Therapeutic Intervention: Using Sensory Gardens to Enhance the Quality of Life for Children with Special Needs

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Abstract

This study investigates the design and use of sensory gardens in two special schools by evaluating their functional zones and how they are utilized, especially by children with special educational needs, and the staff who care for them. Preliminary site studies were undertaken in fourteen sensory gardens around the UK, followed by more detailed data collection at two case-study sites. The research aim was to find out the behaviour settings and issues that are common in sensory gardens. The research data collection included in-depth interviews, observation and behaviour mapping, which was used in conjunction with affordance theory. Drawing on Moore and Cosco's methodology and approach (2007) in relation to inclusive parks, the findings from the data analysis discuss the researcher's main findings, based on the two case-study sensory gardens. There are two main findings: Firstly, the layout of the circulation network enables user behaviour and use of area. Continuous pathways that link the sensory garden to the site context, with easy access to the functional behaviour settings that are placed along it, have the highest number of users. Secondly, users spent a longer time in zones where sensory, rather than aesthetic value, were emphasised. These main findings have been translated by the researcher into a subset of design recommendations that will be applicable across the majority of sensory gardens, and will assist landscape architects when they are designing sensory gardens in the future.

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<u>List of Charts</u>

List of Diagrams

List of Figures

List of Images

List of Plans

List of Tables

CHAPTER ONE

Introduction

1.1 What is a sensory garden?

A sensory garden[1] is a 'self-contained area that concentrates a wide range of sensory experiences. Such an area, if designed well, provides a valuable resource for a wide range of users, from education to recreation'.

Shoemaker (2002:195) stated that *'sensory gardens cannot be designed without considering the human element. Unlike traditional display gardens that are meant to be observed from a distance, sensory gardens draw the visitor in to touch, smell and actively experience the garden with all senses'.*

Sensory gardens have evolved gradually from the traditional concept of a 'garden for the blind'. The term 'sensory garden' has been very much over-used in recent years but, in a therapeutic context, it usually refers to a small garden that has been specially designed to fulfil the needs of a group of people who want to be involved in active gardening and who also enjoy the passive pleasures of being outdoors amongst plants (Gaskell, 1994).

What makes a sensory garden different from any other garden? Lambe (1995:114) differentiated sensory gardens from any other garden by her statement, '*The only difference in a sensory garden is that all these components, (hard landscaping, soft landscaping, colours, textures and wildlife) must be carefully chosen and designed to appeal to the senses in such a way that they provide maximum sensory stimulation'.*

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[1] http://www.sensorytrust.org.uk/information/factsheets/sensory_ip.html (Assessed August 2009)

1.2 Historical background of sensory gardens

It is often assumed that sensory gardens are for people with limited mobility[2] or other impairments, where these gardens are usually attached to a special school or home for elderly people (Lambe, 1995). This attitude was reflected in the early design and construction of sensory gardens, which were focused on too few sensory experiences. In an interview that the researcher conducted with Jane Stoneham (August 9th, 2006), the director of the Sensory Trust[3] and the author of the book, '*Landscape Design for Elderly and Disabled People*', Stoneham stated that the initial idea of sensory gardens derived from the horticultural therapy movement, which developed in the United Kingdom in the 1970s. Horticultural therapy was focused on special environments, i.e. hospitals and rehabilitation units and, as a result, developed more rapidly than sensory gardens, which used to be 'gardens for the blind'. One positive aspect of sensory gardens was the genuine response to meet the needs of visually-impaired people.

Stoneham added, however, there was not really much thought given to the design of these gardens. The first sensory gardens were often located in public parks because the local authority would have decided that it was a way of showing that they were implementing inclusion strategies. However, the reality was that they were small areas, often signposted as 'Garden for the Blind', and they consisted of a combination of scented plants, Braille labels and raised planters. In the interview, Stoneham gave an example of a Sensory Garden in Osaka, Japan[4] that also had a similar history.

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[2] Mobility is *'the ability to travel through the surroundings'* (Bell, 1993:155).

[3] The Sensory Trust was established in 1989 and grew out of a multi-disciplinary consultation resulting in a wide network of disability and environmental organisations working together to promote and implement an inclusive approach to design and manage outdoor spaces; richer connections between people and place; and equality of access for all people (http://www.sensorytrust.org.uk).

[4] Further reading on the Sensory Garden in Osaka, Japan can be obtained from Miyake, Y.

Over time, society's attitude to disability changed, as did the function and users of the sensory garden. Any design for disabled people[5] should aim to help overcome the stigma that is attached to being labelled 'disabled'. Since the mid-1970s, a rapidly growing body of opinion has suggested that this can be achieved more easily by integrating, rather than segregating facilities. In 1978, the then United Kingdom Minister for the Disabled, Alfred Morris, said:

'The simplest way of causing a riot in any locality in Britain would be to clamp on the able-bodied the same restrictions that now apply to the disabled. They feel that their personal handicaps are bad enough without the gratuitous social handicap of being treated differently from everyone else' (Rowson, 1985:21)

Stoneham (2006) added that in the 1980s, visually impaired people challenged the initial ideas about 'gardens for the blind' because the issue of being segregated from able-bodied people was itself beginning to be challenged. It is now widely understood that disabled people do not want to be segregated from able-bodied people in their enjoyment of green area. Thoday and Stoneham (1996:20) support this idea, 'the *sensory landscapes* should be a way of introducing much greater interest and variety into green areas for everyone to enjoy and should not result in *gardens for the disabled*'. The basic idea is to integrate green areas that will allow an enhanced sensory experience, which will make for a more sustainable and inclusive approach rather than making 'special' provision for disabled people (O'Connell and Spurgeon, 1996).

(2001:48.9) 'Landscape Design'. In Wolfgang, F.E. Preiser and Elaine Ostroff (eds.) *Universal Design Handbook*.

[5] A disabled person means *'an individual who has a physical or mental impairment that has a substantial and long-term adverse effect on his/her ability to carry out normal day-to-day activities'* (Disability Discrimination Art 1995).

1.3 The initial study

The topic 'sensory garden' raised a number of preliminary questions for the researcher: *Are not all gardens sensory? What is a sensory garden composed of? How do people use or benefit from sensory gardens?*

During the first five months of the study, the researcher undertook an essential review of the literature to find out how best to approach the topic of 'sensory gardens'. This initial study was undertaken to ascertain what body of knowledge there was on the subject and to help to identify keywords for various searches. However, the review showed that there had been a lack of rigorous research on the subject, it identified a research gap and precise research questions could not readily be identified. After numerous discussions, it was decided that the best approach would be to conduct preliminary site studies, mainly by visiting places that claimed to have sensory gardens (see Appendix A) and by carrying out personal observations of the use of these gardens, walk-through interviews with special education teachers[6], occupational therapists[7], communication therapists[8] and interview with key expert, in order to refine the research direction.

> *'It is essential to select observation techniques, in other words, the specific ways in which you will observe and record, which are appropriate for your study, and this will be determined by the kind of questions you want to address, the kind of phenomenon you will be observing and the context in which you will observe them'.*
>
> Simpson, M. and Tuson, J. (1995:3)

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[6] *'Teachers may work in a special school and be responsible for a class of children, all with special needs'* (Pagliano, 1999:59).

[7] *'An occupational therapist specialises in the development and maintenance of functions and skills necessary for daily living, especially fine motor functions and skills'* (Pagliano, 1999:60).

[8] *'A communication therapist evaluates, diagnoses and treats speech and language disorders, assesses the quality and quantity of sounds in a student's repertoire and identifies other non-verbal means of communication'* (Pagliano, 1999:61).

1.4 Preliminary site studies

In the preliminary site studies, several locations were identified that, it was believed, would assist in establishing what the main issues were in relation to sensory gardens. This fieldwork would also support the selection of case studies and help to prepare for the conducting of interviews at the later data collection stage.

The sites that the researcher visited were: the Scotland Yard Adventure Centre, St. Crispin's School and the Royal Blind School (Craigmiller Campus) in Edinburgh; the Royal School for the Deaf and Communication Disorders in Manchester; Rutland House School in Nottingham; Cranhill Sensory Garden, Kelvin School and Carnbooth Residential School for Dual Sensory Impaired in Glasgow; Red Gates School in Croydon; Woodlands Sensory Garden in Sutton; Iver Nature Study in Slough and St. Ann's School in Surrey; Lyndale School and All Saints High School in Liverpool.

Of the fourteen sensory gardens visited, eight were designed by landscape architects. One of these is a health-care centre for adults, another is a primary school and one other is accessible to the public. The rest are special schools, which cater for students with special educational needs[9].

A few sites that the researcher did not manage to visit were: the Meldreth Manor School in Hertfordshire, Oakleigh School in London and Hazelwood School in Glasgow. These sites were under refurbishment and construction during the progress of this research.

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[9] Special educational needs, includes specific learning disability, moderate learning disability, severe learning disability, profound and multiple learning disability, emotional and behavioural difficulty, speech, language and communication needs, hearing impairment, visual impairment, multi-sensory impairment, physical difficulty, autism spectrum disorder and others (Special Educational Needs Code of Practise, 2001).

1.4.1 Sensory gardens designed by a landscape architect

Royal School for the Deaf and Communication Disorders, Cheshire (RSDCD), Rutland House School, Nottingham (RHS), Red Gates School, Croydon (RGS), Woodlands Sensory Garden, Sutton (WSG), St. Ann's School, Surrey (SAS), Lyndale School, Wirral (LS), All Saints High School, Liverpool (ASHS) and Cranhill Sensory Garden, Glasgow (CSG) (see Appendix I).

1.4.2 Sensory gardens from the client's effort

Scotland Yard Adventure Centre, Edinburgh (SYAC), St. Crispin's School, Edinburgh (SCS), Kelvin School, Glasgow (KS), Cranbooth Residential School for Dual Sensory Impaired, Glasgow (CRS), Royal Blind School, Edinburgh (Craigmiller Park) (RBS) and Iver Nature Study Centre, Slough (INSC) (see Appendix I).

Based on the sensory gardens visited during the preliminary site studies, the researcher decided to select-school-based sensory garden, which were designed by a landscape architect because out of the fourteen sensory gardens visited, two of them has potential as case-study examples, namely the Royal School for the Deaf and Communication Disorders (RSDCD) and Lyndale School (LS). The pilot study and selected case studies will be discussed in Chapter Three.

1.4.3 Three main findings that arose from the preliminary site studies

i. In interviews the researcher conducted with Benjamin (2006), Gough (2006) and Stoneham (2006), their view was that sensory gardens which are designed as such, tend not to be entirely satisfactory from the users' perspective, as some designers, apparently, may not interview the users before designing the actual sensory gardens. According to Stoneham, at present, designers think they are designing sensory gardens well but their biggest mistake is in presuming that they know what the needs of users are, for example:

a) Water is an important feature in that it provides users with the opportunity to respond to it in terms of hearing and touch it but in some sensory gardens, this feature is not fully accessible, therefore, the feature is not of true benefit to the users (see Images 1.1 and 1.2).

Image 1.1: An inaccessible water feature in a sensory garden.

Image 1.2: Another inaccessible water feature, especially to wheelchair users, in a sensory garden.

While water was mentioned by Bashir (2007) and McLellan (2007) as an important feature in a sensory garden, owing to its benefits in terms of learning and therapy, some sensory gardens seem to lack this feature (see Images 1.3 and 1.4).

Image 1.3: A sensory garden that lacks a water feature.

Image 1.4: Another sensory garden that lacks a water feature.

b) Loose materials on the surface of paths, such as gravel separated by wood edging, are inaccessible to wheelchair users, therefore, such users are unable to appreciate significant features that can only be accessed in this way[10] (see Images 1.5 and 1.6).

[10] Not all features will be accessed by loose-surface paths. The loose surface for some users, particularly for students in wheelchairs, is problematic if it is the only form of access. On the other hand, if the school is unlikely to have wheelchair users, the use of loose surfaces can be sensorily stimulating and pleasant for them.

Image 1.5: An inaccessible path to significant features in a sensory garden.

Image 1.6: Another inaccessible path, especially to the wheelchair users, in a sensory garden.

c) Ramps, even with an accessible gradient, were not appreciated by the teachers, as they were concerned about the slippery surface. Steps were also not favoured; especially by wheelchair users and their carers (see Images 1.7 and 1.8).

Image 1.7: Steps like this are common in a sensory garden. As a result, wheelchair users are not able to access some parts of the garden.

Image 1.8: This ramp is hardly used due to its slippery surface, especially when damp, while the stairs are inaccessible to wheelchair users. Consequently, users use another route for access.

ii. Regardless of who designs a sensory garden, a landscape architect or via community or school effort, challenges in terms of long-term maintenance should also be addressed in the design plan. If they are not, a poorly maintained sensory garden will not benefit its users and it will lack aesthetic value (Alsleigh, 2006; Bridge, 2007; Busby, 2006; Jefferies, 2007; Kinnear, 2007) (see Image 1.9).

'Aesthetic', quoted by Hill (1995:170) as '*The philosophy or theory of taste, or the perception of the beautiful in nature and art*' (Oxford English Dictionary). In this study, the term 'aesthetic' will be used generally when describing the visual composition of the respective school sensory gardens (see p.28)

Image 1.9: An example of what a sensory garden can look like if it is not well maintained.

An unkempt sensory garden can lead to it looking poorly cared for, unattractive and if further deterioration occurs, it can be difficult to improve and return to its original condition. In Appendix H, the researcher suggests that landscape architects could do more to assist in maintaining a sensory garden after it has been established (see vii, Maintenance, p.303).

iii. In the interview that the researcher conducted with Stoneham (2006), she stated that, to date, there had been no rigorous research done on the topic of sensory gardens. She added that a considerable amount of research needed to be conducted in the area of sensory impairment, mainly with regard to discovering what people with special needs really required. She warned that a great number of assumptions have been made about how disabled people navigate and benefit from an outdoor environment but that this had not yet been fully tested. She claimed that this is evident in the fact that an ambiguous direction has been taken in relation to sensory gardens in the field of landscape architecture and that there are no design guidelines for sensory gardens (although there are some publications on anthropometrics for a variety of users, including disabled people). Hence, the design of sensory gardens currently relies on the experience and attitude of designers. This idea is supported by designers, Petrow (2006), Mathias (2006), Robinson (2007) and Boothroyd (2007), who note that there is a lack of detailed guidelines available when designing sensory gardens for people with special needs.

This initial interview with Stoneham (2006) led the researcher to want to gain an understanding of what had been written about sensory gardens to date and to consider whether the findings in the preliminary site studies would be reflected in what had been written and the previous work that had been undertaken.

1.4.4 Other findings from the preliminary site studies

i. During the preliminary site studies, the landscape architects highlighted aesthetics, particularly the visual aesthetic when discussing issues in the sensory gardens. In this study, the term 'aesthetic' will be used generally when describing the visual composition of the respective school sensory gardens. By definition, 'visual' means 'able to be seen by the eye', while 'composition' means 'arrangement', therefore, 'visual composition', in the context of the two sensory gardens selected, means *appearance*.

ii. Based on the interviews with the key expert and landscape architects, and walk-through interviews with the teachers and therapists, the researcher noted nine design aspects that might enable the use of sensory gardens, namely: accessibility, aesthetic value, maintenance, planting, quality of sensory equipment, quantity of sensory equipment, quality of surfacing (hard and soft), safety and spatial location of the garden in relation to buildings and context. These design aspects will be used in the interviews at the later data collection stage (see p.194).

The initial study showed the historical development of sensory gardens but also that users of such gardens had not been consulted as fully as might have been expected. Thus, this research takes a fresh approach, one where the users are at the forefront of sensory garden design.

1.5 Aim and objectives

During an interview with Kath Jefferies (February, 16th 2007), who is a retired deputy head teacher of the Lyndale School, she mentioned that: *'Every special school has slightly different needs. The sensory garden will reflect those needs so no sensory garden will be the same. They might have similar elements but there will always be an emphasis upon the needs of their individual children'* (in this study, elements refer to the 'individual behaviour settings').

Following on from Jefferies' statement, the research aim was to find out the common individual behaviour settings and issues that are likely to be common to all sensory gardens, based on the findings from the preliminary site and case-study visits. Specifically, the research would:

i. Observe and record how users responded to and engaged with the individual behaviour settings in a sensory garden;

ii. Investigate the design process and intentions of the landscape architect;

iii. Investigate the teachers and therapists' thoughts and experiences with reference to the benefits and problems in having the sensory garden;

iv. Assess opportunities for users' activity in the sensory garden.

The researcher's findings could then be developed into a subset of design recommendations that would be applicable across all (or most) sensory gardens relevant to her particular case-study examples.

1.6 Research questions

i. *Based on behavioural observation, how do the users respond to the individual behaviour settings of the sensory garden and how is that reflected in their behaviour?*
The study will focus on observing the pattern of use and how an environment enables the uses that can occur within it (see Chapter Four, pp.115-145).

ii. *Are sensory gardens being used in the way that is being claimed by their designers?*
The study will explore the potential for users' engagement with the individual behaviour settings, whether activity is possible or if opportunities are not being actualised because of barriers (see Chapter Five, pp.146-167).

iii. *Which functional zone do users' prefer in their sensory garden and do they reflect the individual behaviour settings they use most often?*
The study will investigate the use of individual behaviour settings in order to find out users' preferences (see Chapter Six, pp.168-190).

iv. *Based on interview, why do problems still exist in sensory gardens even though they are designed by trained designers?*
The study will examine the design process undertaken by, and the intentions of, the designers and the constraints that they had to deal with in accomplishing a well-designed sensory garden that would fulfil users' needs (see Chapter Seven, pp.191-209).

1.7 The research process

The research methods used are case studies[11], which included carrying out observation and behaviour mapping[12] and interviews[13]/individual interviews using walk-through[14] (see Chapter Three). A theory studied in conjunction with these methods was affordance[15] (see Chapter Two).

Interviews/individual interviews using walk-through with the landscape architects, teachers and therapists were conducted first (see Chapter Seven). Design aspects that might enable the use of the sensory garden were queried (see Appendix B). Various quotes were selected to reinforce what was made evident in the data findings.

After conducting the interviews, the researcher then carried out behavioural observation of the sensory gardens (see Appendix C). Chapter Four analyses its frequencies of patterns of use (see Appendix D). Along with the behavioural mapping analysis, the study investigated the differences between variables (the main activities undertaken and the time spend in the sensory garden) in terms of users' role (students[16]/staff[17]) and gender, using

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[11] *'A well-documented and systematic examination of the process, decision-making and outcomes of a project, which is undertaken for the purpose of informing future practice, policy, theory and/or education'* (Francis:2001:16).

[12] *'A commonly used time-sampling technique. At pre-arranged times, an observer codes the activities and locations of all the people in a space'* (Friedman, et al., 1978:203).

[13] *'With a well-composed interview, you will be able to gather data on how far people have travelled to this place, how often they come, what they like best about it, what they would like to see changed, how they feel different after being in the space, and so on'* (Cooper Marcus, 2002:220).

[14] *'The designer walks through the completed design and comments on the experience he or she has had and intended users are likely to have in various areas of the project'* (Bechtel and Srivastava, 1978:442).

[15] Affordance is *'the perceived functional significance of an object, event or place for an individual'* (Heft, 2001:123).

[16] Students who are mainly children with special educational needs.

[17] Staff include teachers, therapists, teaching assistants and gardeners.

the tools of 'Error Bar'[18], 'Man-Whitney U'[19] and 'Kruskal Wallis'[20] in the SPSS software (see pp.121-125 and pp.137-140).

Chapter Five looks into the affordances that occurred, the number of users who engaged with the individual behaviour settings and their length of engagement (see Appendix E). Personal observation notes (see Appendix F) were also recorded to support the study with a few events that the researcher recorded as anecdotal evidence. A selection of photographs[21] was chosen to illustrate these evidences. All photographs used in this thesis were taken by the researcher on her preliminary site and case-study visits, unless otherwise stated.

Chapter Six further categorised the affordances by the landscape design categories[22] in relation to three categories of activities: **sensory stimulation** (touch, taste, smell, sound, sight); **physical** (mobility) and **social skills** (speech[23] and communication) in a form of matrix (see Appendix G). A triangulation of these methods as shown in Diagram 1.1 and Diagram 1.2 presents the overall research structure.

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[18] 'Error Bar' looks at the differences between groups of people (Field, 2005). *'The Error Bar chart displays not only the mean, but also the 95% confidence interval of the mean of each experimental condition* (Field, 2005:274). *'The basic idea behind confidence intervals is to construct a range of values'* within which the experimental value falls (Field, 2005:17).

[19] 'Man-Whitney U' test is *'when you want to test differences between two conditions and different participants have been used in each condition'* (Field, 2005:522).

[20] 'Kruskal Wallis' test is *'if you have non-normally distributed data, or have violated some other assumptions, then this test can be a useful way around the problem'* (Field, 2005:542).

[21] Photographs were taken by the researcher in the sensory gardens but none include shots of the users due to the school policy.

[22] Landscape design categories comprise 'Soft Landscape', 'Hard Landscape' and 'Landscape Furniture'.

[23] Type of communication with a multi sensory deprived student can take many forms: signals, gestures, class cues, finger spelling.

PRELIMINARY SITE STUDIES

Exploratory process for the subject 'Sensory Garden'

- Scotland Yard Adventure Centre, St. Crispin's School and the Royal Blind School in Edinburgh; the Royal School for the Deaf and Communication Disorders in Manchester; Rutland House School in Nottingham; Cranhill Sensory Garden, Kelvin School and Carnbooth Residential School for Dual Sensory Impaired in Glasgow; Redgates School in Croydon; Woodlands Sensory Garden in Sutton; Iver Nature Study in Slough; St. Ann's School in Surrey; Lyndale School and All Saints High School in Liverpool.

PROBLEM DEFINITION AND FORMULATION OF RESEARCH QUESTIONS

PRIMARY DATA COLLECTION

- Design Intention;
- Use.

1. Royal School for the Deaf and Communication Disorders in Cheshire (RSDCD)
2. Lyndale School in Wirral (LS).

DATA ANALYSIS

- Frequencies of the patterns of use;
- Frequencies of the users/main activities;
- Frequencies of the seated activity;
- Frequencies of the actualised affordances;
- Categorisation of the actualised affordances by landscape design categories and activities.
- Interviews/Walk-through interviews

FINDINGS/DISCUSSION/CONCLUSION

Looked into Moore and Cosco (2007)

INTERVIEWS

Landscape architects, special education teachers, therapists, expert:

- Understanding the design process;
- Identifying the issues;
- Understanding the benefit;
- Considering the historical background.

OBSERVATIONS

- Use;
- Design.

THEORY

Environmental Affordances by Gibson (1977)

CASE STUDIES

- Completed and operational;
- The design and its recognition;
- Accessibility;
- The spatial location of the sensory garden;
- Time and funding.

APPLICATION OF THE METHODS

Observation and behaviour mapping;
Interviews/Walk-through interviews.

PILOT STUDY

Testing out a set of questions for the interview and recording the observation and behaviour mapping at St. Crispin's School, Edinburgh.

MEASURES:

- Activities and affordances occurred;
- Behaviour settings engaged with;
- Length of engagement.

Diagram 1.1: Research methodology process. The research stages are on the left-hand side and the research methods are on the right, in descending order.

1.8 The research structure

PART I: Historical background of sensory garden and multi-sensory environment. Special educational needs. Play, outdoor education and disability. Theory of affordance and behaviour setting. Environment – behaviour research.

Chapter 1: Introduction.

Chapter 2: The literature review.

Conducting preliminary interviews and personal observations. Identifying research gap.

PART II: Description of selected case studies (The Royal School for the Deaf and Communication Disorders, Cheshire and Lyndale School, Wirral).

Chapter 3: The research methodology and its implementation.

Discussing the best method to collect data and its implementation.

PART III: Analysis of the selected case studies and the contribution to knowledge.

Chapters 4: Analysis and results of the observation and behaviour mapping.

