness spaces each month on the DST website in order to promote them.

These points of intervention provide areas which could be focused on in order to assist the various spaces to increase their science awareness promotion impact. The extent to which each category of science awareness 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 science awareness space would therefore need to be assessed in order to determine the most appropriate interventions.

#### **4.2. Conclusion**

There is an extensive array of spaces in South Africa which are currently fulfilling a science awareness promotion role. It is imperative to understand the network of spaces which exist, and the ways in which they promote science awareness; as well as the potential which exists in the country for further science awareness promotion through these various spaces.

All of the spaces which have been identified play an important role in the promotion of science awareness in South Africa, albeit to different extents. It is now essential to nurture and assist these spaces to ensure that they continue to promote science awareness. This will involve support in those cases where the promotion of science awareness is well established and well managed, and further assistance and guidance in those spaces which are new to science awareness, or which are less experienced. Some science awareness spaces may require guidance in the form of a start-up plan which provides a guide of how to implement an effective science awareness programme or activities. All of these interventions will require consultation and support from the DST.

## References

Bell, P., Lewenstein, B., Shouse, A.W. and Feder, M.A. (2009). Eds. Executive Summary: Learning Science in Informal Environments: People, Places, and Pursuits. Committee on Learning Science in Informal Environments, National Research Council. [www.nap.edu](http://www.nap.edu).

Colardyn, D. and Bjornavold, J. (2004). Validation of Formal, Non-Formal and Informal Learning: policy and practices in EU Member States, *European Journal of Education*, 39(1): 69-89.

Dorsen, J., Carlson, B. and Goodyear, L. (2006). Connecting Informal STEM Experiences to Career Choices: Identifying the Pathway. ITEST Learning Resource Center.

Eaton, S.E. (2010). Formal, non-formal and informal learning: The case of literacy, essential skills and language learning in Canada. Eaton International Consulting.

Esbach, H. (2007). Bridging In-school and Out-of-school Learning: Formal, Non-Formal, and Informal Education, *Journal of Science Education and Technology*, 16(2): 171-190.

Falk, J.H. (2005). Free-choice environmental learning: framing the discussion, *Environmental Education Research*, 11(3): 265-280.

Falk, J.H. and Adelman, L.M. (2003). Investigating the Impact of Prior Knowledge and Interest on Aquarium Visitor Learning, *Journal of Research in Science Teaching*, 40(2): 163-176.

McCallie, E., Bell, L., Lohwater, T., Falk, J.H., Lehr, J.L., Lewenstein, B.V., Needham, C. and Wiehe, B. (2009). Many Experts, Many Audiences: Public Engagement with Science and Informal Science Education. A CAISE Inquiry Group Report.

NSTA (National Science Teachers Association). (2009) An NSTA Position Statement: Learning Science in Informal Environments. [http://www.nsta.org/docs/PositionStatement\\_Informal.pdf](http://www.nsta.org/docs/PositionStatement_Informal.pdf).

Scholes, J., Anderson, F., Kenyon, C., Napier, J., Ngoepe, P., van Wilgen, B. and Weaver, A. (2008). Science councils in South Africa, *South African Journal of Science*, 104: 435-438.

[www.gov.za](http://www.gov.za). National Parks Week 2015. Accessed 13/04/2015.

[www.hartrao.ac.za](http://www.hartrao.ac.za). Accessed 02/11/2015.

[www.nrf.ac.za](http://www.nrf.ac.za). Accessed 07/04/2015.

[www.saasta.ac.za](http://www.saasta.ac.za). Accessed 05/01/2016.

[www.sanbi.org](http://www.sanbi.org). Accessed 07/04/2015.

[www.sanparks.co.za](http://www.sanparks.co.za). Accessed 13/04/2015.

[www.saa0.ac.za](http://www.saa0.ac.za). Accessed 02/11/2015.

[www.southafrica.info](http://www.southafrica.info). Accessed 22/01/2015.

[www.southafrica.net](http://www.southafrica.net) a. Aquariums and zoos. Accessed 07/04/2015.

[www.southafrica.net](http://www.southafrica.net) b. Planetariums. Accessed 22/01/2015.

## Appendix A: Science Awareness Spaces and their characteristics

Category	Type of space	Science focus	Main function	Main goals	Target groups	Reach	Type of engagement	Type of activities	Access	Management
<b>Science and discovery centres</b>	Physical	Biological science	Education	Education	Schools	Local to provincial	Seeking (people visit the science centres)	Passive (visitors observe)	Intermediate- it is limited to some extent due to transport costs to get to the science centres, but schools take learners to visit them and some of them have outreach programmes	Public
		Physical science	Recreation	Awareness	General public		Receiving (through their outreach programmes)	Interactive (visitors are required to participate)		Private
		Environment		Career guidance						PPP
		Indigenous knowledge								
		Anthropology								
<b>Museums</b>	Physical	Biological science	Education	Education	Schools	Local to provincial	Seeking (people visit the museums)	Passive	Intermediate- people have to pay for transport to get to museums and some charge entrance fees, but some schools do visit museums.	Public
		Environment	Recreation	Awareness	General public		Receiving (some have mobile museums which are used to create awareness)	Interactive		Private
		Indigenous knowledge			Families					PPP
		Anthropology								