- Frequencies of patterns of use;
- Frequencies of the main activities (analysis of the garden differences demographics (variables: activities undertaken by the users and the time they spent in the sensory garden, with the users' roles and gender identified).
- Frequencies of the seated activities.

Chapter 5: Analysis of the actualised affordances (frequencies of the actualised affordances).

Chapter 6: Analysis of the actualised affordances in relation to the landscape design categories and activities.

Chapter 7: Analysis and results of the interviews/walk-through interviews with landscape architects, teachers, therapists and students.

Analysing the design and use of the sensory gardens.

Chapter 8: Discussion and conclusion.

Findings and a subset of design recommendations.

Diagram 1.2: Research structure.

CHAPTER TWO

Literature Review

As mentioned in the previous chapter, the researcher undertook an essential review of the literature to find out how best to approach the topic of 'sensory garden'. However, the review showed that there had been a lack of rigorous research on the subject. The findings from the preliminary site studies and what had found in the literature had identified the research gap.

The literature review started off by looking at the term of special educational needs and understanding the definition as well as the evolution of a multi-sensory environment. This study then extracts on a range of theoretical sources: perceptual learning and affordance by Gibson (1979), Gibson and Pick (2000); and the concept of behaviour setting by Barker (1976). This study also examined the work of Heft (1988, 1999) and Kytta (2002, 2003).

2.1 What is a 'special educational need'?

The term 'special educational needs' covers an array of difficulties as highlighted in the 2001 Special Educational Needs Code of Practise, which *'recognises a wide spectrum of special educational needs that are frequently inter-related, although there are also specific needs that usually relate directly to particular types of impairment'* (Department for Education and Skills, 2001:85, para.7.52)

The Pupil Level Annual Schools Census data set was amended in 2004 to include 12 categories of special educational needs:

i. Specific learning disability
ii. Moderate learning disability
iii. Severe learning disability
iv. Profound and multiple learning disability
v. Emotional and behavioural difficulty
vi. Speech, language and communication needs

vii. Hearing impairment

viii. Visual impairment

ix. Multi-sensory impairment

x. Physical difficulty

xi. Autism spectrum disorder

xii. Other.

Most of the sensory gardens visited during the preliminary site studies (from which two were selected as case studies), provided access to children with at least one or more special educational needs, as per the 12 categories listed above. In this study, the term 'special educational needs' will be used when describing the 'students' of the two case-study sensory gardens.

2.2 What is a 'multi-sensory environment'?

According to Pagliano (1998:107), *'A multi-sensory environment is a dedicated space or room… where stimulation can be controlled, manipulated, intensified, reduced, presented in isolation or combination, packaged for active or passive interaction and temporally matched to fit the perceived motivation, interests, leisure, relaxation, therapeutic and /or educational needs of the user. It can take a variety of physical, psychological and sociological forms'*. The concept of a 'multi-sensory environment' was originated by Hulsegge and Verheul (1987), at the Hartenberg Institute in the Netherlands when they created the first snoezelen rooms at the institute.

Pagliano (1999:14) explained, *'The multi-sensory environment is a 'living environment' where a physical environment is determined by the needs of the user and shaped by the intelligence and sensitivity of the disciplinary team that manages it'*. Pagliano (1999) added, *'the multi-sensory environment literature can be divided into four themes, each describing a particular type of multi-sensory environment. The <u>first</u> multi-sensory environment closely follows the original*

'Snoezelen Philosophy'[24]*, which was created for leisure and recreation in favour of disabled people. The* <u>*second*</u> *theme is a type of environment, which has been developed principally for therapy, specifically designed for the treatment of some disorder or condition. The* <u>*third*</u> *theme has been principally created for education to promote learning and development. The* <u>*fourth*</u> *theme is multi functional, in which space can be used for leisure and recreation, for therapy, education or any combination of the three'.*

According to Pagliano (1999:14), the first two themes of the multi-sensory environment are for recreational and therapy benefits while the fourth theme is any combination of the three. Since the researcher selected school-based sensory gardens, this study considered the third theme, that of a multi-sensory environment which is created for educational use. This type of environment provides an area for users to control, manipulate, intensify or reduce stimulation within a safe environment (Best, 1992) while relaxing and interacting and learning from one another (Glenn et al., 1996).

Lynsey Robinson (2008), an Inclusive Designer with the Sensory Trust defined **sensory** as *'relating to the senses or the power of sensation'*. Oxford American Dictionary defined **sense** as *'A faculty by which the body perceives an external stimulus: one of the faculties of sight, hearing, taste and touch, smell'*.

In this study, the term 'multi-sensory' describes the multiple bodily senses, to which users of the two sensory gardens selected, could be exposed, and particularly, to which students with special educational needs could be exposed, namely, to a stimulating environment that is designed to offer sensory stimulation using textures, colours, scents, sounds, etc.

[24] The word 'Snoezelen' *'was a contraction of two Dutch words, meaning to smell and to doze. The idea came from Hulsegge and Verhuel (1987), and was developed in residential institutions related to recreation and leisure for adults rather than in educational institutional for children'* (Pagliano, 1999:8).

2.3 Evolution of a multi-sensory environment

Hirstwood and Gray (1995) and Hogg et al. (2001) stated that the evolution of the construction of multi-sensory environments began in the 1970s. However, it was only in the late 1980s that they began to take account of visual and aural ambiences and to install equipment that could accommodate the needs especially of people with profound and multiple disabilities in special schools and nursing homes (Mount and Cavet, 1995).

In terms of the history of multi-sensory environments, Hogg and Sebba (1986); and Longhorn (1988) examined the development of auditory, physical and visual disabilities in people with profound and multiple disabilities; and they developed respective multi-sensory curricula. Longhorn suggested, *'without stimulation and an **awakening** of the senses, children with profound and multiple learning difficulties would find it almost impossible to make sense of their experiences and to begin to learn'* (quoted in Mount and Cavet, 1995:52). As a result, a multi-sensory curriculum was integrated into the special needs educational system to accommodate the United Kingdom's national curriculum (Mount and Cavet, 1995; Byers, 1998). For the purpose of this research, 'multi-sensory environment' will be used when describing this type of approach as it has been developed in the United Kingdom, where a comprehensive snoezelen centre has been established at Whittington Hall Hospital, Derbyshire (Cavet and Mount, 1995).

In this study, a sensory garden could also be described as offering a variety of sensory stimuli to people with special educational needs, just as they are also to be found in the 'snoezelen' rooms. As a result of the recognised positive multi-sensory indoor experiences, sensory gardens, literally, have developed out of this (Nebelong, 2008). The only difference is that the cost of having a sensory garden is considerably less and it is a truly natural multi-sensory environment compared to a manufactured multi-sensory or 'snoezelen' room (Lambe, 1995).

2.4 Multi-sensory design in the context of a garden

'Suppose for a moment, that sound, touch and odor were treated as the equals of sight, and that emotion was an important part of cognition. What would our built environment be like if sensory response, sentiment, and memory were critical factors, more vital even than structure and program?'

(Malnar and Vodvarka, 2004, quoted in Ionides and Howell, 2005:34)

Multi-sensory design, focusing on the garden as an outdoor environment, is becoming increasingly popular for educational purposes in special schools (*Building Bulletin 102*, 2008; Woolley, 2003; Frank, 1996; Stoneham, 1996; Titman, 1994a), for rehabilitation purposes in hospitals (Cooper Marcus and Barnes, 1999; Tyson, 1998) and for health benefits in nursing homes (Stoneham, 1997; Stoneham and Thoday, 1994).

2.4.1 Spiral Garden at the Eden Project, Cornwall

'Smells are surer than sights and sounds to make the heart strings crack'.

'Smell is a strong sense but also the mute sense'.

(A couple of phrases displayed at the Warm Temperate Biome at the Eden Project in Cornwall, referring to the senses which are stimulated by plants).

In a recent discussion the researcher had with Jane Stoneham (July 9th, 2008), she strongly recommended visiting the latest garden feature at the Eden Project, called 'The Spiral Garden', which had been designed as a children's garden (see Images 2.1–2.3). The Spiral Garden is not designed as a sensory garden but it is rich in texture and offers different stimuli to engage children's senses. Most features in the garden have been made from natural and recycled materials, which add to the children's' creative, innovative and imaginative play. Many schools in Cornwall explored the garden and considered how and why the outdoor classroom can be used to enhance pupils' learning.

Image 2.1: The Spiral Garden, showing the willow tunnel at the entrance, which gradually changes in height and space as you travel along it.

Image 2.2: One of the surface materials used near the willow tunnel.

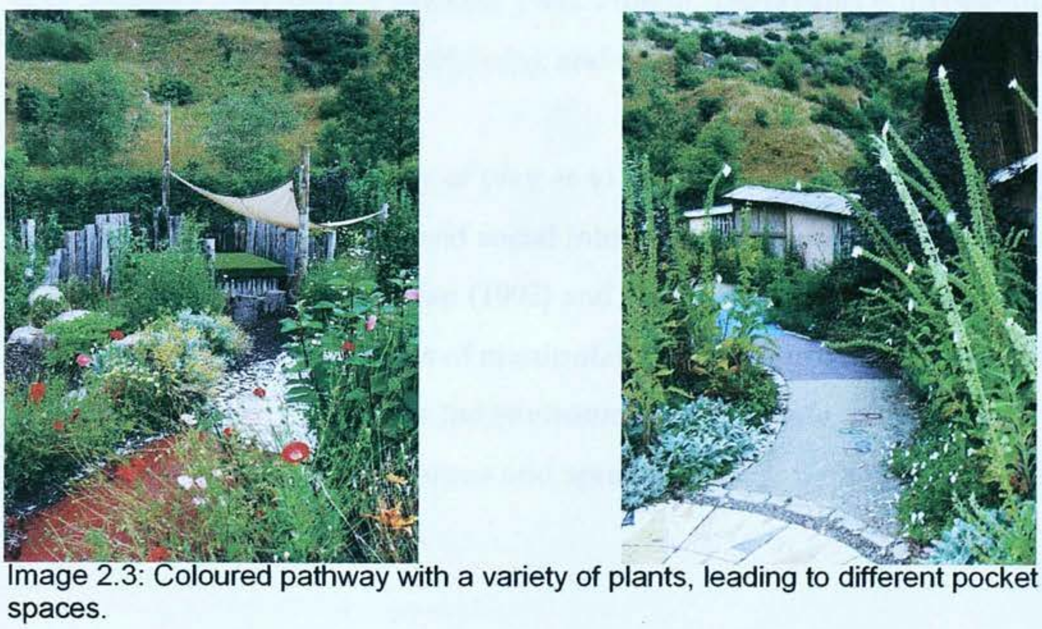

Image 2.3: Coloured pathway with a variety of plants, leading to different pocket spaces.

2.5 Play, outdoor education and disability

The *Building Bulletin 102* (2008) outlined the needs when designing for children with special education needs. One of the requirements when designing a special school is to provide an accessible outdoor environment, which emphasises multi-sensory experiences for therapy, educational and recreational use.

2.5.1 Play

The National Voluntary Council for Children's Play defined play as:

'*... a generic term for a variety of activities, which are satisfying to the child, creative for the child and freely chosen by the child. The activities may involve equipment or they may not, be boisterous and energetic or quiet and contemplative, be done with other people or on ones own, have an end product or not, be light hearted or very serious*' (National Children's Bureau, 1992:4)

Striniste and Moore (1989) signified 'play' as a physical contact between a child with surrounding features and social interaction with peers. Play also means movement (Hart, 1979; Moore, 1986) or mobility (Kytta, 2003). In regards to how users, particularly children use the outdoor environment, play is clearly a significant (Moore, 1986; Titman, 1994a) and is an essential requirement for children's' well-being and development (Lansdown, 1996).

Wolff (1979) stated the quality of play as to allow opportunities for physical activity as well as emotional and social interactions (Moore and Wong, 1997). The National Children's Bureau (1992) and Lansdown (1996) concurred that the quality of play is a process of manipulating the environmental features, allowing a child to experience the environment that is safe, pleasurable, creative, stimulating, adventurous and spontaneous, at the same time affords a child for play opportunities.

Wolff (1979) categorised play into six types as follows:

i. *Solitary play* is defined by Wolff (1979) as an activity that a child plays alone without interaction with others. This type of play offered no social skills but a sense of privacy.

ii. *Parallel play* is an activity when a child engages with a similar activity to his/her peers without interacting with them, verbally or physically.

iii. *Positive interaction with peers* is a play behaviour between a child with another that sometimes involves verbal communication. This play category affords social skills, such as sharing. For example, climbing or sliding down the slope together while talking, etc.

iv. *Negative interaction with peers* is a type of play, which involves aggressive behaviour, such as fighting, refusing to share any play features, unwilling to help or work together with a peer, etc.

v. *Positive interaction with adults* is when a child is willing to work together with an adult by offering or receiving help. This play behaviour affords social skills, such as communication.

vi. *Negative interaction with adults* is when a child being non-cooperative with an adult, i.e. resisting interaction, kicking, screaming, etc.

Examples from the six types of play behaviour above showed that children understand the functional properties (affordances) of the environment by experiential involvement through perception and movement that is, play. Thus, play should be recognised alongside education as a vital part of children's healthy and happy development.

2.5.2 Outdoor education

Having an accessible school ground, for example, a play ground (Titman, 1994a) or a sensory garden (Westley, 2003), is highly important for children to give them the opportunity for free play and choices for exploration and learning. They also value environment that could provide them privacy (Moore, 1986). Titman (1994a:58) identified four elements that children looked for in school grounds: *a place for doing* (opportunities for physical activities); *a place for thinking* (opportunities for intellectual stimulation) *a place for feeling* (to provoke a sense of belonging); and *a place for being* (to allow them to be themselves). Her research focused on the value of improved school grounds as an educational resource to demonstrate how students' attitudes, behaviours and learning skills could be enriched.

> *'Each adult working with a child with multiple disabilities has an important role in ensuring that the child is able to make sense of the environment using appropriate information from a range of sensory channels. In attempting to provide the child with a balanced understanding of the environment, the adult will need to structure on appropriate learning environment which can be both reactivate to the child's actions and responsive to the child's needs'*
>
> (Bell, 1993, quoted in McLinden, 1997:321)

One of the ways in achieving an environmental education is to choose plants that are fast growing, able to provide shade, able to offer visual stimulation through the use of colourful, textured and scented. Plant compositions must be carefully considered so that they provide mystery, the ability to hide and to create space. One example of a school which has built this kind of environment is Meldreth Manor School in Hertfordshire (Frank, 1996; Stoneham, 1996). The sensory garden there was designed with a series of ramps and raised pathways integrated and woven around the existing apples trees, while preserving them, it offers pupils a variety of sensory experiences.

2.5.2a Educational benefits

Having a multi-sensory environment in special schools is beneficial for both teachers and pupils as it provides a two-way learning process. As outlined in the *Building Bulletin 77* (1992:49), *'External spaces can provide opportunities for observation, investigation and problem-solving and form a flexible facility often more readily adaptable to change in user requirements than the building itself. They can offer a stimulating environment suited to practical activities from which many pupils with special needs can benefit'*. This idea matches Titman's (1994a), Lucas's (1996), Stoneham's (1997) and Moore's (1999) beliefs that outdoor environmental learning[25] can give children a stimulating experience as well as influence their behaviour and their development in terms of social relationships. This notion has received further support from Barbara Dunne of the Royal School for the Deaf and Communication Disorders, Manchester: *'Pupils are most likely to succeed when they are involved in 'doing' activities rather than academic learning. Environmental education is an ideal activity learning medium'* (Lucas, 1996:26; Stoneham, 1996:8).

The research findings of Rohde and Kendle (1994), Malone and Tranter (2003), Maller and Townsend (2005/2006), have proven that providing school grounds with sensory stimulation can encourage mental development, health improvements, emotional growth and social integration, in addition to increasing the learning motivation of the pupil, especially being in contact with animals and plants. For children with autism, they may *'seek sensory stimulation from the environment in order to calm or self-regulate their nervous system'* (Stadele and Malaney, 2001:213).

[25] Outdoor environmental learning is defined as *'the opportunities initiated by teachers or students to complement or supplement the formal curricula indoors'* (Malone and Tranter, 2003:285).

Learning through Landscapes, an association that was formed in 1990 in the United Kingdom, has also conducted research concerning children with special educational needs in outdoor areas. The findings made apparent that teachers appreciate outdoor areas as a foundation for the education of children with special educational needs. Among the other special benefits of having outdoor areas in special schools is that they can assist in reducing aggressive behaviour and bullying. Outdoor areas can also be used as a setting for counselling sessions and thus encourages positive behavioural change (Stoneham, 1997).

Woolley (2003:24) listed the developments noticeable in the teachers and students who had access to such outdoor areas. They were: '*improvements in sensory perception, social skills, co-operative skills and work patterns; improvements to children's behaviour, especially enabling emotions to be explored more effectively; a reduction in aggressive behaviour; enhancing learning opportunities outdoors; a greater variety of patterns of play, both in a physically demanding, adventurous sense and in the provision of quieter, restful opportunities; and improvements to the image of the school and to special education in general*'.

To conclude, multi-sensory environments are used by individuals with all kinds of disabilities in special schools where this offers them the opportunity to engage in self-stimulating activities. Research by Long and Haigh (1992) on disabled people showed that they responded positively towards the sensory/snoezelen environment. Stadele and Malaney (2001) undertook further research to see whether negative behaviours among people with autism decreased when they used multi-sensory environments. Findings showed neither positive nor negative effects of a sensory room intervention on the negative behaviours. In other words, there was no clear pattern of decreased negative behaviours. However, individual patterns of behaviour were recorded in the two students with autism.

2.5.3 Disability

Mount and Cavet (1995) and Chawla and Heft (2002) mentioned the richness of the visual, auditory and tactile stimuli that gardens can offer and the opportunities they could offer for exploration and thus, how they could assist users to develop an understanding of the environment. However, any impairment[26], disability[27] or handicap[28] will limit a person's ability to engage with the environment. The principal of Farrer Huxley Associates, Noel Farrer (2008:17), mentioned that, *'When designing for children with disabilities, it's vital to understand that their senses are completely different. You are not dealing with the same sort of physicality, you are dealing with texture, smell and sound; motor skills are far more localised…'*.

Passini and Proulx's (1988) and Jacobson's (1998) research found that it is easier for a visually impaired person to orientate and navigate in the outdoor setting when landmarks and walkways are distinguished through texture or other means as clues. Tyson (1998:75) noted that *'the composition of selective plantings, strategic location and significant elements could orientate people with impairments around green spaces'*. Kaplan et al. (1998:50) supported, *'The distinctiveness of such elements, where they are placed, and the number of them are all key aspects of designing for way-finding'*. For example, during one of the observation days at the case-study sites, 'Eileen' who has special educational needs was able to find her way back to her classroom after the literacy session through the use of plants (see the anecdotal evidence, p.105, para.3).

∗ This coding can be referred to in the SPSS software data in p.257.

[26] Any loss or abnormality of psychological, physiological or anatomical structure or function (World Health Organisation, 1980).

[27] Any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being (World Health Organisation, 1980).

[28] A disadvantage for a given individual, resulting from an impairment or disability, that limits or prevents the fulfillment of a role (depending on age, sex and social and cultural factors) for that individual (World Health Organisation,1980).

McLinden and McCall (2002:54) differentiated between the close senses (touch and taste), and the distance senses (sight, smell and hearing). They further noted that *'when the distance sense of vision is impaired, young children may be able to compensate to some extent by making greater use of their other distance sense – hearing'*. For example, during the observation period at the Royal School of Deaf and Communication Disorders (RSDCD), a female teacher (X1*) expressed her feeling that it was a pity that the water feature was not working because her visually-impaired male student (Y1*) loved to hear the sound of the water and when he did, he would remain at the *Water Central Area* for a longer period (see p.128, para.1). Another similar example at the Lyndale School (LS) was when the sound stimulation feature was making a noise by itself and a male student with special educational needs heard it and ran towards the sound via the decking at the *Woodland Garden* (see the anecdotal evidence, p.131).

Best (1992:119), quoted by McLinden and McCall (2002:99), stated that *'when facial expression and tone of voice are too sophisticated (through learning difficulties) or inaccessible (through sensory impairments), then touch is the primary channel of communication for the children. Information and emotions will be conveyed through touch and so the adult will need to ensure that the intended message is being conveyed'*. This is evident from the research findings at both case-study examples that the sense of touch has the highest sensory stimulation compared to other senses amongst the users of sensory garden (see Charts 6.1, p.178 and 6.2, p.187).

2.6 What do other researchers have to say?

Stoneham and Thoday (1994) posit that designers must consider the outdoor and indoor relationship, i.e. the quality and variety of views, as these are significant in providing interest, display and stimulation, especially through the use of detailed planting. Maintenance should be taken into consideration to avoid overgrown plants. Thus landscape architects must think about upkeep because there is no point in having carefully designed landscapes unless they can be properly maintained. These findings are also in agreement with those of Aldous and Relf (1999) that plant selection and the level of maintenance need to be well thought-out.

Imrie (1996) stressed that poor project management and the lack of an effective monitoring at the construction stages, can lead to an unworkable design. He noted that it was vital to make sure that project plans are followed from the initial design stage to the implementation and construction phase because often the detailed interpretation is not as the landscape architects had envisaged.

An access survey[29] conducted by Hussein (2002) identified a few points on tree maintenance:

- Old and dying trees may need to be felled for safety reasons;
- Jutting tree branches could cause a danger to users. They should be cut back to ensure a minimum clear headroom of 2 metres as noted in the accessible built environment guidelines (Fleck, 1998:9);
- Tree roots can cause unevenness in paths, particularly if the underlying substrate is compacted and the roots are therefore confined to the shallow zone just beneath a path.

[29] An access survey is a tool to gauge an external space performance in terms of accessibility for disabled persons. The method is structured in a format that consists of a set of questions and guided by the particular country's legislative codes, standards and guidelines. The tool enables one to record the dimensions and existing specification of an external space element, and hence provides for an evaluative method. One goes through and checks whether the specification is according to the standards and guidelines. One or many persons must create a realistic route, often starting from the drop-off point and go around the premises and record the information that will be processed later. The analytical tool also guides the correct specification, which can contribute to the formation of an access audit. This in turn could enable the quantity surveyor or contractor to cost the specifications and help to quicken the implementation process. The client could easily see if the costs could be met from the budget that they have and could plan when to install the specifications. This evaluation came about because the disabled persons need to communicate technically and effectively concerning the lack of access features in an external space (Yaacob, 2000)

Another of Hussein's (2002) findings was concerned with raised planting beds. She noted that these should be accessible and strategically located for functionality and at appropriate heights in order to allow users to explore the plants, particularly visually impaired people, as they could use the placing of various plants as guidance to help them navigate around the garden. However, according to Ewan and Ewan (2004), in some sensory gardens, raised planting beds are not practical because they increase root temperature and the reflective heat of wall surfaces. Their solution is to rely on plant height as people's legs might brush up against the plants and their hands would be able to touch them.

2.7 The concept of affordances

'A key of understanding the implications of the built environment and children's active living is the concept of affordance' (Gibson and Pick, 2000, quoted in Cosco, 2007:127). *It helps us to understand the impact of the physical environment on children and to identify environmental attributes that are associated with specific behavioural responses'* (Gibson and Pick, 2000, quoted in Cosco, 2006:17).

As mentioned in section 2.5 of this Chapter, children playing in an educational setting offer positive interactions between them. That is, playing involves perceptual learning and physical actions. During play, a child will 'pick up', gather and process the information through direct perception while moving in the setting. The approach can be understood through three concepts: *affordance, information and pickup information* (Gibson and Pick,2000).

2.7.1 Affordance

'Affordance is the perceived functional significance of an object, event or place for an individual' (Heft, 2001:123). Affordance is generally defined as the functionally significant properties of physical opportunities and dangers, which an organism perceives while acting in a specific setting (Gibson,

1979/1986; Gibson and Pick, 2000; Heft, 2001; Kytta, 2003). In other words, the environment features as a property of the relationship between the environment and the users and the possibilities that a place can offer users, whether or not the designers intended those possibilities. Thus the concept of affordance, in Gibson's ecological approach, has been applied to *'examine the relationship between the functional properties of the environment and how environments are used'* (Clark and Uzzel, 2002:95).

2.7.1a The levels of affordances

According to Kytta (2003), children's engagement with the environment can be divided into two levels of affordances: *actualised* and *potential*. Actualised affordances are what the children encountered during their independent mobility, perception and engagement with the environmental features (Heft 1988, 1999; Kytta 2002, 2003, 2004, 2006). Potential affordances are different for each individual and each specific group of people, depending on how their physical skills or bodily proportions, social needs and personal intentions are matched with the environmental features (Kytta, 2002, 2003, 2006). Heft (1989) suggests that potential affordances should be distinguished from actualised affordances. Kytta (2003:49) supported, *'potential affordances become qualities of the environment and the actualised affordances become individual relationships with the environment'*.

In this study, the actualised affordances recorded the activities users undertook that were afforded by the design of the sensory garden. The potential affordances recorded a behaviour setting in the garden, such that it had the potential to offer an affordance but there was some design limitation that hindered uptake by the users. Examples of both affordances recorded in the case studies are described in Chapter Five.

2.7.1b The types of affordances

Kytta (2003) further noted that users perceive two types of affordances: *positive* and *negative*. Both of these types are determined by the quality of the behaviour settings that can be perceived through their senses. Positive affordances relate to the children's movements and their perceptions of the environment, resulting in them offering satisfaction, finding it appealing and friendly, while negative affordances induce feelings of avoidance, danger, escape and fear (Heft, 1999; Kytta, 2003). However, according to Hart (1979) and Kytta (2003), children might also be interested in engaging with behaviour settings that are unsafe as they like to take risks when they are active in their surroundings.

In this study, positive and negative affordances recorded different users' responses to their experience of the sensory garden. Findings from the observation and behaviour mapping showed that both gardens afforded more positive affordances than negative ones (see p.166, para.2).

2.7.2 Information

According to Gibson and Pick (2000), the environment provides information as ambient arrays of energy that is structured by surfaces, boundaries, events, objects and layout of the environment. The information perceived changes depending on the perceiver's movement (sitting, standing, walking, etc.) and their senses (sight, hearing, taste, touch and smell). These changes are essential for identifying, extracting and describing information about where one is, where one is going and what one is accomplishing. For example, users passing through the sensory garden often stop for a while to engage with the behaviour settings that are adjacent to the pathway. Their engagement enables them to experience different views of the garden.

2.7.3 Pickup information

In a view of children movement in experiencing the environment, Gibson and Pick (2002) classified two types of information pickup: *exploratory* and *performatory*. The former permits children to discover about the new properties of the environment and about their own capabilities, while the latter is the outcome of already learned affordances and relates to actions directed towards objects or individual within a setting for an intended purpose, for example, throwing, hitting, etc. *'Perception and action are closely intertwined in both exploration and performance, and learning is an important outcome of both types of action'* (Gibson and Pick, 2000:21).

What is perceived by the perceiver is not the abstraction of light, colour, form, space or other sensory properties but as the integration as a whole of *layout, objects* and *events* (Gibson and Pick, 2000). Layout of the environment is the composition of surfaces that we walk on, the walls that enclose and the canopies that shelter us. Objects contains animate and inanimate, such as people, animals, plants and objects to sit on, etc. Events refer to the movements and actions that occur in the particular layout in relation to the objects. These three perceptual categories assist users in locating and orientating themselves, thus users will gain confidence in finding their way around the environment.

2.8 Behaviour setting

'Behaviour setting is an ecological unit where physical environment and behaviour are indissolubly connected in time and space' (Moore and Cosco, 2007:87). Wicker (1984) defined the term behaviour setting as a small-scale system composed of physical objects, people and behaviour, which are confirmed in such a way as to carry out a routine programme of actions within specific time and place limits or bounds.

These eco-behavioural units were first described by Barker (1976) through direct observation of children (Cosco, 2006:22). Barker discovered that behaviour settings are composed of *entities* and *events* (people, objects, behaviour) and other processes (sound, shade, etc.). He added that their components are arranged functionally as part of the whole and their functions are independent of other adjacent eco-behavioural units. Behavioural setting is effective for analysing human spaces by disaggregating their functional parts (Cosco, 2006; Moore and Cosco, 2007).

Abou El-Ela (nd:155) cited that *'it is significant that the same people behave very differently in different settings. In other words, a behaviour setting has been defined as a stable combination of one or more extra-individual patterns of behaviour surrounded by non-psychological milieu, or as a combination of standing patterns of behaviour and its surrounding milieu, i.e. a setting and a program'*. Barker (1968) supported the idea of behaviour setting as the setting programmes, which are lists of orders that are informed by input from other participants and from the physical milieu of the behaviour setting. Barker mentioned that people's actions are most directly influenced within behaviour settings by setting programmes (quoted in Abou El-Ela, n.d:156).

To put this in context, the concept of Barker's (1968) behaviour settings is closely related to the concept of affordances (Gibson, 1979; Gibson and Pick, 2000) that they are important features of the environment as both affordance and behaviour settings are properties of environment – person relationships (Heft, 2001). If landscape architects were to begin by looking at the action of affordances; the behaviour settings that are being used and the way users are engaging with these settings, this could suggest the potential of the sensory garden from a different perspective as cited by Heft (1989:10) *'The relationship between an affordance and behaviour is that of fittedness and compatibility'*. It would have the advantage of not seeing disability as the starting point. This ties in with Barker's (1976) idea of behaviour setting, an idea of a sub-settled place where certain behaviours can come across and are likely to happen.

2.9 Affordance in the design of sensory gardens

The theory of affordance raises questions that deserve exploration when considering the design of sensory gardens.

- *How familiar are users with the environment and are they encouraged to interact with the behaviour settings in alternative ways?* For instance, the water feature stimulates the sense of hearing but the feature also offers an opportunity to splash around.

- *What do users of sensory gardens usually do in terms of affordances?* For example, rather than focusing on the footpath, bench or grassy area, it might be more beneficial to observe the frequency of activities such as running, crawling, hanging, swinging in this particular setting. In addition, it would be fruitful to consider the availability and accessibility of these observed affordances, i.e. the potential for users' physical engagement with the environment, whether the physical activity was accessible or was not being actualised because of barriers.

- Users' experience of the sensory gardens and their engagement with the behaviour settings, further prompts the following questions: *How do the settings afford users the chance to evaluate their benefits or disadvantages? Are the affordances in the sensory garden accessible to the users? If not, why not? How have these affordances been actualised?*

Wohlwill and Heft (1987) used the concept of affordances by articulating the children-environment relationship in school grounds in terms of three characteristics: *sensory stimulation* (through colours, form, pattern, dimension and texture); *response feedback* (with reference to the child's abilities, competencies, capacities and behaviours); and *affordances*. In their research, Wohlwill and Heft (1987:319) viewed affordance as follows: *'affordance stresses the action possibilities that environmental features and environmental settings encourage or permit...the affordance framework may aid the designer in explicitly formulating design features with user characteristics in mind'*.

In this study, the concept of affordances is useful in describing the engagement between the users and the environment features and their responses as well as the possibilities that a sensory garden can offer users, whether or not landscape architects intended those possibilities when designing for sensory garden. Moore and Cosco's research on inclusive parks (2007) was relevant to this study since affordance and behaviour setting are two of their key theoretical frameworks. They used the concept of affordances *'to identify and analyse similarities and differences among behaviour settings'* (Moore and Cosco, 2007:88).

2.10 The classification of environmental qualities for children's outdoor environment

When discussing the qualities of an environment that can offer affordance to children, this study examined Heft's (1988, 1999) and Kytta's (2002, 2003) work. Heft categorises ten types of environmental qualities that support affordances in children's outdoor environment. Kytta utilised Heft's categorisation and also included affordances of 'sociality' (see Table 2). Heft (1988, 1999) discovered that the children's movements and their perceptions were influenced by the functional significance of the environmental features. This means they were able to find and identify affordances in the environment (Kytta, 2003).

This study applied both authors' findings in the case studies' observation and data collection in the Royal School for the Deaf and Communication Disorders and Lyndale School. The researcher then took the environmental qualities of Heft and Kytta's studies, using them as key reference points, and combined them in her work, to produce a new category of activities, based on her observation and behaviour mapping, especially in relation to students with special educational needs. These new categories of activities are: **sensory stimulation** (touch, taste, smell, sound, sight); and **physical** (mobility) and **social skills** (speech and communication) (see p.169, para.2; Appendix G).

The categories used by Heft (1988, 1999)		The categories used by Kytta (2002, 2003)		The category of activities used by Hussein (2009)		
1. Flat, relatively smooth surface.	Affords: walking, running, cycling, skating, skateboarding.	1. Flat, relatively smooth surfaces.	Affords: cycling, running, skipping, skating, playing hopscotch, skiing, playing (e.g. football, ice hockey, tennis, or badminton).	1. Flat surface (lawn, rubbery, pathway)	Affords: running, skipping, crawling, sitting, jumping, crossing over, stepping, playing puddle, squatting, laying, singing, walking fast, walking, stopping, hopping.	**Physical** (mobility) **Social skills** (speech and communication)
2. Relatively smooth slope	Affords: coasting down (e.g. on bike, wagon), rolling, sliding, running down, rolling objects down.	2. Relatively smooth slopes	Affords: coasting down, skateboarding.	2.Smooth/rough surface (slope, decking – boardwalk, *vaporised trail* – gravel, raised beds)	Affords: coasting down, stamping, running, stepping, skipping, singing, leaning against, sitting, jumping, walking, cheering, clapping, fear of slippery, laughing.	**Physical** (mobility) **Social skills** (speech and communication)
3. Graspable/ detached object	Affords: drawing, scratching, throwing, hammering, batting, spearing, skewering, digging, cutting, tearing, crumpling, squashing, building structures (e.g. raw materials for forts).	3. Graspable/ detached objects	Affords: throwing, digging, building of structures, playing with animals, using plants in play.	3. Graspable/ Detached object (Animals: bees, butterflies, birds, slugs, cats, tadpoles. Plants: herbs, shrubs, moss, climbers, trees)	Affords: Fear of stung, pointing, picking, holding, talking about it (via sign language), listening, disgusting, putting on palm, burying, watching, looking, communicating. Affords: playing, sniffing, smelling, plucking, rubbing, touching, jumping over, eating, tasting, spitting, brushing legs; body; hands, collecting, searching,	**Sensory stimulation** (touch, taste, smell, sound, sight) **Physical** (mobility) **Social skills** (speech and communication)

					pointing, talking about it (via sign language), holding, giving, keeping, cutting, picking, sitting, throwing, feeling, running hands, blowing, taking photos, smelling hands, grabbing, shaking, pulling, stepping over.	
4. Attached object	Affords: sitting-on, jumping-on/over/down-from.	4. Attached objects	Affords: jumping over, jumping down from.	4. Attached object (textured wall, boulders, lighting bollard, wood edge, talking tubes, sound stimuli)	Affords: touching, shaking, stepping on, balancing, sitting, taking photos, climbing on, feeling, jumping from, staring, walking, running hands, touching, talking, listening, pressing, laughing.	**Sensory stimulation** (touch, taste, smell, sound, sight) **Physical** (mobility) **Social skills** (speech and communication)
5. Non-rigid, attached object	Affords swinging-on (e.g. tree branch).	5. Non-rigid, attached object	Affords: swinging on, hanging.	5. Non-rigid, attached object (musical instruments; pipes, chimes, artworks)	Affords: swinging, playing, hitting, lifting, holding, hearing, counting, reading notes, listening, clapping, pointing, talking about it (via sign language).	**Sensory stimulation** (touch, taste, smell, sound, sight) **Physical** (mobility) **Social skills** (speech and communication)

6. Climbable feature	Affords: exercise/mastery, looking out from, passage from one place to another (e.g. stairs, ladder).	6. Climbable feature	Affords: climbing, looking out from.	6. Climbable feature (log, balancing beam, rock sculpture)	Affords: touching, shaking, stepping on, balancing, sitting, climbing on, feeling, jumping from, running hands, touching.	**Sensory stimulation** (touch, taste, smell, sound, sight) **Physical** (mobility)
7. Aperture	Affords: locomoting from one place to another, looking and listening into adjacent place.	7. Shelter	Affords: hiding, being in peace and quiet.	7. Shelter (willow tunnel, covered tunnel, building)	Affords: hiding, privacy, touching, playing, cheering, fear in getting in, taking photos, staring, talking about it (via sign language), spreading both arms, feeling the column, passing through, pointing.	**Sensory stimulation** (touch, taste, smell, sound, sight) **Physical** (mobility) **Social skills** (speech and communication)
8. Shelter	Affords: microclimate, prospect/refuge, privacy.	8. Mouldable materials (dirt, sand, snow)	Affords: moulding something, building of snow structures.	8. Mouldable materials (sand, chipping)	Affords: throwing, digging, moulding, scooping.	**Sensory stimulation** (touch, taste, smell, sound, sight)
9. Mouldable materials (e.g. dirt, sand)	Affords: construction of objects (e.g. pottery), pouring, modification of its surface features (e.g. sculpting).	9. Water	Affords: swimming, fishing, playing with water.	9. Water (water feature, water channel)	Affords: splashing, playing, pouring, sprinkling, talking about it (via sign language), stepping over, washing hands, pointing, feeling water; surface of 'pineapple', crossing over,	**Sensory stimulation** (touch, taste, smell, sound, sight) **Physical** (mobility)

					taking photos, laughing, drinking, hand dipping, tasting, scooping, repairing, throwing stones, watching, looking over, greeting, fear of getting wet, hearing, touching, squatting, staring.	**Social skills** (speech and communication)
10. Water	Affords: splashing, pouring, floating objects, swimming, diving, boating, fishing, mixing with other materials to modify their consistency.	10. Affordances for sociality	Affords: role-playing, playing rule games, playing house, playing war, being noisy, following/sharing adults' business.	10. Microclimate (thunder, rain water, sun, wind)	Affords: listening, talking about it (via sign language), pouring, sprinkling, scooping, feeling, affords getting agitated.	**Sensory stimulation** (touch, taste, smell, sound, sight) **Social skills** (speech and communication)

Table 2: The classification of environmental qualities for children's outdoor environment by Heft (1988, 1999) and Kytta (2002, 2003). Hussein (2009) produced a new category of activities: sensory stimulation, physical and social skills, based on her behavioural observation in relation to students with special educational needs.

2.11 Environment and behaviour research

Even though gardens as a therapeutic environment has long been recognised, little empirical study evaluating how gardens support the user's well-being has been gathered (Whitehouse et al., 2001; Cooper Marcus, 2002). Added to that, the researcher had discovered the lack of rigorous research on sensory gardens. Despite the scarcity, there are a couple of close-related work on other variety of outdoor environments, namely hospital garden (Whitehouse et al., 2001) and inclusive parks (Moore and Cosco, 2007). These works, which have some insights on the impact of a garden on the users' wellbeing and behaviour, were also relevant to this study in terms of their theoretical framework, methods and findings (will be explained later in this section).

Although there are many publications on multi-sensory environments (Snoezelen) and disabled persons' needs (anthropometrics), the study of sensory gardens demands an environment and behaviour research because such garden must be designed, maintained and managed to fulfil the users' needs. In order to meet those needs, landscape architects should understand how these users behave, use and engage with the behaviour settings in the sensory garden. During the preliminary site studies, the researcher had discovered that there are many precedents of multi-sensory environments but none of these are specifics. Thus, environment and behaviour research that include systematic investigation of relationships between the environment and human behaviour and their application in the design of sensory gardens is needed.

- Study by Whitehouse et al. (2001) at the Children's Hospital and Health Centre in San Diego investigated the effects of garden on patients, visitors (family members) and hospital staff. A Post-Occupancy Evaluation was carried out to record the demographics, traffic flow, user activities and variables, including visual analysis, behavioural observations (specifically, behaviour mapping and behaviour tracking), surveys and structured interviews. Two sets of analysis were conducted: descriptive statistics for survey data, and content analysis for interview data. Through descriptive analysis, the study found that adult family members and hospital staff used the garden to escape from stress of the hospital and relaxation. While the children experienced improvement in moods and were satisfied with the hospital's outdoor environment because they value the garden as a place that afforded them with play activities. Their recommendation includes manipulative play such as building with blocks and digging in sand. The findings suggest the garden properties (trees and play features) and attributes (sense of calmness and openness) engaged the children attentions and fascinated them. This study generally concerned on the physical movement and perceptual activities of the children in the garden, not comparing with the ones in the ward.

- Study by Moore and Cosco (2007) at the Kids Together Park in Cary (near to Raleigh, USA) examined the use of a universally designed park and how it was perceived by the users. A multi-method approach was applied, including behaviour mapping, behaviour tracking, park visits with people with disabilities, setting observations and interviews with users. Theoretical framework, such as territorial range development, behaviour setting and affordance was studied in conjunction with these methods. GIS was used as a tool to analyse the spatial distribution of use. The findings showed that users were attracted to engage with manufactured play structures, such as swings and sandplay, the varied gathering settings (benches designed as art objects, park-style benches, sitting walls and group setting areas) and primary pathways. These structures and settings indicate a high use of gathering and social interaction within the park.

2.12 Key conclusions

It is evident from the literature review and the two case-study examples that children's engagement with multi-sensory environments encourages sensory stimulation, social interaction and behavioural changes. These observed positive developments are important in their outdoor environmental education, for example, plants found in both school settings, encourage a greater understanding of and exploration by users afforded easy wayfinding and they generated activities. Thus, the children recognised the functional properties of their outdoor environment. However, if these needs are not met, users may feel frustrated and even threatened, thus it will add to their fears and apprehension (Kaplan et al., 1998).

Kytta (2003) categorised affordances as being of two types: *positive*, meaning, they offered environmental opportunities, and *negative*, meaning, there were environmental dangers. Nevertheless, few studies have been undertaken on negative affordances. On the other hand, several studies have been carried out on positive affordances, which are affective values that trigger users to engage with and explore the landscape, and which signify positive shifts in their functioning.

Kytta's (2003) *actualised* and *potential* affordances' classification included a limitation: *'The actualisation of affordances can also be limited through the design of objects and spaces so that not all users are able to actualise the potential affordances'* (Costall, 1995, quoted in Kytta, 2006:147). Kytta (2006) further added that this kind of environment can be unfriendly to users, especially disabled people. Heft and Chawla (2006) assented that access and mobility are equally significant when engaging with affordances. These studies, cited above, led the researcher to undertake her two case-studies in order to assess the issues that are common to sensory gardens; to evaluate areas in these gardens by examining their usability and users' behaviour; and to record how users, including those with different levels of physical and mental capabilities, engaged with outdoor multi-sensory environments in terms of their limitations, challenges and successes.

To conclude, findings from the preliminary site studies (see pp.23-28) that were not found in the literature would be the research gap. This includes a lack of detailed guidelines when designing for people with special needs as noted by designers whom the researcher had interviewed. Other issues were access to the behaviour settings in the sensory garden, whether activities undertaken by users was accessible or was not being actualised because of barriers.

CHAPTER THREE

The Research Methodology and Its Implementation

Gilbert (2004), Lennox et al. (2005) and Nind (2008) mentioned that they were unable to find much literature on research with people with special educational needs as very little research has been done on their needs. Nind (2008:4) further added, '*... the literature rarely addresses researching people with profound and multiple learning difficulties as qualitative research with this group is particularly rare and difficult*'. Chapter Three will discussed the possible methods in conducting research with people with special educational needs, why the researcher had selected her research methods and how she implemented these in her case studies.

3.1 Methodology

The main reason for choosing a qualitative study paradigm is when the nature of a problem that has to be researched involves much exploration and where the variables are unknown from the outset (Creswell, 2003).

As mentioned in Chapter Two, Moore and Cosco's research (2007) was useful in relation to the researcher's theoretical framework as well as methodology because four of their research methods were relevant to her study. Their research data were '*generated using behaviour mapping, behaviour tracking, park visits with people with disabilities, setting observations, and interviews with users*' (Moore and Cosco, 2007:87).

This study employed a case study approach, interviews/walk-through interviews, observation and behaviour mapping. The theory of affordance was studied in conjunction with these methods, and was applied to the case studies in order to find out which areas in the respective sensory gardens were utilised by the users and what the frequency of this use was.

3.1.1 Methods in conducting qualitative research with people with special educational needs

This section discusses the diverse ways in which researchers have addressed the challenges of conducting empirical work for research with people with special educational needs. Inevitably, many of the methods have been used in the context of case study.

i. Gaining access

Gaining access to participants of a research is essential for an effective data collection. Most studies that deal with people with special educational needs involve going through their gatekeepers[30] (Hood et al., 1996) or management (Lennox et al., 2005). In other words, approaching the higher ranking officer in an organisation must be done first.

In this study, getting approval from the human resource representatives, school principles and centre directors, visited during the preliminary site studies had to be done first. In addition, the researcher provided them with information and outcome of the study to convince the beneficial of this study to the participants.

ii. Communicating

According to Whitehurst (2006) when communication between a researcher and participants, particularly children with profound and complex learning needs appeared to be challenging, using professionals such as speech therapists will assist in gathering and interpreting information required. Another approach of communication is to employ augmentative and alternative communication, which includes electronic aids, sign language, symbols systems (cue cards) and photographs (Lewis, 2002). However,

[30] Gatekeepers are who control access to parents and children.

according to Brewster (2004), these methods make assessing the views of people with learning disabilities very challenging.

A low-tech and inexpensive visual communication resource that seemed to be reliable is 'Talking Mats' (Murphy, J., 1997; Murphy and Cameron, 2001; Cameron et al. 2004; Germain, 2004; Murphy et al., 2005; Whitehurst, 2006). This method was *'designed as a resource, not intended to replace someone's communication aid but used in conjunction with their normal mode of communication, together with other non-verbal methods such as facial expression and gesture'* (Cameron et al., 2004, quoted in Whitehurst, 2006:58). 'Talking Mats' will be further explained under vi, Visual Methods (see p.69).

The researcher had learned that all researchers need to be good at communicating and getting to know participants of their research. Researchers also need to use different ways to communicate, not just speech.

iii. Interview

Individual interview is the best method of qualitative research. However, conducting interviews with people with learning disabilities brings with it a number of challenges regarding validity (Gilbert, 2004). There are three principles in interviewing: First, authenticity, requiring that opinions expressed are fair. Second, validity/credibility, requiring that opinions expressed are correct. Third, reliability/trustworthiness, requiring that opinions expressed are typical of what the person believes (Lewis, 2002). The social and historical context is also part of the methodological challenge as Lewis and Porter (2004:195) added, *'individuals need to have self-esteem to believe that their views are valid and important [...and] to believe that they will be listened to, responded to and understood'.*

Booth and Booth (1996:55) stated that there are four challenges in interviewing people with learning difficulties, namely, *'inarticulateness, unresponsiveness, a concrete frame of reference and difficulties with the concept of time'*. Nind (2008:11) also supported this, *'for some people whose learning difficulties are more profound, no amount of visual or other structure will make the interview method possible'*.

It is evident that in this study, the researcher found that it was difficult to get first-hand information from students with special educational needs who were interviewed.

iv. Focus groups

'Focus groups are an alternative to interviews and questionnaires providing the advantages of a group dynamic that can help build confidence, safe environments that are not threatening or intimidating and peer support and validation, all enabling people with learning difficulties to contribute to research discussions' (Cambridge and McCarthy, 2001, quoted in Nind, 2008:11). However, in a later study by Barr, et al. (2003), they noted that there are challenges when conducting focus group with people with learning difficulties because of their limited verbal communication, sensory impairments or behavioural difficulties. They added, these challenges can be resolved by using familiar places as meeting venues and working with human resource officers as organisers in recruiting the participants.