									Some museums have also introduced mobile museums for outreach	
<b>Zoos, aquariums and animal sanctuaries</b>	Physical	Biological science  Environment	Education  Recreation	Education  Awareness  Profit	Schools  General public  Families	Local to provincial	Seeking (people have to go the zoo, aquarium or animal sanctuary)	Passive (mainly observation)  Interactive (there may be some interaction, in the form of people interacting with the animals)	Limited (people have to get to the zoo, aquarium or animal sanctuary and pay an entrance fee)	Public  Private  PPP
<b>Nature reserves and game reserves</b>	Physical	Biological science  Environment  Indigenous knowledge  Anthropology (Many reserves have bushmen paintings etc.)	Education  Recreation	Education  Awareness  Profit	Schools  General public  Families	Local to international (some of the bigger game reserves are visited by international tourists)	Seeking (people have to go the reserves)	Passive (observation)  Interactive (some reserves offer interaction with the animals, and provide trails for the public)	Limited (people have to get to the reserve and many require an entrance fee)	Public  Private  PPP

<b>Botanical gardens</b>	Physical	Biological science Environment	Education Recreation	Education Awareness	Schools General public Families	Local to national	Seeking (people have to go to there)	Passive Interactive	Intermediate (people have to travel to get to them, but entrance is sometimes free)	Public Private PPP
<b>Planetariums</b>	Physical	Astronomy	Education Recreation	Education Awareness Profit	Schools General public Families	Provincial to national (there are very few in South Africa)	Seeking (people have to go to the planetariums) Receiving (there are some mobile planetariums which travel to schools)	Passive Interactive	Limited- there are only 2 main planetariums in the country. There are a number of mobile planetariums which travel to schools.	Public Private PPP
<b>Science festivals and events (including National Science Week)</b>	Physical	Various	Education Recreation	Education Awareness Career guidance	Schools General public Families Scientists	Local to national	Seeking (people attend these events) Receiving (In some cases, such as for part of NSW, schools and communities are visited)	Passive Interactive	Intermediate-wide (some of these events are able to be accessed by large numbers of people such as science week)	Public Private PPP

<b>Industries</b>	Physical	Scientific processes Technology	Education	Education Awareness Career guidance	Schools	Local	Seeking (schools visit these industries)	Passive	Limited (mainly limited to groups of school learners)	Public Private PPP
<b>Libraries</b>	Physical	Various	Education Recreation	Education Awareness	Schools General public Families	Local	Seeking (People go to libraries)	Passive Interactive	Intermediate (many areas have libraries, but some do not have access to libraries)	Public PPP
<b>National Research Facilities and science councils</b>	Physical	Various (including astronomy, biological science, physical science, environment, social science)	Education Research	Education Awareness	Schools General public Scientists	National to international	Seeking (some of these facilities allow the public to visit them)  Receiving (some facilities undertake outreach programmes and science awareness)	Passive Interactive	Intermediate (some of these facilities allow the public to visit and conduct outreach)	Public PPP

<b>Media:</b> - TV - Radio - Newspapers and magazines - Internet: websites, scientific blogs/forums and social media	Notional	Various	Education  Recreation	Education  Awareness  Profit  Career guidance	Schools  General public  Families  Scientists	Local to international	Seeking (people buy newspapers, look for specific programmes on the TV, and search for particular topics on the internet)  Receiving (scientific information is presented by the media without people having to search for it, on TV, radio and some internet sites and social media)	Passive  Interactive (if people can engage with the topics, comment and participate in debates on social media etc.)	Wide (many people have access to a radio, TV, or newspapers; access to the internet is more limited)	Public  Private  PPP
<b>NGOs and NPOs</b>	Physical	Various	Education	Education  Awareness	Schools  General public  Families	Local to national	Seeking (people may approach the NGOs/NPOs for information)  Receiving (NGOs/NPOs may provide information to people)	Passive  Interactive	Wide (Free access, people can approach them)	Public  Private  PPP

<b>Education centres</b>	Physical	Various	Education	Education Awareness	Schools General public	Local to national	Seeking (people go to these centres)  Receiving (through outreach programmes, these centres provide information to people)	Passive  Interactive	Intermediate (There are likely to be costs for some centres)	Public  Private  PPP
<b>Community groups</b>	Physical  Notional (may not always have physical premises, may have an online forum etc.)	Various	Education	Education Awareness	General public  Families	Local to provincial	Seeking (people may go to these community groups for information)  Receiving (these community groups provide people with information)	Passive (people may listen to the groups)  Interactive (people may get involved with the groups or with discussions and debates)	Intermediate (within the areas where these community groups operate many people will have access to them)	Private  PPP

<b>Showgrounds and community halls</b>	Physical	Various	Education Recreation	Education Awareness Career guidance Profit	Schools General public Families Scientists	Local to national	Seeking	Passive Interactive	Wide	Public Private PPP
<b>Malls</b>	Physical	Other (including retail and entertainment)	Recreation	Profit	General public Families	Local to provincial (some malls such as Gateway attract people from around KZN)	Seeking	Passive Interactive	Wide	Private PPP