During the preliminary site studies, the researcher conducted a focus group with the visually impaired at the Royal School of Blind in Edinburgh. However, the researcher found that it was unsuccessful in getting information she wanted. Therefore, walk-through interview was conducted, which the researcher discovered is particularly useful in understanding how they use their sensory garden.

v. **Questionnaire and survey**

Quantitative methods such as surveys are not always effective in getting information from people with special educational needs with whom more interaction may be needed (Hussein, 2001). This method seems rarely conducted in qualitative research and methodological literature. In some cases, such as McConkey and Mezza's (2001) survey of the employment aspirations of people with learning disabilities, questionnaires are completed by support workers who consult with the disabled person about their view. Therefore, this has obvious limitations in terms of the validation.

vi. **Visual methods**

Visual methods, such as photo-elicitation (Mathers, 2004; Banks, 2001), photovoice (Booth and Booth, 2003) and participatory photographic (Aldridge, 2007) could assist in solving the verbal and communication problem between the researcher and people with learning disabilities. These methods involve using photographs to invoke remarks, bring back memory and generate discussion in the course of a semi-structured interview.

Another visual method, 'Talking Mats' is a particularly useful tool for students with autism who rely on visual clues. The aim of this method is to enable those with communication difficulties to choose responses (in the form of three sets of picture symbols: topics, options and visual scale) and place them on a 'mat' in a way that express their preferences and feelings, using either 'like/happy', 'dislike/unhappy' or 'unsure'. Talking mats are also useful for the visually impaired, with a few tips to help them: 1. Amend the margins, size and colour of the symbol, depending on the individual; 2. For better sensing, create textured symbols; and 3. To avoid reflection, use non-laminated symbols (Murphy and Cameron, 2001).

The researcher did not choose neither of the visual methods above because the process of getting permission from the parents via school management, for the children with special educational needs to participate in the study were time consuming. This would not allow the researcher to conduct behavioural observation within the school term, in the month of May and July where this time of year has possibly the best outdoor conditions. Talking mats or other visual methods could be one of the suggestions to improve the methodology when undertaking future research.

vii. Narrative

The aim of a narrative method is to enable people with learning disabilities to share stories of their life experiences with others (Gilbert, 2004). The 'life history' or 'life plan' approach (Goodley, 1996) that includes photography and pictorial representation has been developed to bring together insight and empathy of the individual, enabling others to make connections and take strength. Goodley (1998) further added, the narrative method involves total commitment to listening and facilitating the relating of experiences, for instance through group discussions or interviews skills. This method requires time and a genuine approach by the researcher.

In this study, observation notes of the users' activities in the sensory garden were written up while undertaking the behaviour mapping. Photographs were taken by the researcher but none include shots of the users due to school policy. As a result, in order to interpret the results, a few significant occurrences were used as anecdotal evidence with the integration of a selection of photographs to illustrate these occurrences.

viii. Ethnography/observation

How does ethnography differ from observation?

'Ethnography is the study of people in naturally occurring settings or 'field' by methods of data collection which capture their social meanings and ordinary activities, involving the researcher participating directly in setting, if not also the activities, in order to collect data in a systematic manner' (Brewer, 2000:6)

'Observation is self-exploratory. The observer looks, listens and records' (Silverman, 2006:218)

An empirical study of a children-environment relationship is best conducted by observing the children's situation and their actions in a particular context (Graue and Walsh, 1995). The same method is also appropriate when observing children with multiple and severe disabilities (McLinden and McCall, 2002). Hart (1979) utilised such a method when investigating environmental knowledge and when exploring children in their living environments.

In this study, the researcher had carried out behavioural observation method. Its implementation will be explained later in this Chapter.

ix. Other methods

When reviewed individual data collection methods for people with special educational needs, it is more common for researchers to combine a range of methods. For example, Goodman (1998) combined focus groups and workshops with collage, drawings, role plays, videos, posters, photographs and pictures. According to Boothroyd (2007), a landscape architect who designed the sensory garden of Lyndale School, the collage work that the students produced is more useful than the huge amount of consultation data, questionnaire and reports because it shows exactly the kind of atmosphere that they wanted.

3.2 Methods chosen

Due to the lack of information on the subject of 'sensory gardens', the limitations of time for research and the difficulties surrounding communication between the researcher and the students with special educational needs, particularly those with a speech, language and communication difficulties, the following methods were thought to be the most appropriate.

3.2.1 Interview / Walk-through interview

This method had been used when gathering information from the landscape architects, teachers, therapists and a selection of students with special educational needs.

Zimring (1987:282) noted that a walk-through interview *'is an unstructured interview procedure that has been proposed by Bechtel and Srivastava (1978), Zeisel (1981) '…it uses the physical environment as a prompt to help respondents articulate their reactions to the setting'*. This method, as stated by Bechtel and Srivastava (1978), *'can be used early in a post-occupancy evaluation to help define the major issues in the evaluation and it can be a central part of initial data-gathering, followed by more directed methods such as questionnaires or observation'*.

Zeisel (1981) added, in order to full benefit from the walk-through interview, the interviewer should gather up points, in terms of the environmental qualities to a more detailed specification. This will allow the interviewer to use the respondent's personal definition of the setting in order to define important features. Thus, the walk-through will assist the interviewer in getting further explanation.

3.2.2 Observation and Behaviour mapping

This method had been used when collecting data of the users using the sensory gardens, particularly students with special educational needs when the researcher found that it was difficult to get first-hand information from them who were interviewed.

Golicnik (2005:53) stated that, *'Observation as a research method is well known in the field of environmental psychology. It deals with how to understand what people do in particular spatial settings…'*. Laurie (1986) and Natu and Padmavathi (2006) noted the importance of making observations in spaces, which could reveal patterns of use. Natu and Padmavathi (2006:54) emphasised that *'landscape architects who understand these patterns and try to achieve the 'Synomorphy'*[31] *between the milieu and the behaviour, as Barker (1968) puts it, [create] a successful design'*.

Bechtel et. al (1987:12) stressed that *'the ultimate goal of behavioural methods in environment behaviour research is primarily to gain insight into research questions and problems'. 'They described observation as a method having five dimensions: behaviour, environment, time, observer and record of observation…'* (Bechtel et al., 1987, quoted in Golicnic, 2005:54). Golicnic (2005:54) further noted that, *'Behavioural mapping is the recording technique that often supports an observation'*. It was developed by Ittelson et al. in 1970 to record behaviour as it occurred in the design (Bechtel and Zeisel, 1987:22). Ittelson et al. (1970:666) explained that, *'Behavioural mapping was developed as a technique for studying the relationships between behaviour and the physical space in which it occurs'*. They added, *'Behavioural mapping as thus defined is a very general technique for studying environmental influences on behaviour'*.

[31] 'Synomorphy' means similar to nature (LeCompte, 1974:185). Moore, Gary T. (1979:53) stated that 'synomorphy' means *'If the setting components are in harmony with the behavior and its rules or purposes, there is a fit between environment and behavior, between form and purpose and the behavior setting'.*

According to Bechtel et al. (1987:23), *'the purpose of behavioural mapping is to locate behaviour on the map itself, to identify kinds and frequencies of behaviour and to demonstrate their association with a particular design feature. By associating the behaviour with a certain environment, it is then possible to both ask questions and draw conclusions about the behaviour and its relationship to a design feature'*. In order to understand the whole picture of the individual's involvement with his environment, there must be an understanding of the individual's mental set in relation to his spatial behavioural patterns. It is not enough to know only what behaviour occurs but also to know why they occur and their significance and meaning (Lang, et al., 1974).

In terms of an analytical tool to evaluate sensory gardens, observation and behaviour mapping hence signify a complex method that combines both methods into a whole. A typical study by Cooper Marcus and Francis (1998) on post-occupancy evaluation stressed its systematic approach, which is based on usability rather than the aesthetics of a place. From their approach, they also argued that *'too often aesthetic/design critiques evaluate only form, whereas these (post-occupancy) evaluation techniques look at how people and form interact'* (Cooper Marcus and Francis, 1998:346). Research done by Nager and Wentworth (1978) on an urban park evaluation and Whitehouse et al. (2001) on a children's hospital garden environment also used a similar approach.

3.2.3 Case study

As mentioned is section 3.1.1 in this Chapter, many methods in conducting qualitative research with students with special educational needs have been used in the context of case study.

Francis (2001:16) defined a case study in relation to landscape design as *'a well-documented and systematic examination of the process, decision-making and outcomes of a project, which is undertaken for the purpose of informing future* *practice, policy, theory and/or education'*. A case-study approach is used where human experience can be examined through the detailed description of the people being studied. It is a method which involves studying a small number of subjects through extensive and prolonged engagement to allow the researcher to see patterns and to understand the meaning of relationships (Soy, 1997). Key features of case studies are that they involve in depth analysis of features and relationships between cases. Analysis of case studies can be carried out alone or jointly as a comparison across projects (Yin, 2003). According to Francis (2001:21), in a case study analysis for landscape architecture, it is important *'to incorporate a variety of methods such as site visits; site analysis; historical analysis; design process analysis; behavioural analysis; interviews with landscape architect(s), developer(s), manager(s) and public officials; interviews with users and non-users; archival material searches…'*.

3.3 Piloting the method: St. Crispin's School, Edinburgh

St. Crispin's School was chosen as the site for the pilot study to test the methods because its sensory garden was easily accessible, was of an appropriate size and was well used.

3.3.1 Description of the school and the sensory garden

St. Crispin's School is a school for students with severe learning difficulties, ranging from five to eighteen years old. The school has two sensory gardens, one for the seniors[32] (thirteen to eighteen year olds) and the other for the juniors (five to twelve year olds). There are nine classes that use both sensory gardens for about fifteen to twenty minutes per session. The sessions that are run, based on the sensory curriculum, are suited to and matched with students' interests (see Image 3.1).

[32] St. Crispin's sensory garden for seniors was not chosen as the site for the researcher's pilot study because it was not of an appropriate size and was not well used compared to the sensory garden for juniors.

Image 3.1: St. Crispin's sensory garden for juniors was chosen as the site for the researcher's pilot study.

The sensory garden for the juniors was built in 1998 after many fundraising events and the efforts of the school staff. Before it was built, students used to go to public parks but a lot of supervision was needed, thus the idea of the school having its own sensory garden came about. Ellie Alsleigh (2006), a teacher who uses the sensory garden for her sessions stated that: *`The sensory garden is a valuable resource to the school as the students are quite stressed being in the classroom. They have to follow all the routines. So coming out to the sensory garden is great for them to relax'*. The subject that she taught, 'Understanding our Environment' includes activities, which are repeated to help students remember what has occurred and all the activities that are undertaken are documented, both on papers and/or photographs (see Image 3.2).

Image 3.2: One of the student's work where they were assigned to find matching leaves in the sensory garden as part of the '*Understanding our Environment*' subject.

When the researcher conducted a preliminary interview with Alsleigh, it was during the harvest period. A thirteen-year-old male student, 'Tony' came up to Alsleigh and the researcher and asked whether he could have a red apple. Alsleigh gave her permission and got her camera ready to hand. Soon he plucked one from an apple tree nearby and had a big bite while Alsleigh captured the moment. *'Is the apple juicy? Ooh! It looks juicy!'* said Alsleigh. 'Tony' looked happy and walked away with his teaching assistant back into school. This anecdotal evidence illustrates that having a sensory garden in a special school can satisfy some students' needs.

The conclusion of the pilot study is divided into three main points: The initial approach, the difficulties identified in carrying out the method, and the modification made to the methodology and approach.

3.3.1a The initial approach

The researcher had never conducted the observation and behaviour mapping before, so she consulted Dr. Barbara Golicnic[33] to understand how the method could be carried out on the site practically. Among issues raised during the discussion were the essential instruments needed, such as an accurate scale map of the area (an A3 size would be best to work with), multi-coloured pens, a clipboard, a wristwatch, a digital camera and a tape recorder. The discussion also led towards the 'invention' of symbols to map the users' activity on a scaled base plan with a matrix to record the details of the setting, the user characteristics and the type of activities undertaken. According to Golicnic, it is important for the researcher to memorise the activity codes so the data will be collected systematically, as well as to note any significant behaviours that occurred during the observation period.

[33] Dr. Barbara Golicnic was a PhD student at the Edinburgh College of Art. She undertook observation and behavioral mapping as one of her research methods.

During the on-site investigation, the researcher conducted an interview with the teacher, which involved testing a preliminary questionnaire to understand the experience in terms of the benefits and problems as perceived by the adult carers (staff) in the sensory garden. This initial step also mapped both staff and student behaviour as it occurred within the setting, on a scaled base plan, using symbols. This entailed the recording of discrete behavioural observations as they took place, which were then categorised and a behavioural setting inventory was compiled (Barker, 1968). After carrying out this initial step, it was possible to categorise the different types of main activities that were undertaken by the users.

3.3.1b The difficulties identified in conducting the method

i. There was confusion in the sequence of method as to whether to conduct the interviews, or the observation and behaviour mapping, first. In addition to that, there was uncertainty as to how to systematically record the affordances that were observed during the observation period.

ii. It was felt that the preliminary questionnaire should be refined as the teachers found it hard to grasp. As a result, it had to be explained in more detail. There was also uncertainty over whether to conduct interviews with the special educational needs students because of their speech, language and communication difficulties.

iii. There was an uncertainty in the timescale of users' activity and the optimum extent of the duration of observation (anything from 30-60 minutes) recorded per base plan.

iv. There were technical problems also, such as insufficient in quantity of the scaled base plan and matrix; and more binder clips were needed due to the windy weather.

3.3.1c The modification made to the methodology and approach

i. The sequence of the method

As the nature of this subject required a great deal of primary data collection, the need to verify information with individuals who are expert in, and knowledgeable about their own specialism, was attended to first. In this study, interviews/walk-through interviews were conducted with the landscape architects, teachers, therapists and students. These were followed by a systematic series of observations and behaviour mapping.

ii. The approach

The questionnaires were simplified into structured interviews and made into four sets, i.e. two sets for the landscape architects, one set for the teachers and therapists and another set for the students. The researcher also had to strategise as to how to approach and conduct walk-through interviews with the students as well as to record the affordances comprehensively.

By reference to Golicnic's work (2005), it was decided to have four timescales to record the users' activity, i.e. less than 1 minute, 1–2 minutes, 2–5 minutes, and more than 5 minutes. In order to avoid too much data packed into the one scaled base plan, it was planned to conduct the observation and behaviour mapping over thirteen separate thirty-minute periods, on different days, and at different times of the day. Therefore, careful planning and time management was needed in executing this data gathering. Further explanation of this is in section 3.4, Data collection.

3.4 Data collection

The data collection started with an interview with the landscape architect and this was conducted over two sessions. The first interview was undertaken at a place of the landscape architect's choosing and the second interview involved a walk-through of the sensory garden. This was a necessary part to understand the design process and the intentions of the landscape architect as well as finding out the challenges he or she had to deal with. This first interview also assessed whether users utilised areas and behaviour settings in the way that they were intended to do by the designer.

Teachers and therapists were then interviewed to explore the benefits in having a sensory garden as part of a school's special education facility and were also asked to discuss any problems the students had encountered with the sensory garden when they used the setting.

After this, walk-through interviews were conducted with a diverse group of special educational needs students[34] (in the presence of their teacher) to find out what they really favoured in the sensory garden, their experience in the sensory garden, the use of design features and the problems they encountered in the sensory garden. However, when the researcher interviewed them, particularly those with a speech difficulty, about how they used the area in their a sensory garden, she found that it was difficult to get first-hand information from them, thus, the researcher investigated the popularity of areas by observing different behavioural clues in each of the zones in the garden. The purpose of this interview with students was to

[34] Students who had learning disabilities, profound and multiple learning disabilities, emotional and behavioural difficulties, speech, language and communication needs, hearing impairment, multi-sensory impairment, physical difficulty and autism spectrum disorder.

assist in gaining an understanding of how students behaved in the sensory garden that observation alone could not obtain. This method is believed to provide a more rounded picture of use as the information comes first hand from the student and is derived from the student's own responses. Teachers, therefore, must not either answer on behalf of the student or prompt the student, other than in non-leading ways. It is acceptable for them to encourage the student, i.e. by helping them to understand the question or by assisting the interviewer in grasping the answer.

These interviews included a standard questionnaire that the researcher carried out and they were followed by a systematic series of observations and behaviour mapping. The users of the sensory garden were observed to see if she understood what was going on, in terms of how they (the users), especially some particular students, behaved, how long they spent in the sensory garden and if they took advantage of affordances in the landscape.

After the interviews/walk-through interviews with the landscape architects, teachers, therapists and students had been conducted, observation and behaviour mapping of on-site activities at the case-study sites were undertaken. This data gathering was conducted in May and July, for seven days each month. This time of year has possibly the best outdoor conditions and the period of observation was chosen to try to ensure that the daily variations in behaviour could be observed. The data was then recorded continuously from 8.30am to 3.30pm on weekdays, during the opening hours of the school during the term, for thirteen separate thirty-minute periods, on different days, and at different times of the day (see 3.4.2, Observation and behaviour mapping procedure, for further explanation and examples as how the researcher mapped the behavioural observation and affordances)

In this study, the focus of the analysis was on observation and behaviour mapping. The interview material is the secondary data of the study. All interviews were audio taped and transcripts were typed but full transcripts are not included in the thesis; only selected quotes are used. The interviews are a very good way of reinforcing what is in the data and giving it more of a personal viewpoint, as Zimring and Reizenstein (1980:442) stressed, *'Once the clients' and landscape architects' intentions are known, they are checked with actual user experience as measured by interview, questionnaire, direct observations and so forth'*.

3.4.1 Preparation for the observation and behaviour mapping

Before the observation and behaviour mapping method was executed, a list of questions was prepared for self- guidance when collecting the data:

i. Viewing the sensory garden from the perimeter.

- *Do the attributes of the sensory garden draw users into the setting?*

ii. Wayfinding to the sensory garden and back to the school building.

- *How does the student recognise access to the garden and back to the school building?*

iii. Engaging with the behaviour settings of the sensory garden.

- *Why/how is the student fascinated to engage with the behaviour settings?*
- *What is the pattern of use?*
- *Which area and behaviour settings do most/least students prefer and engage with more/less frequently?*
- *Does the student identify any behaviour settings of the sensory garden that resemble to the ones at his/her home?*
- *Is the student stimulated by the weather, artefacts and/or wildlife in the sensory garden?*

The pilot study gave the opportunity to test the efficiency with which data could be collected, prior to undertaking the greater data collection task.

3.4.2 Observation and behaviour mapping procedure

According to Zeisel (1981:25), *'…for behavioural mapping to be useful, procedures and categories must be standardized for each specific location to establish the reliability of observers'.*

<u>A3 size sheet no.1</u>: An accurate scale plan of both case-study sensory gardens were obtained and functional zones as well as behaviour setting boundaries were first established, according to the landscape architects design theme (see Plans 3.1, p.97 and 3.2, p.108)

<u>A3 size sheet no.2</u>: Behaviour mapping symbols (see Appendix C) were used to record observed behaviour on an accurate scale map of the area as follows:

- **Identification of the setting** (where and when observation took place; and weather conditions).
- **User types** (who was observed: students or staff; their type of groupings; and the gender of users).
- **The type of activities and affordances** (what users were doing; how long they spent doing the activities and affordances).

In both special schools selected as the case studies, there was no timetable allocation set for the teachers, therapists and students to use the sensory garden. Students had their own individual timetable and they were free to use the garden as they wished, with the help of their adult carers. However, students were also not allowed to wander around the garden by themselves. As a result, the researcher made a decision to record and to observe all users (grouped by categories[35]) who utilised the sensory garden, in a specific observation period, as mentioned previously.

When both A3 size sheets (an accurate scale plan of the sensory garden and behaviour mapping symbols) are clipped on the clipboard with a multi-coloured pen ready in hand, the researcher began the observation and behaviour mapping as follows:

Behaviour mapping that records the users' movement (using symbols) from they enter the sensory garden until they leave the setting, which includes coding each type of user (gender and users' role: student or staff) and their grouping categories. This is by observing (from a distance[36]) and recording the location of main activities[37] the users undertook, simultaneously with the behaviour settings engaged by the users and the affordances[38] they took advantage, within the four timescales[39], on a scaled base plan.

Example of the observation and behaviour mapping were recorded in one thirty-minute period is illustrated (see A3 sheets no.1 and 2, pp.85-86) and described as follows:

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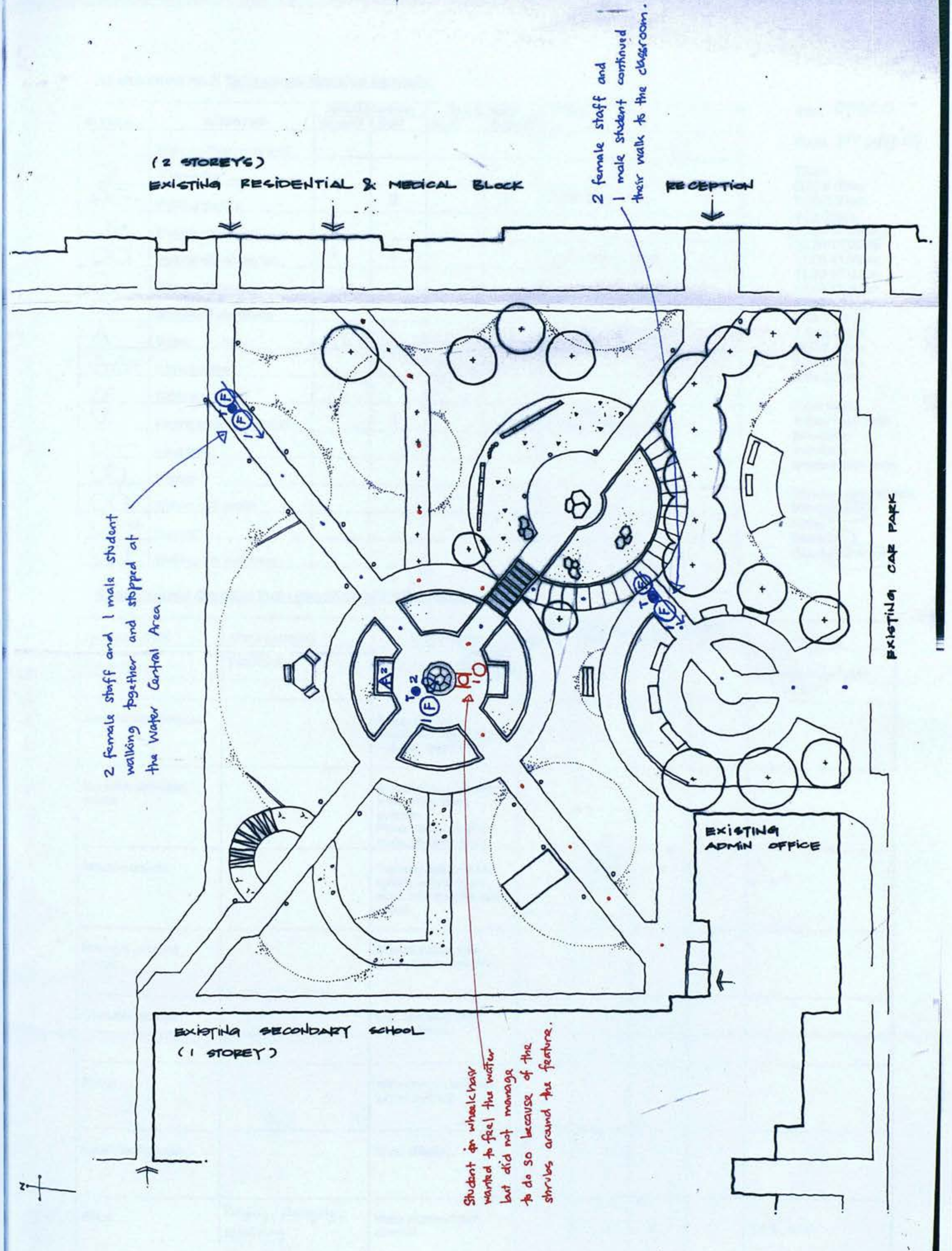
[35] The grouping categories were 'student alone', 'staff alone', '1 student with 1 staff', '1 student with staff', 'students with staff', 'staff', 'students' and 'students with 1 staff'.

[36] The researcher stayed as 'invisible' as possible from the users, especially from students with special educational needs because according to the teachers and therapists of the special school, for them (students), strangers could attract their attention and this would influence the outcome of the behavioural mapping data.

[37] Main activities were walking/passing through, walking fast, walking together, walking with wheelchair/cyclist/walk frame, running, stopping/standing, stop/stand and talking, sitting, sitting together, sitting and talking, playing with the sensory equipment, laying down and singing.

[38] Affordances include the actualised, potential, positive, negative, unique and multiple affordances.

[39] The timescales to record user activity were categorized as less than 1 minute, 1–2 minutes, 2–5 minutes, and more than 5 minutes.


(2 STOREYS)
EXISTING RESIDENTIAL & MEDICAL BLOCK
RECEPTION
2 female staff and 1 male student continued their walk to the classroom.
EXISTING CAR PARK
2 female staff and 1 male student walking together and stopped at the Water Central Area.
EXISTING ADMIN OFFICE
EXISTING SECONDARY SCHOOL (1 STOREY)
Student in wheelchair wanted to feel the water but did not manage to do so because of the shrubs around the feature.

A3 size sheet no.2: Behavioural Mapping Symbols

SYMBOL	ACTIVITIES	FEMALE(outline) StudentT	FEMALE(outline) StaffF	MALE (solid) StaffF	MALE (solid) StudentT	NOTES
	Walking / Passing through					
	Walking fast					
	Walking together		2		1	Less than 1 min.
	Walking and talking					
	Walking with wheelchair	1	1			Less than 1 min.
	Stopping / Standing					
	Stop/Stand and talking					
	Sitting		1			Fear of getting wet. (1-2 min)
	Sitting together					
	Sitting and talking					
	Playing sensory equipment		1		1	at water feature (less than 1 min)
	Lying down					
	Singing					
	Walking with cyclist					
	Running					
	Walking with walkframe					

Site: RSDCD

Date: 8th MAY '07

Time:
8.30-9.00am
9.00-9.30am
9.30-10am
10.00-10.30am
10.30-11.00am
11.00-11.30am
11.30-12.00pm
12.00-12.30pm
12.30-1.00pm
1.00-1.30pm
1.30-2.00pm
2.00-2.30pm
2.30-3.00pm
3.00-3.30pm

Time scale:
1=less than 1min
2=1=2min
3=2-5min
4=more than 5min

Weather conditions:
Windy/Breezy
Rainy
Damp/Dry
Cloudy/Sunshine

Environmental Qualities that support certain Affordances

ENV.QUALITIES	AFFORDANCES	OCCURANCE	FEMALE(outline) StudentT	FEMALE(outline) StaffF	MALE (solid) StudentT	MALE (solid) StaffF	NOTES
Flat surfaces	Walking	Lawn, Rubbery Pathway.		3	1		+1 wheelchair user.
Smooth/rough surfaces		Slope, decking – boardwalk, *vaporised trail* – gravel, raised beds.					
Graspable/detached objects		Animals: bees, butterflies, birds, slugs, cats, tadpoles. Plants: herbs, shrubs, moss, climbers, trees.					
Attached objects		Textured wall, boulders, lighting bollard, wood edge, talking tubes, sound stimuli.					
Non-rigid, attached objects		Musical instruments; pipes, chimes, artworks.					
Climbable features		Log, balancing beam, rock sculpture.					
Shelter		Willow tunnel, covered tunnel, building.					
Mouldable materials		Sand, chipping.					
Water	Playing, scooping, splashing	Water feature, water channel.			1		1-2 min.
Microclimate		Thunder, rain water, sun, wind.					

Description: It was a sunny morning. Two female staff and a male student with hearing-impaired walked together (main activity) from *Green Space Two* and stopped at the *Water Central Area*. The water feature offered the potential for hands to be splashed about in it. A female teaching assistant had a fear of getting wet at the water feature (negative affordance[40]). She was sitting on the seat (unique affordance[41]) while another female teacher and a male student, were busy playing with the water. Suddenly, the student scooped up the water with his hands and splashed it on his teacher (actualised[42] and multiple affordance[43]). After being at the *Water Central Area* for less than two minutes, three of them continued their walk to the classroom, via *Asteroids Arts Garden* and *Parents' Waiting Area*. On another occasion, students in wheelchairs wanted to feel the water but did not manage to do so because of the shrubs around the feature (potential[44] but never actualised).

While undertaking the behaviour mapping, observation notes were written up to provide a view of users' additional activities and potential affordances in the sensory garden. A few significant occurrences were used as anecdotal evidence to help interpret the results. Selections of photographs were also integrated to assist these occurrences. Behaviour mapping data later were keyed-in and analysed using Statistical Package for Social Science (SPSS)

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[40] Negative affordances induce feelings of avoidance, danger, escape and fear (Heft, 1999; Kytta, 2003).

[41] Unique affordances mean a single opportunity of activity engaged in by users while in a specific setting.

[42] Actualised affordances of an environment are what the children encountered during their independent mobility, perception and engagement with the environmental features (Heft, 1988, 1999; Kytta, 2002, 2003, 2004, 2006).

[43] Multiple affordances mean two or more opportunities for the activities engaged in by users while in a specific setting.

[44] Potential affordances of an environment or an object can be looked at in relation to the individual's qualities such as children's physical skills or bodily proportions, social needs and personal intentions are matched with the environmental features (Kytta, 2002, 2003, 2006).

software, such that descriptive summaries of the case studies could be produced.

From the on-site investigation, the actualised affordances were then listed into four tables (see Table 3.1). These tables were categorised as the number of unique (positive[45] and negative affordances) and multiple affordances, the number of users and their length of engagement with the behaviour settings in the sensory garden. In calculating the length of engagement per user, the median for each timescale was taken and the total time spent was calculated as follows:

Timescale: Less than 1 minute recorded as (30seconds); 1-2minutes recorded as (1minute 30 seconds); 2-5 minutes recorded as (3minutes 30seconds); More than 5 minutes recorded as (6 minutes).

Time spent: Number(s) of users x median of the timescale.

Duration of each activity that the users undertook and affordances that they took advantage is important in this study to measure how long they spent in the garden and their engagement with behaviour settings of the garden. These are the measures undertaken to enable user engagement with the behaviour settings and the richness of activities in the sensory garden.

Number of unique affordances (positive and negative)	Timescale
Fear of getting wet and sitting on the seat	1 - 2 minutes
Playing with the water	Less than 1 min
TOTAL	2

Number of multiple affordance (2 or more affordance)	Timescale
Playing, scooping up and splashing the water with hands	1 - 2minutes
TOTAL	1

[45] Positive affordances relate to the children's movements and their perceptions of the environment, resulting in them offering satisfaction, finding it appealing and friendly (Heft, 1999; Kytta, 2003).

Number of users	Staff (F/M)	Students (F/M)
Fear of getting wet and sitting on the seat	1 F	0
Playing with the water	1 F	0
Playing, scooping up and splashing the water with hands	0	1 M
TOTAL	**2 Females**	**1 Male**

Length of engagement	Staff	Students
Fear of getting wet and sitting on the seat	1min 30sec	0
Playing with the water	30 sec	0
Playing, scooping up and splashing the water with hands	0	1min 30sec
TOTAL	**2 minutes**	**1min 30sec**

Table 3.1: Example of the number of unique affordances, the number of multiple affordances, the number of users and the length of engagement at the *Water Central Area*.

Observation note on the potential affordance:

1. Students in wheelchairs wanted to feel the water but did not manage to do so because of the shrubs around the feature.

3.4.3 Summary of the data collection

Note: Data collection was conducted during the opening hours of the school during the term, i.e. from Monday to Friday of the week.

APRIL 2007					
Royal School for the Deaf and Communication Disorders, Cheshire					
DAY	**DATE**	**TIME**	**VENUE**	**OBJECTIVES**	**METHODS**
Thursday	26th	11.00a.m. - 1.15p.m.	Stockport Metropolitan Borough Council, Manchester.	To investigate the design process and landscape architect's intention.	Interview with landscape architect, Sue Robinson.
Friday	27th	9.30a.m. - 12.00p.m.	Multi Sensory Millennium Maze	To allow subsequent assessment of whether users utilise the functional zones and behaviour settings in the way they are meant to.	Walk-through interview with landscape architect, Sue Robinson.
Monday	30th	9.30a.m. - 3.30p.m	Meeting room	To enquire into their experience of and benefits in having the sensory garden; To assess the garden features and any problems identified in the sensory garden.	Interview with the teachers (n=4) and therapists (n=2). n = number of respondents.
MAY 2007					
Tuesday	1st	-	*PUBLIC HOLIDAY: May Day/Labour Day*		
Wednesday	2nd	10.00a.m-11.15p.m.	Multi Sensory Millennium Maze	To understand how students behave in the sensory garden thus providing information that observation alone cannot provide; To get information first hand from the students and to obtain their own responses.	Walk-through interview with the students with special educational needs (n=3).
Thursday	3rd	8.30a.m. - 3.00p.m.	Multi Sensory Millennium Maze	To understand how users behave and take advantage of affordances in the setting; To categorise all the different types of use (behaviour) and their time spend in the sensory garden.	Observation and behaviour mapping of all users.
Friday	4th				
Monday	7th				
Tuesday	8th				
Wednesday	9th				
Thursday	10th				
Friday	11th				

Lyndale School, Wirral

DAY	DATE	TIME	VENUE	OBJECTIVES	METHODS
Monday	14th	1.30p.m. - 3.45p.m.	Groundwork Wirral, Liverpool.	To investigate the design process and landscape architect's intention.	Interview with landscape architect, Mark Boothroyd.
Tuesday	15th	1.30p.m. - 3.30p.m.	Sensory garden	To allow subsequent assessment of whether users utilise the functional zones and behaviour settings in the way they are meant to.	Walk-through interview with landscape architect, Mark Boothroyd.
Wednesday	16th	10.00a.m. - 3.00p.m.	Meeting room	To enquire into their experience of and benefits in having the sensory garden; To assess the garden features and any problems identified in the sensory garden.	Interview with the teachers (n=6) and therapists (n=3). n = number of respondents.
Thursday	17th				
Friday	18th	10.00a.m- 11.30p.m.	Sensory garden	To understand how students behave in the sensory garden thus providing information that observation alone cannot provide; To get information first hand from the students and to obtain their own responses.	Walk-through with the students with special educational needs (n=6).
Monday	21st	9.00a.m. - 3.30p.m.	Sensory garden	To understand how users behave and take advantage of affordances in the setting; To categorise all the different types of use (behaviour) and their time spend in the sensory garden.	Observation and behaviour mapping of all users.
Tuesday	22nd				
Wednesday	23rd				
Thursday	24th				
Friday	25th				
Monday	28th				
Tuesday	29th				

Data collections continues in JULY 2007 at the Lyndale School, Wirral

DAY	DATE	TIME	VENUE	OBJECTIVES	METHODS
Wednesday	11th	9.00a.m. - 3.30p.m.	Sensory garden	To understand how users behave and take advantage of affordances in the setting;	Observation and behaviour mapping of all users.
Thursday	12th				
Friday	13th				

Monday	16th	9.00a.m. – 3.30p.m.	Sensory garden	To categorise all the different types of use (behaviour) and their time spend in the sensory garden.	Observation and behaviour mapping of all users.
Tuesday	17th				
Wednesday	18th				
Thursday	19th				
Royal School for the Deaf and Communication Disorders, Cheshire					
Monday	23rd	8.30a.m. – 3.00p.m.	Multi Sensory Millennium Maze	To understand how users behave and take advantage of affordances in the setting; To categorise all the different types of use (behaviour) and their time spend in the sensory garden.	Observation and behaviour mapping of all users.
Tuesday	24th				
Wednesday	25th				
Thursday	26th				
Friday	27th				
Monday	30th				
Tuesday	31st				

Table 3.2: Summary of the data collection with the landscape architects, teachers, therapists and students with special educational needs for their respective sensory garden.

3.5 The case study selection

Chapter One provided a brief discussion about the definition of a 'sensory garden' and the fourteen potential sites identified from the preliminary site studies. Of the fourteen sensory gardens visited, eight were designed by landscape architects, namely, the Royal School for the Deaf and Communication Disorders in Manchester, Rutland House School in Nottingham, Cranhill Sensory Garden in Glasgow, Redgates School in Croydon, Woodlands Sensory Garden in Sutton, St. Ann's School in Surrey, Lyndale School and All Saints High School in Liverpool.

For the purposes of this study, it was vital to choose sensory gardens which had been designed by landscape architects, in order to investigate the design process that had been undertaken by, and the intentions of, a landscape architect and to assess the constraints with which they have had to deal. The potential final case studies were short-listed based on five set criteria:

i. Completed and operational

The sensory gardens in these case studies had to have been completed and operational, in terms of the outdoor activities they were offering.

ii. The design and its recognition

The selected sensory garden must offer a variety of individual behaviour settings and had to be of apparently good design, as cited in websites[46] and magazines[47]. The case-study sites also had to have been recommended by Jane Stoneham, who is the key expert in this area.

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[46] http://www.rsdmanchester.org/ourfacilities/sensory.php
http://merseyside.groundworknw.org.uk/project.asp?action=view&id=277

[47] *Green places*, Issue Winter 05/06, p.31.

iii. Accessibility

The availability of information about the chosen case studies and easy access to them were important.

iv. The spatial location

The spatial location of the sensory garden in relation to the building was considered, into in order to find out whether this aspect would influence how users utilised the area, whether this factor was likely to result in high use levels and whether landscape architects took that aspect of accessibility into account.

v. Time and funding

Choice of site locations was also limited by what could be achieved with the funding available and the time required to conduct behavioural observation.

Of the fourteen potential sites for study, two sites were chosen, based on these key factors. The first is used as a transition area between buildings (CASE STUDY 1: Royal School for the Deaf and Communication Disorders, Cheshire) and the second is attached to one building, with an open view to the residential backyard (CASE STUDY 2: Lyndale School, Wirral). Both descriptions of the case studies are explained as follows:

3.6 Descriptive summaries of the case studies

3.6.1 CASE STUDY 1: Royal School for the Deaf and Communication Disorders, Cheshire: Multi Sensory Millennium Maze (RSDCD)

Description of the school and the sensory garden

It was a sunny day and there was a light wind. A group of students with multiple disabilities were ready for the literacy session with their teacher and a few teaching assistants. This weekly session with the students was used to reinforce what they were feeling, smelling, hearing or seeing, in terms of the different sounds and textures offered in the sensory garden. As they were leaving their classroom, they chanted and repeated together, *'We are going out to the garden'*. 'Eileen', who wore leg braces, looked pretty with her pink hair band. She showed excitement on her face by nodding, while 'Hamzah', who was in his wheelchair, clapped his hands while looking up at his teacher. The rest of the literacy session continued in some of the functional zones in the sensory garden (see Plans 3.1a, 3.1c, 3.1e and 3.1f).

The RSDCD is located in Cheshire (about one hour train ride from Manchester) and is a residential, co-educational, non-maintained special school and college. The school hours are from 9am until 3pm, Mondays to Fridays. The students' disabilities range from severe and complex learning difficulties, autism, emotional and behavioural difficulties, multi-sensory impairment, to medical, physical and language disorders. The age range is from two to twenty years.

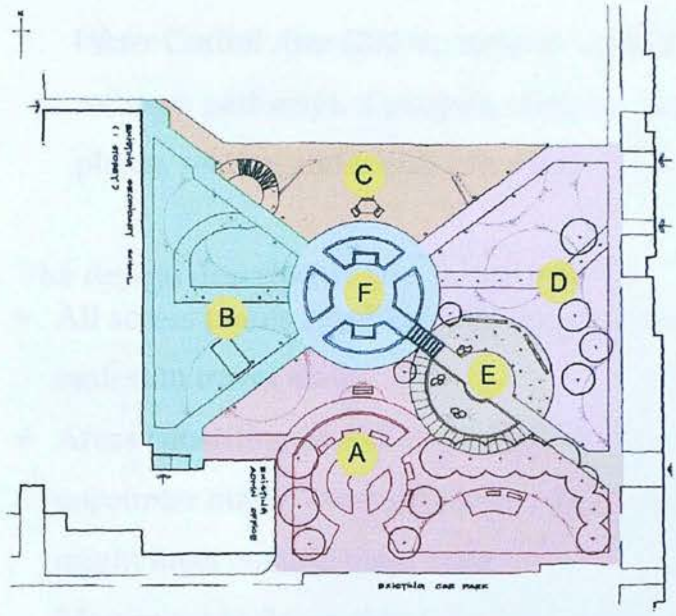
The sensory garden, called the Multi Sensory Millennium Maze, was designed in 2000 by Sue Robinson, a landscape architect from Stockport Metropolitan Borough Council. It is situated in the middle of the school, between two buildings. It is a square form: a courtyard with flat topography. The school has an in-house gardener who provides continuous maintenance.

Image 3.3: The site before the design was implemented (source: Robinson, 2007).

Below are the landscape architect's statements about her intentions when designing the sensory garden, followed by the design description:

- To provide a strong overall framework to channel and encourage movement from one area to other individual areas.
- To improve sense of direction, maximise path widths and areas of experience within a protected environment.
- To provide for emotional, visual and physical security through the pocket arrangement.
- To reduce anxiety by not seeing too much all at once whilst allowing glimpses of views beyond to encourage curiosity.
- To ameliorate, physically, the microclimate through shelter and wind reduction.
- The sensory garden has been divided into six functional zones, namely, *Parents' Waiting Area, Exploraway, Green Space One, Green Space Two, Asteroid Arts Garden* and *Water Central Area.* The total area of the garden is 2318 sq. metres (see Plan 3.1).



Plan 3.1: Plan of the sensory garden, showing the functional zones and individual behaviour settings of the RSDCD.

The functional zones were defined as follows:

A. *Parents' Waiting Area* (660 sq. metres) contain **eight** individual behaviour settings: two lawn patches, trees, shrubs, pathways, seating, a textured wall and a signage.

B. *Exploraway* (511 sq. metres) contain **six** individual behaviour settings: three lawn patches, gravel on the path surface, lighting bollards and pathways.

C. *Green Space One* (316 sq. metres) contain **seven** individual behaviour settings: lawn patch, scented plants, lighting bollards, seating, a *vaporized trail*[48], a willow tunnel with bark chip on the path surface and artwork display.

D. *Green Space Two* (370 sq. metres) contain **eleven** individual behaviour settings: six lawn patches, trees, hedges, lighting bollards, pathways and a rubber walk.

E. *Asteroids Arts Garden* (231 sq. metres) contain **nine** individual behaviour settings: shrubs, pathways, lighting bollards, balancing beams, boardwalks, gravel, musical instruments, rock sculpture and wood edge.

[48] *Vaporised trail* was the term used by the landscape architect who designed the sensory garden. It was designed for wheelchair users to offer challenges, with a surface of gravel and limestone blocks and it is located at *Green Space One*.

F. *Water Central Area* (230 sq. metres) contain **eight** individual behaviour settings: pathways, a pergola, climbers, raised beds, herbs, scented plants, seating and a water feature.

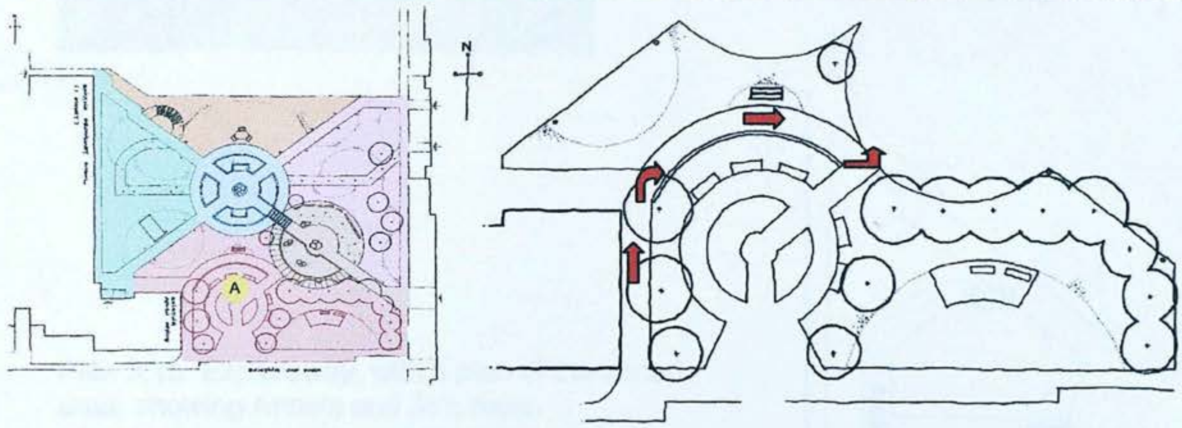
The design description (see Image 3.4)

- All access points emphasise the main routes as being the most direct and easiest to travel along.
- Areas consisting of different materials are provided for the young users to encounter many 'everyday experiences' in preparation for what they might meet outside the school.
- Movement is channelled from one experience to another with a choice of routes, providing different complexities.
- The surfaces of the main routes are smooth red tarmac with a pavior edging trim.
- Fringe routes widen the experience by offering a variety of surfaces for users with wheelchairs. For example, a bark track leading under the willow tunnel and the *vaporised trail* with limestone surface.

Image 3.4: Aerial view of routes and access of the RSDCD (source: Robinson, 2007).

As stated earlier in this chapter, the literacy session continued in several of the functional zones of the sensory garden. Coloured arrows were mapped onto the plan of the zones to illustrate their route, with anecdotal evidence (shown in the shaded text box) used illustrate how users engaged with the individual behaviour settings in the sensory garden. This is followed by a description of the zones (see Plans 3.1a–3.1f).

Parents' Waiting Area (see Plan 3.1a)

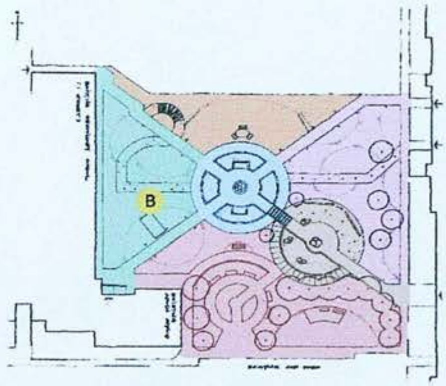


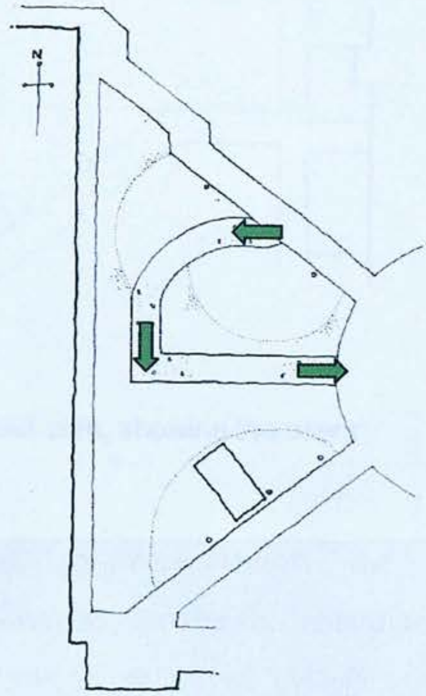
Plan 3.1a: *Parents' Waiting Area*, with a plan of the zoned area, showing the users' route during the literacy session.

As a group of teachers, and students with multiple disabilities turned left out of the patio doors, they reached out to touch the textured wall. The teachers supported the students in doing this, chanting the appropriate words as they explored the wall, *'Fence panel, fence panel... bamboo, bamboo...trellis, trellis... little sticks, little sticks... brush, brush... thick bamboo, thick bamboo...'* The students began to anticipate the sequence of the texture of these features.

- Sited at the entrance to the sensory maze and it utilises an underused fringe area with two lawn patches, scented plants pathways, seating and a textured wall.
- Easily accessible from the car park and main building entrance.
- The area covers 660 sq. metres.

Exploraway (see Plan 3.1b)



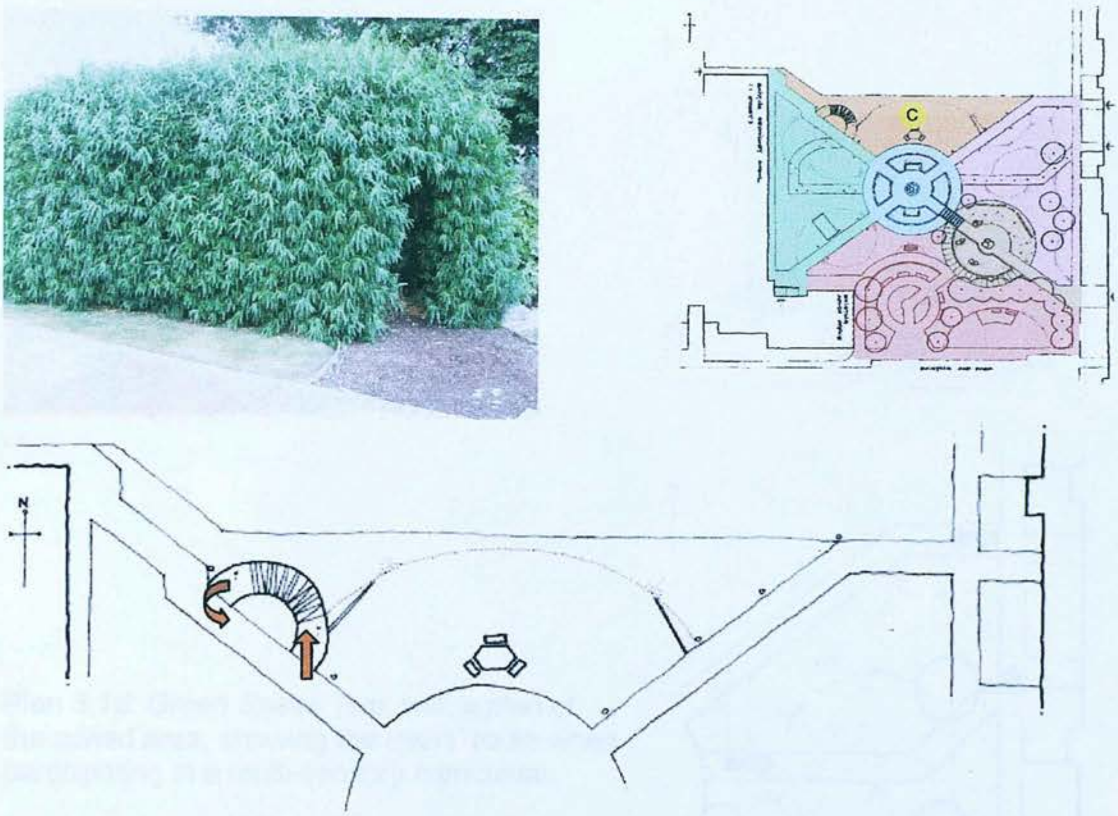


Plan 3.1b: *Exploraway*, with a plan of the zoned area, showing Anne's and Jo's route.

- Offers more difficult challenges in terms of the change in levels, together with the larger surface textures of loose stone.
- The area covers 511 sq. metres.

The group of students and teachers undertaking the literacy session did not use this zone because its surface was unsuitable for wheelchair users. However, in a preliminary interview the researcher conducted with Anne Gough (July 20th, 2006), who is a teacher of children with multi-sensory impairments up to age 16, she used the trail with 'Jo', who has poor sight. 'Jo' found her way around the sensory garden very well, using the scent of lavender and, when she smelt it, it reminded her of her mother at home, who had also had it planted in her garden. According to Kaplan (1976), when users encounter familiar features, this may encourage easy wayfinding.

Green Space One (see Plan 3.1c)

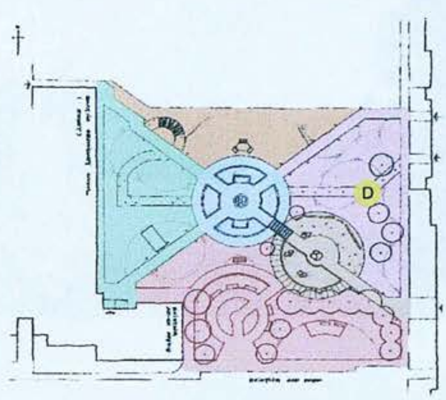


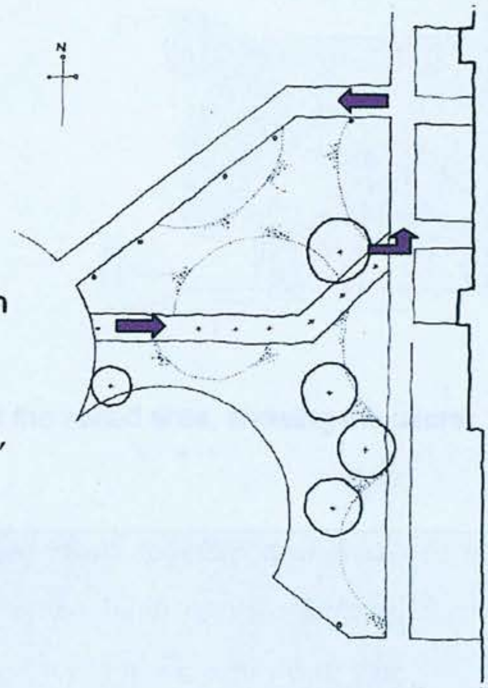
Plan 3.1c: *Green Space One*, with a plan of the zoned area, showing the users' route during the literacy session.

The students moved over to the willow tunnel. *'Where are we, Hamzah?'* the teacher asked. They went through the tunnel slowly to give the students time to respond to the experience of slight coolness from the shadows. *'Willow, willow all around…willow, willow all around…,'* chanted the teachers, while wheeling their students through the willow tunnel. Then they stopped in the middle of the tunnel and played with the artwork display. They touched and felt the artwork. Some hit and heard the sound of rattling decorative cans.

- Includes lawn patch, scented plants, lighting bollards, seating, a *vaporised trail* with gravel and limestone blocks on the surface and a willow tunnel with bark on the path surface and artwork display.
- The area covers 316 sq. metres.

Green Space Two (see Plan 3.1d)





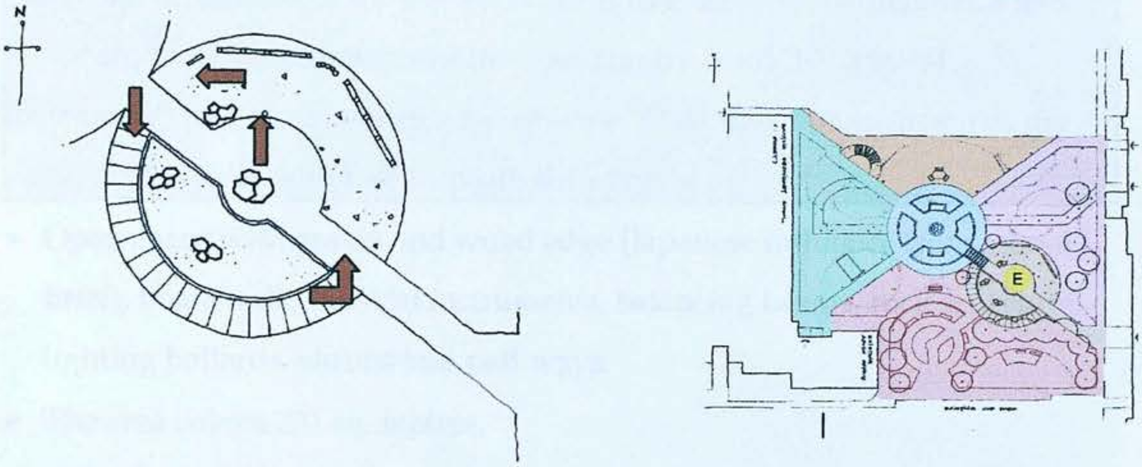
Plan 3.1d: *Green Space Two*, with a plan of the zoned area, showing the users' route when participating in a multi-sensory curriculum.

- Includes six lawn patches, trees, hedges, lighting bollards, pathways and a rubber walk.
- The area covers 370 sq. metres.

One of the standard multi-sensory curriculum item, which is used by teachers in all special schools, is PECS[49] (Picture Exchange Communication System), which involves showing photographs and finding objects in the sensory garden using touch, hearing, smell and sight. This exercise is beneficial for wayfinding and identifying significant features in the sensory garden. *Green Space Two* is one of the zones used for the session.

[49] PECS allows staff and students with autism and other communication difficulties to initiate communication. Further information on PECS can be obtained at http://www.pecs.org.uk/general/what.htm

Asteroid Arts Garden (see Plan 3.1e)



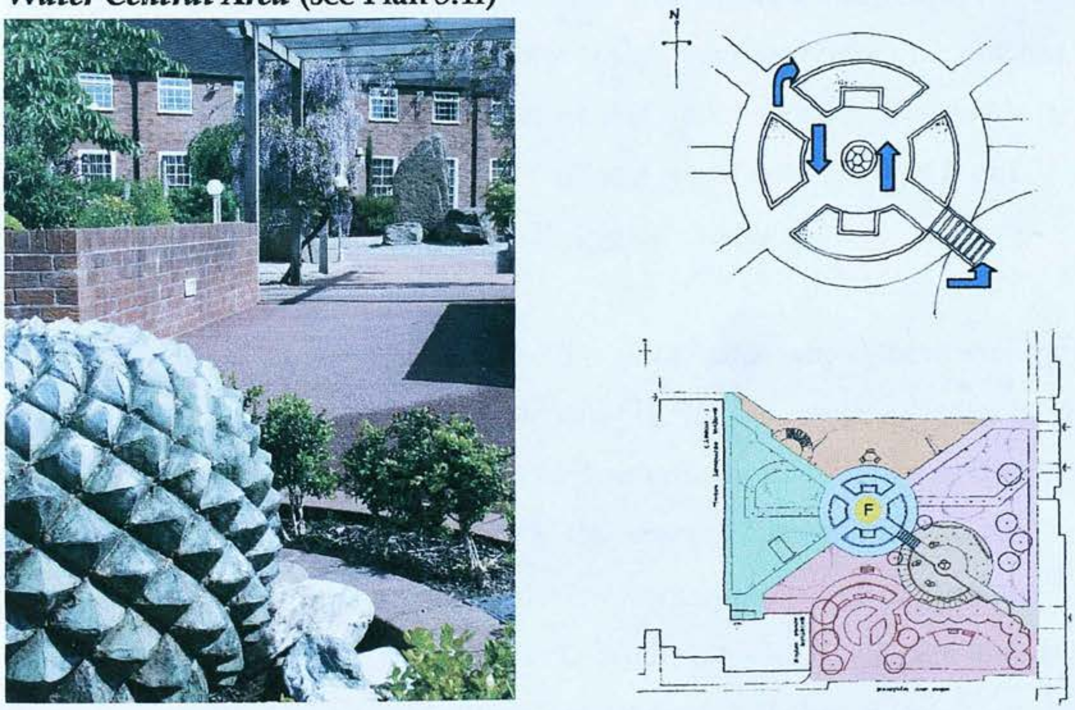
Plan 3.1e: *Asteroid Arts Garden*, with a plan of the zoned area, showing the users' route during the literacy session.

The teachers stamped their feet over the boardwalk together and chanted, *'Bump, bump, bump over the decking... bump, bump, bump over the decking...'* 'Eileen', who was wearing leg braces, copied what her teacher did. The vibration on the boardwalk stimulated Steve, who is visually impaired. Then they moved round to the sand and gravel area to explore these textures while singing, *'Sand between my fingers...sand between my fingers...gritty gravel, gritty gravel...big rocks, big rocks...'* The teachers laughed as 'Hamzah', who was in his wheelchair, put his face on the surface of the boulders. One of the teachers asked the researcher, *'Can you see in his eyes that he is enjoying it?'* The teacher then encouraged her other student, *'Well done! You are feeling the big rocks too, Steve'*. In the previous session, 'Eileen' had got sand in her eyes. As a result, she was not allowed to touch the element.

Next they moved across to the musical instruments. As they wheeled onto the gravel surface, the sound of the gravel crushing under the wheels and their footsteps could be heard. The group dispersed to each of the musical instruments and made rhythms with the different features while singing, *'Knock, knock, knock on the wood, knock, knock, knock on the wood...blow the pipes, blow the pipes... hit the chimes to make a sound, hit the chimes to make a sound...'* 'Steve' loved the feel of the vibration as his teacher hit the different chimes. Other students were then given the opportunity to hit the musical instruments and they responded positively. Then they moved towards the water fountain by going underneath the pergola.

- Open space with gravel and wood edge (Japanese influence from school brief), boardwalk, musical instruments, balancing beams, rock sculpture, lighting bollards, shrubs and pathways.
- The area covers 231 sq. metres.

Water Central Area (see Plan 3.1f)



Plan 3.1f: *Water Central Area*, with a plan of the zoned area, showing the users' route during the literacy session.

'Underneath the pergola, underneath the pergola…,' the teachers sang. Everyone grouped around the fountain to hear the water. They chanted in a whisper, *'Can you hear the water trickling? Can you hear the water trickling?'* Some students jumped in their wheelchair while making loud, shrill noises, showing their excitement! The teachers helped the students to feel the water from the fountain by stepping over the shrubs which were planted around the water feature and scooped the water with their hands and whispered again, *'Feel the cool, cool water… feel the cool, cool water…'* and they sprinkled some water onto the students' faces and hands. The students' positive behaviours included licking the water with their hands and then reaching out for more.

Surrounding the *Water Central Area* were the raised beds with scented plants. The teachers chanted the names of the herbs, *'Curry plant, curry plant… basil, basil…, mint, mint…'* One of the teachers put some herbs close to 'Hamzah's' nose. He was still, concentrating while his eyes were moving. He smelt the herbs for a while and suddenly grabbed them from his teacher's hand and put some into his mouth. The teacher let him do it and said, *'Do you like it?… Ooh! Yes! It's nice, isn't it?* 'Hamzah' pulled a weird face and spat it out. *'I guess you just like to smell it, don't you?'* giggled the teacher.

All of them then moved as a group to the picnic table where there was some food to taste. *'Snacks at the picnic table, snacks at the picnic table…'* After having their snacks, the teachers said, *'We have finished'* and they signed to their students. *'Do you know our way back to the classroom?'* the teacher asked 'Eileen'. Amazingly, she began to take the lead and, through the use of plants, followed the path back to her classroom's patio. Using sign language, the teacher smiled and patted Eileen's shoulder, *'Well done, Eileen'.*

- Focal area with water feature.
- Water feature that offers a contrasting texture between the soft water and the rough 'pineapple' surface.
- Pergola with climbers linked to the central area garden.
- Raised planters with seating and easy access to scented plants, herbs and moss.
- The area covers 230 sq. metres.

3.6.2 CASE STUDY 2: Lyndale School, Wirral (LS)

Description of the school and the sensory garden

A large group of teachers wheeled their students with special educational needs out from their classroom to the *Rainbow Walk*. A teacher wanted to conduct their speech therapy session there. The morning weather was fine with sunny spells and the wind was blowing in between the leaves. *'Do you know where we are going, David?'* asked a teacher. 'David' jumped in his wheelchair while his hands grasped the armrest. He was making a loud sound, showing anticipation. As the large group reached the area, they formed a circle around the conifer tree. The rest of the literacy session continued at the *Rainbow Walk* (see Plan 3.2a).

LS is a non-residential special school. The school hours are from 9am until 3pm, Mondays to Fridays and it caters for children with complex needs, and profound and multiple disabilities from the ages of two to eleven years.

The inspiration for having a sensory garden came from the school's Deputy Head, Dave Jones, who died in summer 2002. In January 2003, the planning and design work started and was completed in September 2005. A landscape architect from Groundwork Wirral, Mark Boothroyd, designed the sensory garden. It is situated between the school's building and the residential backyard. It has a linear form with a combination of flat and undulating topography. The school relies on volunteer efforts for the garden's maintenance. The project relied on extensive local community fundraising, making it difficult to anticipate final budgets or programme work. It was phased to overcome difficulties in programming works and budgets.

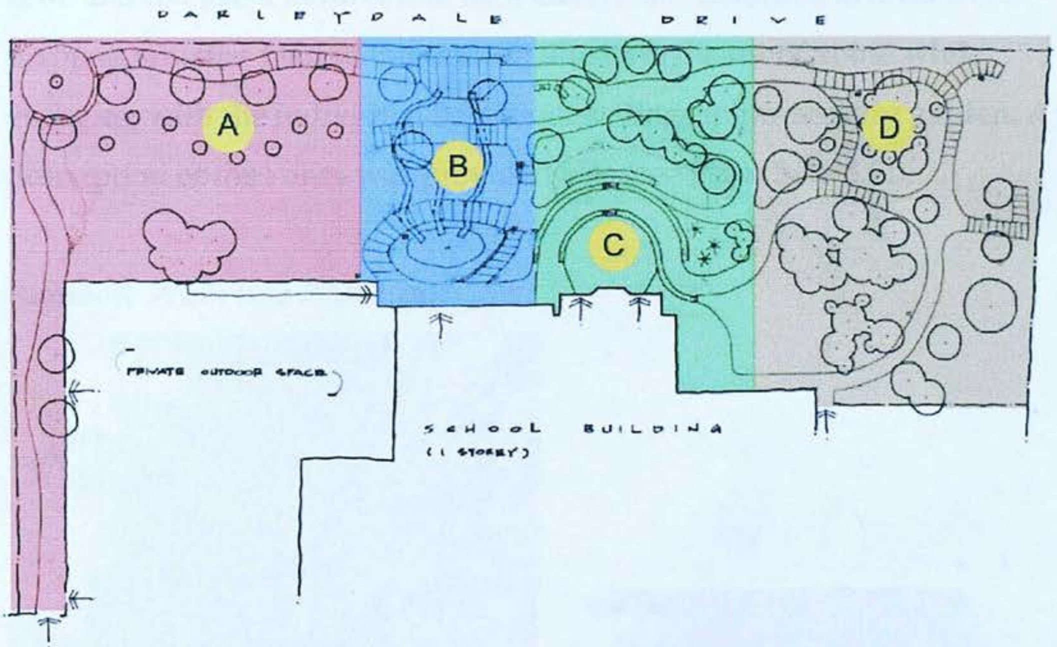
Phase one included providing a pathway network, including the *Rainbow Walk* to enable users to explore and access the sensory garden independently. Phase two consisted of the design of the *Water Garden*, specifically, slate stone channels, a pond and interactive fountain, which can be triggered by users talking through the talking tubes or using an infra-red, hand-held remote control unit. Phase three involved the creation of the *Woodland Garden*, that is, an interactive sound installation in the woodland area. Phase four involved the planting. For the purpose of this thesis, the design description has been taken from the landscape architect's statements of his intentions.

Image 3.5: *Rainbow Walk* and *Water Garden* before the design implementation (source: LS, 2007).

Image 3.6: *Green Space* and *Woodland Garden* before the design implementation (source: LS, 2007).

Below are the landscape architect's statements about his intentions when designing the sensory garden of the LS:

- To maximise the potential of the site with landform and the meandering pathway network that provides a range of options and opportunities to move through spaces along the way.
- To offer interaction with the environment that has diversity of different experiences using natural features such as touch, scent, sounds, colour, texture as well as the strong contrast of light and dark.
- The sensory garden has been divided into four functional zones, namely, the *Rainbow Walk, Water Garden, Green Space* and *Woodland Garden*. It has a total area of 1883 sq. metres (see Plan 3.2).



Plan 3.2: Plan of the sensory garden, showing the functional zones and individual behaviour settings of the LS.

The functional zones were defined as follows:

A. *Rainbow Walk* (737 sq. metres) contain **four** individual behaviour settings: lawn, boardwalks, pathways and trees.

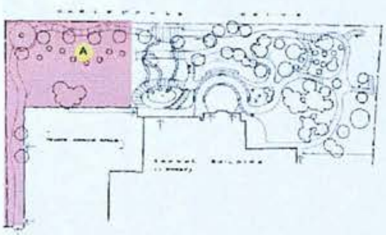
B. *Water Garden* (223 sq. metres) contain **seven** individual behaviour settings: boardwalks, steps, an interactive fountain, talking tubes, a pond, marginal plants and slate stone channels.

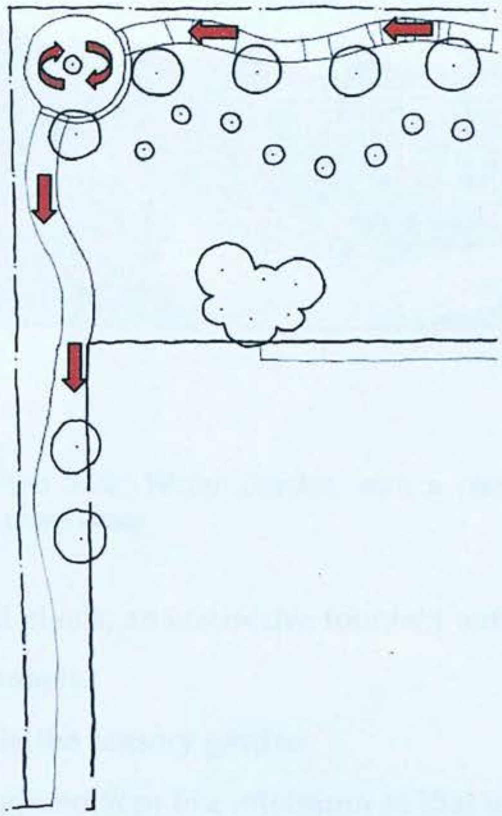
C. *Green Space* (337 sq. metres) contain **nine** individual behaviour settings: a covered tunnel, seating, a sloping lawn, musical pipes, pathways, raised beds, herbs, scented plants and a textured wall.

D. *Woodland Garden* (556 sq. metres) contain **seven** individual behaviour settings: an artwork display, boardwalks, rope railing, pathways, a lawn patch, trees and a variety of sound stimulation.

As stated earlier, the literacy session continued at the *Rainbow Walk*, with anecdotal evidence (shown in the shaded text box). This session ended in this zone and the users' returned to their classroom. Coloured arrows were mapped onto the plan of this zone to illustrate the users' route while engaging with the individual behaviour settings in the sensory garden. A description of the zones was provided also (see Plans 3.2a–3.2f).

Rainbow Walk (see Plan 3.2a)



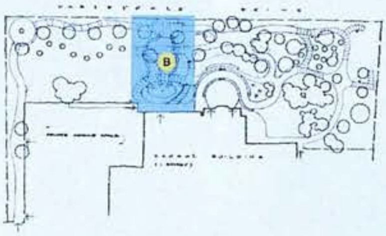


Plan 3.2a: *Rainbow Walk*,
with a plan of the zoned area,
showing the users' route during the
literacy session.

As the teachers and students gathered in pairs around the conifer tree, with a plank as the floor surface, the teachers sang, *'Here we go 'round the mulberry bush'*. As they chanted, the researcher thought it was a perfect song to sing as it invited many physical movements that generated sound and vibration for the students, such as stamping, jumping, skipping, clapping and cheering. The students responded positively by swinging their hands while turning their heads from one side to another. Some students opened their mouths and tried to mimic their teachers.

- The *Rainbow Walk* surface offers different colours and textures, which provide a broad learning experience.
- It includes a kickabout area with lawn and trees that provide shade.
- The zone covers 767 sq. metres.

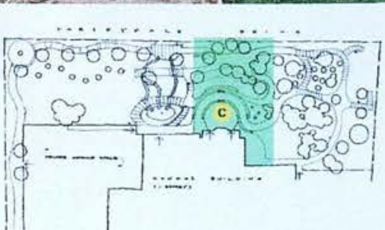
Water Garden (see Plan 3.2b)



Plan 3.2b: *Water Garden*, with a plan of the zoned area.

- It includes a pond with marginal plants, an interactive fountain with talking tubes and slate stone channels.
- It acts as a visual and focal area in the sensory garden.
- Low wooden handrails were used and kept to a minimum so that users can have close contact with the water feature using boardwalks and bridges.
- It also comprises rough, loose stones that can be moved around to divert the direction of the water channels. This allows close engagement with the environment.
- The zone covers 223 sq. metres.

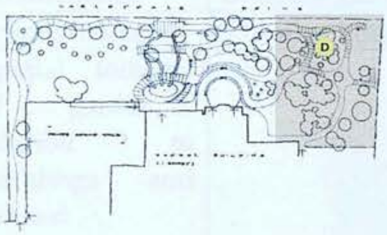
Green Space (see Plan 3.2c)



Plan 3.2c: *Green Space*, with a plan of the zoned area.

- It consists of a covered tunnel, seating, a sloping lawn, musical pipes, a textured wall as well as raised beds with herbs and scented plants.
- Environmental art and willow weaving add to the richness of the area.
- The zone covers 337 sq. metres.

Zone D: *Woodland Garden* (see Plan 3.2d)

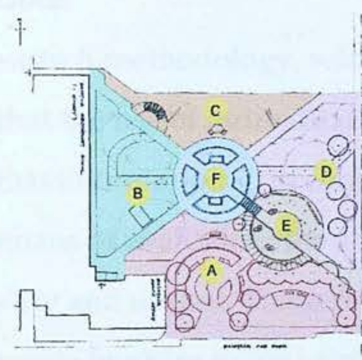
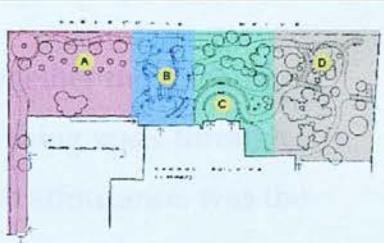


Plan 3.2d: *Woodland Garden*, with a plan of the zoned area.

- Also known as the sound garden or the sound trail.
- It integrates an artwork display, a boardwalk with rope railing and a variety of sound stimuli.
- Lush and rich woodland planting provide texture, sound and scent as well as inviting wildlife.
- A strong contrasting area of dark and shade offers experiences that are different from other areas.
- The zone covers 556 sq. metres.

Summary of the case studies are listed as follows:

3.6.3 Summary of the case studies

CASE STUDIES	RSDCD	LS
Type of school	Residential, co-educational, non-maintained special school and college.	Non-residential special school.
Reason of choosing as case study	Both sensory gardens are completed and operational, offers a variety of individual behaviour settings, easy access for information and adequate size for study. The landscape architects were available during the data collection. Compared with the LS, the RSDCD is a residential school, however, the sensory garden was not use during after school hours because the residents have their own indoor activity. Furthermore, the lighting bollards are not working, thus limited the use of sensory garden after sunset.	
Students (disabilities and age)	Severe and complex learning difficulties, autism, emotional and behavioural difficulties, multi-sensory impairment, medical, physical and language disorders. 2 – 19 years old.	Complex needs. Profound and multiple needs, sensory impairments, medical needs and life threatening conditions (e.g. on oxygen). 2 – 11 years.
Maintenance	In-house gardener.	Relies on volunteer efforts.
School hours	9.00am – 3.00pm	9.00am – 3.30pm
Spatial location of the garden in relation to buildings and context	 Situated in the middle of the school, between two buildings. A square form: Courtyard. Flat.	 Situated between the school's building and residential backyard. A linear form. Flat and undulating.
The functional zones were defined as:	A. *Parents' Waiting Area* (660 sq. metres) contain **eight** settings: two lawn patches, trees, shrubs, pathways, seating, a textured wall and a signage. B. *Exploraway* (511 sq. metres) contain **six** settings: three lawn patches, gravel on the path surface, lighting bollards and pathways. C. *Green Space One* (316 sq. metres) contain **seven** settings: lawn patch, scented plants, lighting bollards, seating, a *vaporized trail* with gravel and limestone blocks on the surface, a willow tunnel with bark chip on the path surface and artwork display.	A. *Rainbow Walk* (737 sq. metres) contain **four** settings: lawn, boardwalks, pathways and trees. B. *Water Garden* (223 sq. metres) contain **seven** settings: boardwalks, steps, an interactive fountain, talking tubes, a pond, marginal plants and slate stone channels. C. *Green Space* (337 sq. metres) contain **nine** settings: a covered tunnel, seating, a sloping lawn, musical pipes, pathways, raised beds, herbs, scented plants and a textured wall.

	D. *Green Space Two* (370 sq. metres) contain **eleven** settings: six lawn patches, trees, hedges, lighting bollards, pathways and a rubber walk. E. *Asteroids Arts Garden* (231 sq. metres) contain **nine** settings: shrubs, pathways, lighting bollards, balancing beams, boardwalks, gravel, musical instruments, rock sculpture and wood edge. F. *Water Central Area* (230 sq. metres) contain **eight** settings: pathways, a pergola, climbers, raised beds, herbs, scented plants, seating and a water feature.	D. *Woodland Garden* (556 sq. metres) contain **seven** settings: an artwork display, boardwalks, rope railing, pathways, a lawn patch, trees and a variety of sound stimulation.

Table 3.3: Summary of the case studies.

3.7 Key conclusions

To conclude, the research methodology, which draws together the research questions clarifies that the use of individual interviews, using walk-through, observation and behaviour mapping, in conjunction with affordance, was the most appropriate means of evaluating the effectiveness of a sensory garden, in terms of its usability and design. These research methods and affordance theory were appropriate in order to find out which areas in the sensory garden were utilized by the users and the frequency of this use. These findings could then be related to the future design of sensory gardens.

The Multi Sensory Millennium Maze at the RSDCD; and the Lyndale Sensory Garden at the LS have six and four functional zones, respectively. Both sensory gardens include individual behaviour settings where users, especially students with special educational needs, are able to have delicate sensory experiences. Both sensory gardens were designed by landscape architects, who had taken into consideration all students' needs, irrespective of age, gender, abilities and skills. The design of each garden challenges the student's perceptions and motivates them to practise their motor skills.

CHAPTER FOUR

Analysis and Results of the Observation and Behaviour Mapping

Measures undertaken to enable user engagement with the individual behaviour settings and the richness of activities in the sensory garden:

- Activities and affordances occurred refers to the number of main activities and actualised affordances, which most and least frequently occurred in each functional zone of the sensory garden during the observation period.

- Individual behaviour settings engaged with are the quantity of items of hard landscape (for example, hard surfaces, structures, raised planters, water feature, artefacts); soft landscape (plants, animals, microclimate); and landscape furniture (seating, lighting bollards), which users have played with/in/amongst, encountered or visited during the observation period.

- Length of engagement with is the time-span, in seconds and minutes, of the users' main activities and the actualised affordances in each functional zone of the sensory garden during the observation period.

The data later shows the links between the individual behaviour settings and the number of actualised affordances (unique and multiple affordances), the number of users and the median time spent per person in the different functional zones of the sensory garden (the zones of the garden refers to the total area covered, in square metres). Unique affordances mean a single opportunity of activity engaged in by users while in a specific setting. Multiple affordances mean two or more opportunities for the activities engaged in by users while in a specific setting.

4.1 CASE STUDY 1: Royal School for the Deaf and Communication Disorders (RSDCD)

It was windy and drizzly. A young girl in a wheelchair (X3*) was in the sensory garden with her teaching assistant (X2*) [* This coding can be referred in the SPSS software data in p.257]. She was wearing a pink sweater with her hair in a ponytail, which was tied with a matching pink ribbon. She was quiet and just sat still in her wheelchair, feeling the rainwater running on her cheek. Her teaching assistant kept on wheeling her despite the weather. At one point, the teaching assistant stopped to tie her own shoelace. The girl opened her mouth and shouted out loud, shrill noises while jumping a little in the wheelchair. She was irritated! The teaching assistant knew that she disliked that they had stopped and explained to the girl in sign language why she had to do that. After a short while, the teaching assistant gently wheeled the girl on. Passing the water feature and the scented plants at the raised beds, the girl became silent. Now the only noises that could be heard were the wind in the leaves, the trickling water from the water feature and a little splashing on a puddle (see Appendix F, F.1, zone A, observation note no.3).

Since the patterns of use in May and July were very similar, the data collected from these two observation periods are combined in the analysis. Statistical Package for Social Science (SPSS) software was used to assess the differences in the two gardens' demographics, such that descriptive summaries of the case studies could be produced. For the purpose of this analysis, behaviour mapping data covered six functional zones with 49 individual behaviour settings (see Plan 3.1, p.97).

4.1.1 Frequencies of the patterns of use

The behavioural mapping data was coded by the time of observations, the type of weather, the gender of the users, whether the user was a student or a staff, the grouping categories, the functional zones of the sensory garden, the main activities in which the users engaged, the type of affordances that occurred in the garden, the number of users by showing their frequencies and their median time spent per person (see Appendix D, D.1). A summary was produced to assist the reader in understanding the data (see Table 4.1l, p.119 and Chart 4.1, p.120). Based on these tables and charts, Plan 4.1 (see p.121) illustrates the distribution of users in the sensory garden. Subsequently, the frequencies of seated activity (see Charts 4.2, p.126 and 4.3, p.130), according to the zones, will be analysed with the aid of a few selected photographs (see Images 4.1–4.4).

A summary of the frequencies of use recorded during the fourteen-day observation period and the behaviour mapping throughout all the functional zones in the sensory garden of the RSDCD, is as follows (see Appendix D, Tables 4.1a–4.1k).

OBSERVATION CODES	FREQUENCIES (shown as 'n' value) for the sensory garden of the RSDCD
Time (see Table 4.1a)	Users were in the sensory garden most between 9.00am – 9.30am (n=545). They used the garden mainly used for criss-crossing between buildings. The least frequent usage occurred between 12.00pm – 12.30pm (n=224).
Weather (see Table 4.1b)	Users preferred being in the sensory garden when it was windy, dry and cloudy (n=1777). The least number of users seen in the sensory garden was when it was damp and cloudy (n=28).
Gender (see Table 4.1c)	More females (n=2874) than males (n=1639) used the garden.
Users (see Table 4.1d)	Staff (n=3348) used the garden more than students (n=1165). The ratio between staff and students is 3:1 throughout all of the functional zones.
Grouping categories (see Table 4.1e)	Staff alone[50] had the highest frequency (n=1660) of use. Students[51] had the lowest frequency (n=20).
Functional zone (see Tables 4.1f-4.1k)	*Parents' Waiting Area* had the highest frequency of users (n=4254). *Green Space One* had the lowest frequency of users (n=73).
Activity (see Tables 4.1f and 4.1h, under Act1 and Act3)	Passing through was the most frequent main activity undertaken by the users at the *Parents' Waiting Area* (n=1687) (see Chart 4.1). Sitting was the least frequent main activity in *Green Space One* (n=2).

[50] 'Staff alone' means either a member of the school staff who either engaged with the essential or simply passed through the sensory garden by him or herself.

[51] 'Students' means a groups of students (2-3 students) who passed through the sensory garden either walking at a slower or faster pace than their adult carers or teachers. Students were not allowed to wander around the garden by themselves.

Multiple affordances	*Water Central Area* had the greatest frequency of multiple affordances (n=120). *Exploraway* had the lowest frequency of multiple affordances (n=2).
Unique affordances	*Green Space Two* had the greatest frequency of unique affordances (n=137). *Green Space One* had the lowest frequency of unique affordances (n=29).
Both types of affordances (see Tables 4.1f - 4.1h, under Aff1, Aff2, Aff3, Aff4, Aff5, Aff6)	*Water Central Area* had the greatest frequency of both types of affordances (n=218). *Exploraway* had the lowest frequency of both types of affordances (n=47).
Number of users and the median time spent per user (see Tables 4.1f and 4.1h, under Tsc1 and Tsc3)	*Parents' Waiting Area* had the greatest number of users (n=4250). The median time spent per user in this zone was 59 seconds. *Green Space One* had the lowest number of users (n=73). The median time spent per user in this zone was 1 minute and 50 seconds.

Table 4.1l: Summary of the frequencies of the greatest and lowest use of the sensory garden of the RSDCD.

4.1.2 Frequencies of the users and main activities at the RSDCD

Frequencies of the main activities[52], according to the functional zones, are referred to in Tables 4.1f – 4.1k of Appendix D (under Act1, Act2, Act3, Act4, Act5 and Act6). The total number of users (staff and students) is equivalent to the total number of main activities. Below is a summary of the frequencies of users and the total area of all the functional zones in the sensory garden.

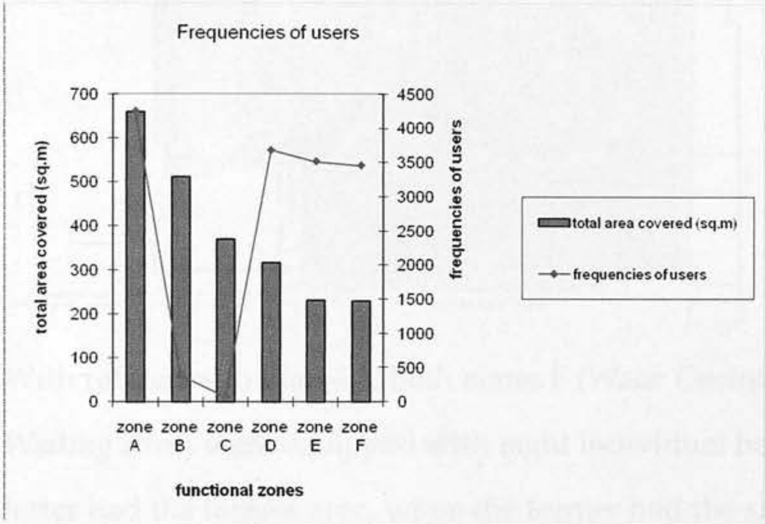


Chart 4.1: Summary of the frequencies of users recorded in the sensory garden of the RSDCD, according to the functional zones.

The above chart shows that zone A (*Parents' Waiting Area*) had the highest frequency of users and main activities (n=4254), followed by zone D (*Green Space Two*) at 3679, zone F (*Water Central Area*) at 3457 and zone E (*Asteroid Arts Garden*) at 3506. Although zone C (*Green Space One*) had the third largest area, the frequency of users and main activities was the lowest, at 73, while zone B (*Exploraway*) had 397. The results suggest that the accessibility of individual behaviour settings in zones A, D, F and E afforded many functional properties related to engaging users in activities. In summary, the users' activities in the sensory garden were not dependent on the total area of each zone but rather the functionality of the individual behaviour settings and the ease of accessibility.

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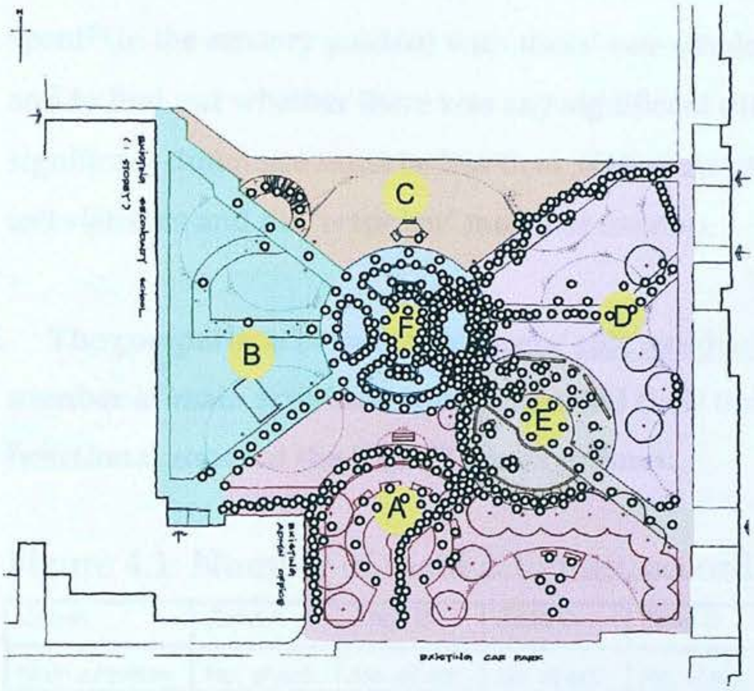
[52] Main activities were walking/passing through, walking fast, walking together, walking with wheelchair/cyclist/walk frame, running, stopping/standing, stop/stand and talking, sitting, sitting together, sitting and talking, playing with the sensory equipment, laying down and singing.

Distribution of the users



Plan 4.1: Behaviour map of the sensory garden at the RSDCD, showing the distribution of the users.

With reference to Plan 4.1, both zones F (*Water Central Area*) and A (*Parents' Waiting Area*) were equipped with eight individual behaviour settings. The latter had the largest area, while the former had the smallest area. However, the *Water Central Area* was used the most. The *Asteroids Arts Garden* (zone E) was also comparable to the *Water Central Area* in terms of the size of total area, where both zones are relatively equal in terms of square metres. While zone F offered eight individual behaviour settings, zone E has nine. However, the former had the highest usage. The results suggest that the individual behaviour settings in zone F afforded many functional properties related to engaging users in activities. The findings signify that the users' activities in the sensory garden were not dependent on the total area or the number of settings but rather the functionality of the individual behaviour settings that were offered.

4.1.3 Results of the demographics using SPSS

In this stage, the analysis consisted of using the following tools: 'Error Bar', 'Mann-Whitney U' and 'Kruskal Wallis'. These tools were used to check the differences between variables (the main activities undertaken and the time spent[53] in the sensory garden) with users' role (student/staff) and gender and to find out whether there was any significant difference. Note that the significant difference must be less than .05 [see Asymp. Sig. (2-tailed)] in the test statistics and the 'error bar' must not overlap.

i. The comparison between the users' role (student/staff), in terms of the number of main activities undertaken and their time spent in each of the functional zones at the RSDCD, is as follows:

Figure 4.1: Number of main activities, according to the zones.

Zones	Zone A	Zone B	Zone C	Zone D	Zone E	Zone F
Main activities	No. of act.	No. of act.	No. of act.	No. of act.	No. of act.	No. of act.
Chi-Square	517.869	30.067	6.907	400.763	384.879	349.195
df	1	1	1	1	1	1
Asymp. Sig.	**.000**	**.000**	**.009**	**.000**	**.000**	**.000**

Figure 4.1: Results of Kruskal Wallis test, with the users' role as a grouping variable in terms of the number of main activities undertaken in each of the functional zones at the RSDCD.

Figure 4.2: Time spent, according to the zones.

Zones	Zone A	Zone B	Zone C	Zone D	Zone E	Zone F
	Time spent	Time spent	Time spent	Time spent	Time spent	Time spent
Chi-Square	43.152	27.092	.005	35.213	44.707	49.265
df	1	1	1	1	1	1
Asymp. Sig.	**.000**	**.000**	**.946**	**.000**	**.000**	**.000**

Figure 4.2: Results of Kruskal Wallis test, with the users' role as a grouping variable in terms of the time spent in each of the functional zones at the RSDCD.

Figures 4.1 clearly indicates that there is a significant difference in all zones between the students and the staff in the main activities undertaken; while figure 4.2 showed that there is no significant difference in zone C (*Green Space One*) between the students and the staff in terms of the time spent. This

[53] The time spent was measured by number(s) of users x median of the timescale. The timescale to record user activity were categorised as less than 1 minute, 1–2 minutes, 2–5 minutes, and more than 5 minutes.

means the students undertook a higher number of activities than the staff and spent a longer time in all the zones, except in zone C.

ii. The comparison between <u>gender</u>, in terms of the number of main activities undertaken and the time spent in each of the functional zones at the RSDCD, as follows:

Figure 4.3: Number of main activities, according to the zones.

Zones	Zone A	Zone B	Zone C	Zone D	Zone E	Zone F
Main activities	No. of act.	No. of act.	No. of act.	No. of act.	No. of act.	No. of act.
Chi-Square	.871	1.129	8.443	.068	.678	.000
df	1	1	1	1	1	1
Asymp. Sig.	**.351**	**.288**	**.004**	**.794**	**.410**	**.984**

Figure 4.3: Results of Kruskal Wallis test, with gender type as a grouping variable in terms of the number of main activities undertaken in each of the functional zones at the RSDCD.

Figure 4.4: Time spent, according to the zones.

Zones	Zone A	Zone B	Zone C	Zone D	Zone E	Zone F
	Time spent	Time spent	Time spent	Time spent	Time spent	Time spent
Chi-Square	.041	1.463	.028	.348	.000	.279
Df	1	1	1	1	1	1
Asymp. Sig.	**.840**	**.226**	**.868**	**.555**	**.990**	**.598**

Figure 4.4: Results of Kruskal Wallis test, with gender type as a grouping variable in terms of the time spent in each of the functional zones at the RSDCD.

Of all functional zones in the sensory garden of the RSDCD, only zone C (*Green Space One*) has a significant difference in terms of the main activities undertaken by females and males. However, none of the zones has a significant difference for the time spent by gender. This means that males undertook a higher number of activities than females in zone C but within the same time spent there, as throughout all of the zones.

A summary of these grouping variables, in terms of the main activities undertaken and the time spent in the RSDCD sensory garden, is presented in Table 4.3:

Grouping Variables	Main activities/ Time spent	Significant/ No significant difference	Main findings of the demographics	Key features of the functional zone where significant differences were found
User (student/ staff)	Main activities	All zones significant (see Figure 4.1)	The students undertook a higher number of activities than the staff and spent a longer time in all the zones, except in zone C.	Zone C: ***Green Space One*** (316 sq. metres) Seven individual behaviour settings: lawn patch, scented plants, lighting bollards, seating, a *vaporized trail* with gravel and limestone blocks on the surface, a willow tunnel with bark chip on the path surface and artwork display.
	Time spent	Zone C not significant (see Figure 4.2)		
Gender (female/ male)	Main activities	Zone C significant (see Figure 4.3)	Males undertook a higher number of activities than females in zone C but within the same time spent throughout all of the zones.	
	Time spent	All zones not significant (see Figure 4.4)		

Table 4.3: Grouping variables and main activity/ time spent in the RSDCD sensory garden to discover, which zone has/has not any significant difference, with the main findings of the demographics.

Table 4.3 shows that, in terms of users and time spent in the RSDCD, the students participated in more activities than the staff and spent a longer time in all the zones, except in *Green Space One* (zone C). This is probably because in this zone:

- The wrong choice of surface material for the *vaporized trail* (see Image 7.2, p.193). One staff used it for less than 1 minute and ten students used it for 30 seconds per user by stepping on the trail rather than using it as the designer had envisage.

- The positioning of seating far away from the water feature, making it unpopular with users (see Image 4.3, p.129). As a result, only one staff and one student sat on this bench for less than 1 minute per user.

- The end positioning of the willow tunnel in the garden with bark surface

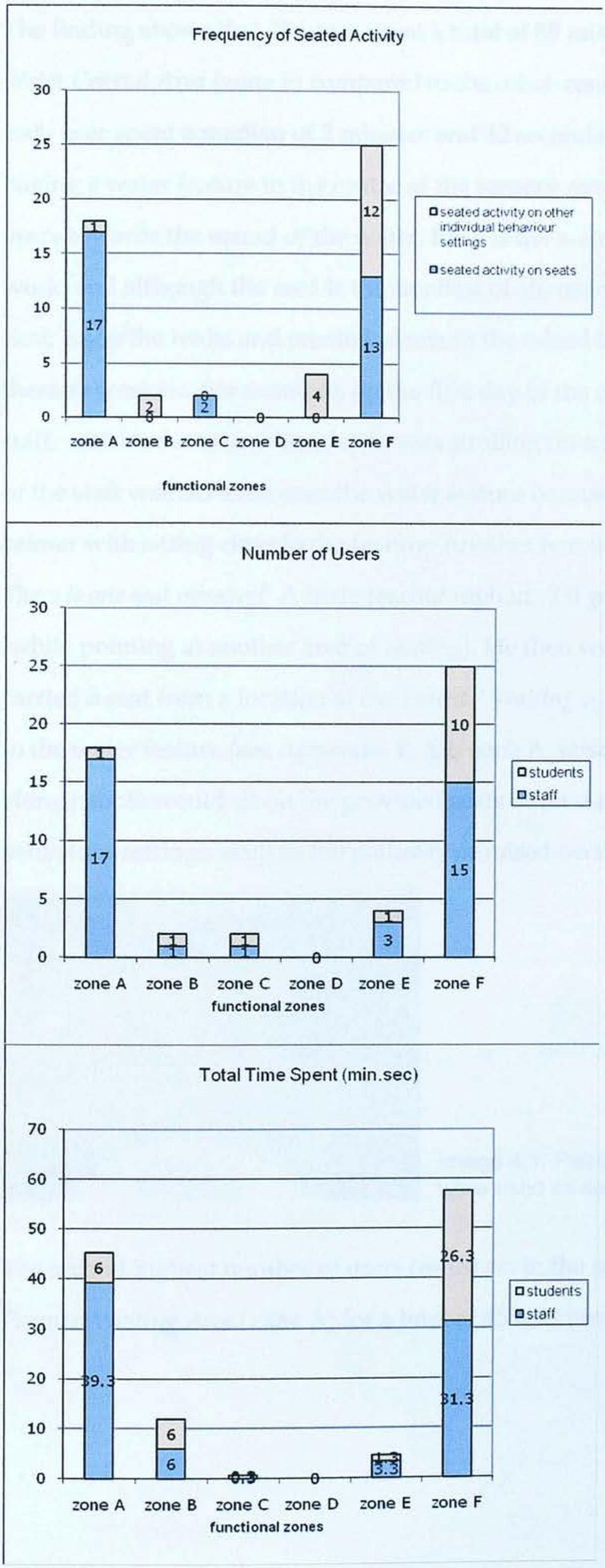
material was disliked by the users, especially wheelchair users (see Image 5.5, p.153). The willow tunnel offered a number of potential affordances, for example, a student on a specially-adapted bicycle wanted to cycle under it but did not manage because of the surface material and because the pathway led to a dead end.

The results, however, showed a significant difference between the users and activities they undertook in the *Green Space One* (as well as the other zones) where three staff and four students liked to brush against the shrub/scented plants, 12 staff and 15 students liked to smell the scented plants, one student liked tasting and eating the herbs, and three students liked touching the lighting bollards while passing through the sensory garden (see Image 5.6, p.154). All users engaged with these individual behaviour settings for less than 1 minute per user.

4.1.4 Frequencies of the seated activity

Although seated activity[54] had the least number of frequencies, compared to the other main activities, with a total of 51, it was established in which functional zones the users spent most or least time sitting while engaging with the individual behaviour settings. Seated activity is important for children with disabilities (for example, wheelchair users), who may have mobility impairment or may not be able to stand and move around easily. It was also established whether the seating provided in the sensory garden zones was used as it had been intended or whether users preferred to sit on other individual behaviour settings of their own choice, such as pathways or raised beds.

[54] Seated activity refers to users who sat either on seats or other individual behaviour settings in the sensory garden, including wheelchair users.



Legend:

zone A: *Parents' Waiting Area*

zone B: *Exploraway*

zone C: *Green Space One*

zone D: *Green Space Two*

zone E: *Asteroids Arts Garden*

zone F: *Water Central Area*

Chart 4.2: Frequencies of seated activity, the number of users and the total time spent recorded in the sensory garden of the RSDCD, according to the functional zones.

The finding shows that 25 users spent a total of 58 minutes sitting at the *Water Central Area* (zone F) compared to the other zones, which means that each user spent a median of 2 minutes and 32 seconds there. This is because having a water feature in the centre of the sensory garden appears to draw users towards the sound of the water. Even if the water feature does not work, and although the area is the smallest of all, users choose to sit there to chat, enjoy the herbs and scented plants in the raised beds and conduct therapy sessions. For example, on the first day of the observation, a group of staff, with students in wheelchairs, was strolling on a sunny afternoon. One of the staff wanted to sit near the water feature because her student felt calmer with sitting close to the feature. Another female teacher said, *'Oh! There is one seat missing!'* A male teacher replied, *'I'll go and get one there* (while pointing at another area of seating). He then went there, lifted and carried a seat from a location at the *Parents' Waiting Area* and placed it close to the water feature (see Appendix F, F.1, zone A, observation note no.2). Here, people would sit on the provided seats or on the other individual behaviour settings, such as the pathway or raised beds (see Image 4.1).

Image 4.1: Pathways and raised beds were used as seating.

The second highest number of users (n=18) sat in the sensory garden at the *Parents' Waiting Area* (zone A) for a total of 45 minutes and 30 seconds, which means that each user spent a median of 2 minutes and 52 seconds there. This was the largest zone, in terms of its total area and was provided with the greatest number of seats. For example, during the observation period, on a sunny day, a visually-impaired male student (Y1*) preferred to sit on the pathway rather than on a seat, while his female teacher (X1*) preferred to sit on a seat. *'I don't know why Daniel loves to sit on the pathway but he seems to enjoy it,'* said his teacher to a colleague who passed by (see Appendix F, F.1, zone A, observation note no.4). In contrast, the *Green Space Two* (zone D) had no users who utilised the area for seated activity, even though it is the third largest area in the sensory garden. This is probably due to the lack of variety of individual behaviour settings that are offered in this area compared with the other zones.

Of the *Exploraway* (zone B), *Green Space One* (zone C) and *Asteroid Arts Garden* (zone E), the first has the second largest area but the fewest number of people choosing to sit (n=2), with the longest time spent there of 12 minutes in total, compared to the *Green Space One* and *Asteroid Arts Garden*. This signifies that each user spent 6 minutes sitting on the pathway as no seats were provided in this area. These two users were a female teacher and a male student with a learning difficulty. She tried to attract his attention to the water feature but he went towards the noise (one of the school buildings was being refurbished in May. The work was completed in July). The student sat on the pathway near the construction fence and looked at the builders. Sometimes both parties communicated with one another (see Image 4.2 and Appendix F, F.1, zone B, observation note no.2).

* This coding can be referred in the SPSS software data in p.257.

Image 4.2: *Exploraway*. This was where a female teacher, together with a male student who had a learning difficulty sat on the pathway near the construction fence. No seats were provided here.

Similar to the *Exploraway, Green Space One* had two users who sat on a seat for a total of 1 minute (see Image 4.3). Although this zone has seating, the least amount of time was spent in it compared to the *Exploraway* and *Asteroid Arts Garden,* where one user spent only 30 seconds sitting at *Green Space One.*

Image 4.3: Picnic seat at the *Green Space One*.

Unlike the two zones mentioned above, the *Asteroid Arts Garden* had four users who sat on other individual behaviour settings, such as the rock sculpture (n=2) and wood edge (n=2) for a total of 5 minutes, which indicates that each user spent a median of 1 minute and 25 seconds there. Two staff sat on the rock sculpture and took photographs beside the feature. No seats were provided in this functional zone (see Image 4.4).

Image 4.4: Rock sculpture and wood edge used as seats at the *Asteroid Arts Garden*.

Below is a summary of the frequencies of seated activity and the total area of all the functional zones in the sensory garden of the RSDCD.

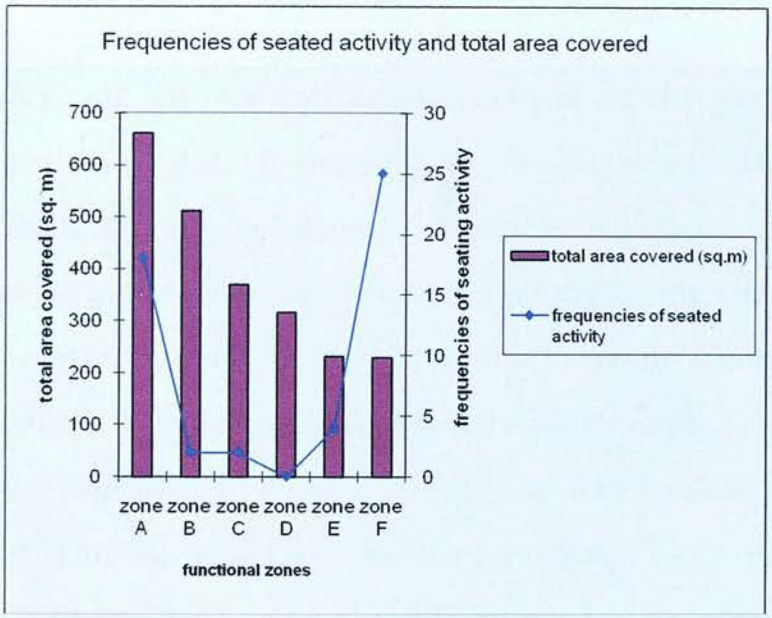


Chart 4.3: Frequencies of seated activity in which users engaged and the total area, recorded in the sensory garden of the RSDCD, according to the functional zones.

From Chart 4.3, zone F (*Water Central Area*) had the greatest frequency of seated activity engaged in by the users. In terms of the median time spent per user, zones B (*Exploraway*) and C (*Green Space One*) are comparable because both zones had 2 users who sat in the area. Although zone B offered six individual behaviour settings, the median time spent there per user was the highest recorded (6 minutes), compared to zone C with seven individual behaviour settings but the total time spent there per user was only 30 seconds. The highest number of seated users occurred in zone F (*Water

Central Area) with 25 users (2 minutes and 32 seconds per user), followed by zone A (*Parents' Waiting Area*) with 18 users (2 minutes and 52 seconds per user), then zone E (*Asteroid Arts Garden*) with 4 users (1 minute and 25 seconds per user), while no one sat in zone D (*Green Space Two*). According to the number of users, therefore, the number of individual behaviour settings and the total area did not relate to the length of the median time spent in a zone per user but, rather, it was the attractiveness and richness of the individual behaviour settings on offer that did.

4.2 <u>CASE STUDY 2: Lyndale School</u> (LS)

> A young boy was walking hand in hand with his teaching assistant in the sensory garden. He was wearing glasses and looked very charming. Both of them were silent - listening to the humming insects, chirping birds and the wind in the leaves. As they were strolling together, one of the sound stimuli went off by itself. The boy let go of his assistant's hands and ran towards the sound. Soon he managed to find the source of the sound, he walked towards the researcher and asked, *'Are you here to see the flowers? It's a nice garden, isn't it?'* He then smiled and continued strolling with his teaching assistant (see Appendix F, F.2, zones B and D, observation notes no.2 and 3, respectively).

Since the patterns of use in May and July were comparable, the data collected from these two observation periods are combined in the analysis. Similar to the first case study, Statistical Package for Social Science (SPSS) software was used to assess the differences in the two gardens' demographics, such that descriptive summaries of the case studies could be produced. For the purpose of this analysis, behaviour mapping data covered four functional zones with 27 individual behaviour settings (see Plan 3.2, p.108).

4.2.1 Frequencies of the patterns of use

In analysing the data, the sequence of information and how it is presented, this case study will be similar to the first, in order to identify the activities that were noted in the sensory garden.

The behavioural mapping data was coded by the time of observations, the type of weather, the gender of the users, whether the user was a student or a staff, the grouping categories, the functional zones of the sensory garden, the main activities in which the users engaged, the type of affordances that occurred in the garden, the number of users by showing their frequencies and their median time spent per person (see Appendix D, D.1). A summary was produced to assist the reader in understanding the data (see Table 4.2j, p.134 and Chart 4.4, p.135). Based on these tables and charts, Plan 4.2 (see p.136) illustrates the distribution of users in the sensory garden. Subsequently, the frequencies of seated activity (see Charts 4.5, p.141 and 4.6, p.143), according to the zones, will be analysed with the aid of a few selected photographs (see Images 4.5–4.8).

A summary of the frequencies of use recorded during the fourteen-day observation period and the behaviour mapping throughout all the functional zones in the sensory garden of the LS, is as follows (see Appendix D, Tables 4.2a–4.2i).

OBSERVATION CODES	FREQUENCIES (shown as 'n' value) for the sensory garden of the LS
Time (see Table 4.2a)	Users were in the sensory garden most between 10.30am – 11.00am (n=82). They used the garden mainly as an outdoor classroom. The least frequent usage occurred between 09.00am – 10.00am (n=30).
Weather (see Table 4.2b)	Users preferred being in the sensory garden when it was windy, dry and sunny (n=181). The least number of users seen in the sensory garden was when it was damp and cloudy (n=8).
Gender (see Table 4.2c)	More females (n=247) than males (n=186) used the garden.
Users (see Table 4.2d)	Students (n=220) used the garden more than staff (n=213). The ratio between students and staff is 1:1 throughout all of the functional zones.
Grouping categories (see Table 4.2e)	Students with staff had the highest frequency (n=219) of use. Students had the lowest frequency (n=4).
Functional zone (see Tables 4.2f-4.2i)	*Water Garden* had the highest frequency of users (n=350). *Rainbow Walk* had the lowest frequency of users (n=70).
Activity (see Table 4.2g, under Act2)	Walking with a wheelchair was the most frequent main activity undertaken by the users at the *Water Garden* (n=206) (see Chart 6.4). Sitting was the least frequent main activity in the *Water Garden* (n=2). Due to the nature of the students' physical abilities and the topography of the site, there were none on wheel frames or specially-adapted bicycles, unlike the students at the RSDCD.
Multiple affordances **Unique affordances**	*Woodland Garden* had the greatest frequency of multiple affordances (n=114). *Rainbow Walk* had the lowest frequency of multiple affordances (n=51). *Green Space* had the greatest frequency of unique affordances (n=17).

	Water Garden had the lowest frequency of unique affordances (n=13).
Both types of affordances (see Tables 4.2f - 4.2i, under Aff1, Aff2, Aff3 and Aff4)	*Green Space* had the greatest frequency of both types of affordances (n=107). *Water Garden* had the lowest frequency of both types of affordances (n=70).
Number of users and the median time spent per user (see Tables 4.2f, 4.2g and 4.2i, under Tsc1, Tsc2 and Tsc4)	*Water Garden* had the greatest number of users (n=350). The median time spent per user in this zone was 1 minute and 22 seconds. *Rainbow Walk* had the lowest number of users (n=70). The median time spent per user in this zone was 4 minutes and 17 seconds. *Woodland Garden* recorded no timescale of 'less than 1 minute' compared to the other zones. The second longest time spent by the users was recorded in this zone, with median time spent per user of 3 minutes and 54 seconds.

Table 4.2j: Summary of the frequencies of the greatest and lowest use of the sensory garden of the LS.

4.2.2 Frequencies of the users and main activities at the LS

Frequencies of the main activities, according to the functional zones, are referred to in Tables 4.2f – 4.2i of Appendix D (under Act1, Act2, Act3 and Act4). The total number of users (staff and students) is equivalent to the total number of main activities. Below is a summary of the frequencies of users and the total area of all the functional zones in the sensory garden.

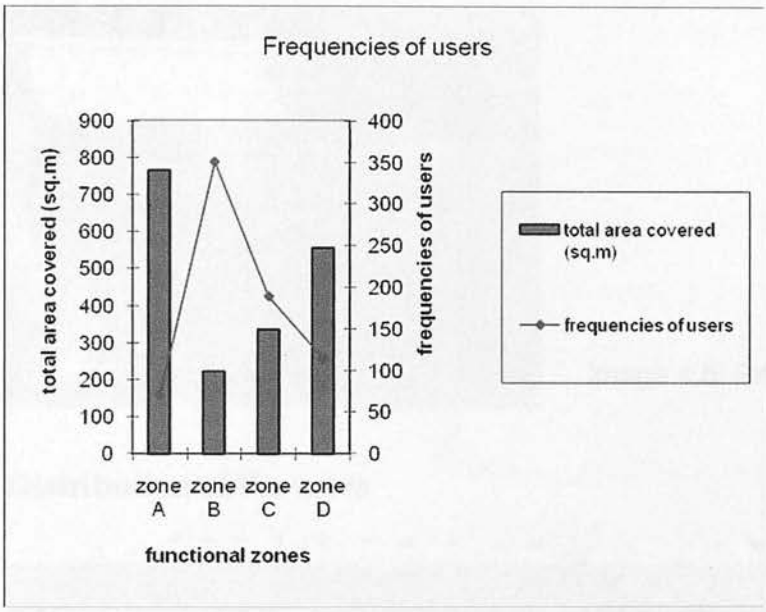


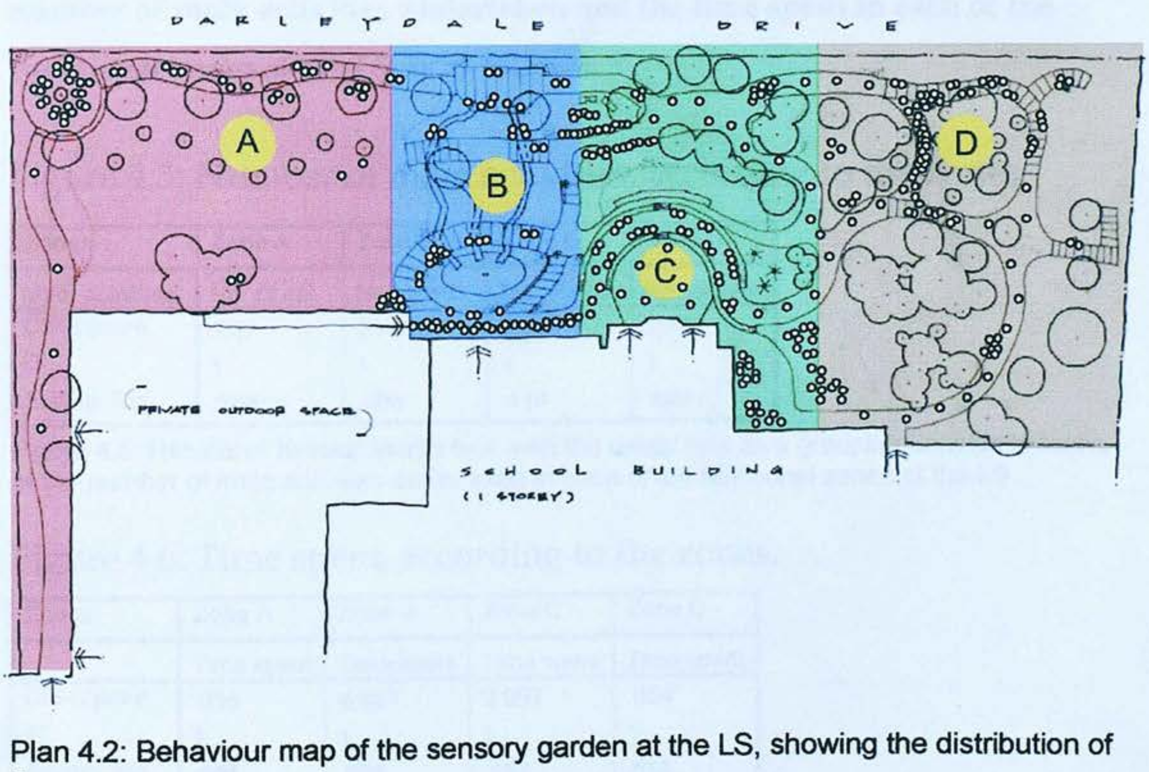
Chart 4.4: Summary of the frequencies of users recorded in the sensory garden of the LS, according to the functional zones.

Chart 4.4 shows that zone A (*Rainbow Walk*) had the largest area with the lowest frequency of main activities at 70. In contrast, zone B (*Water Garden*) had the smallest area with the highest frequency of main activities at 350. This is probably because the school is under-staffed for each classroom at playtimes. As a result, students and teachers use the pathway at zone B to go to their private outdoor play area (see Image 4.5) between 12.30pm – 2.30pm every day. While walking to this play area, users like to watch the tadpoles in the pond while talking about it. The results suggest that the accessibility in zone B afforded many functional properties related to engaging users in activities. In summary, the users' activities in the sensory garden were not dependent on the total area of each zone but rather the ease of accessibility.

The private outdoor play area is independent of the sensory garden. There are several private outdoor areas around this school, which are allocated to each classroom. Although safety considerations encourage use of this play area, it was a pity to see that the sensory garden was not being used to the maximum. Safety considerations include rubberised play surface and locked fence surrounding the play area.

Image 4.5: Private outdoor play area.

Distribution of the users



Plan 4.2: Behaviour map of the sensory garden at the LS, showing the distribution of the users.

With reference to Plan 4.2, the *Water Garden* (zone B) was comparable to the *Woodland Garden* (zone D) in terms of the number of individual behaviour settings, where both zones have the same number (n=7). However, the latter was used the most. The results suggest that the individual behaviour settings in zone D afforded many functional properties related to engaging users in activities. The findings signify that the users' activities in the sensory garden were not dependent on the number of settings but rather the functionality of the individual behaviour settings that were offered.

4.2.3 Results of the demographics using SPSS

Similar to the RSDCD, the next stage of the analysis began with an assessment of the differences in demographics.

i. **The comparison between the <u>users' role (student/staff)</u>, in terms of the number of main activities undertaken and the time spent in each of the functional zones at the LS, is as follows:**

Figure 4.5: Number of main activities, according to the zones.

Zones	Zone A	Zone B	Zone C	Zone D
Main activities	No. of act.	No. of act.	No. of act.	No. of act.
Chi-Square	.087	23.428	2.561	2.730
Df	1	1	1	1
Asymp. Sig.	**.768**	**.000**	**.110**	**.098**

Figure 4.5: Results of Kruskal Wallis test, with the users' role as a grouping variable in terms of the number of main activities undertaken in each of the functional zones at the LS.

Figure 4.6: Time spent, according to the zones.

Zones	Zone A	Zone B	Zone C	Zone D
	Time spent	Time spent	Time spent	Time spent
Chi-Square	.016	4.483	2.052	.054
df	1	1	1	1
Asymp. Sig.	**.901**	**.034**	**.152**	**.816**

Figure 4.6: Results of Kruskal Wallis test, with the users' role as a grouping variable in terms of the time spent in each of the functional zones at the LS.

Figures 4.5 and 4.6 clearly indicate that only zone B (*Water Garden*) has a significant difference between the students and the staff in the main activities undertaken and the time spent in the sensory garden. This means the students undertook a higher number of activities and spent a longer time than the staff in zone B.

ii. The comparison between gender, in terms of the number of main activities undertaken and the time spent in each of the zones at the LS.

Figure 4.7: Number of main activities, according to the zones.

Zones	Zone A	Zone B	Zone C	Zone D
Main activities	No. of act.	No. of act.	No. of act.	No. of act.
Chi-Square	.370	12.633	1.824	.909
df	1	1	1	1
Asymp. Sig.	**.543**	**.000**	**.177**	**.340**

Figure 4.7: Results of Kruskal Wallis test, with gender type as a grouping variable in terms of the number of main activities undertaken in each of the functional zones at the LS.

Figure 4.8: Time spent, according to the zones.

Zones	Zone A	Zone B	Zone C	Zone D
	Time spent	Time spent	Time spent	Time spent
Chi-Square	.196	.386	.021	2.639
df	1	1	1	1
Asymp. Sig.	**.658**	**.534**	**.884**	**.104**

Figure 4.8: Results of Kruskal Wallis test, with gender type as a grouping variable in terms of the time spent in each of the functional zones at the LS.

Of all zones in the sensory garden of the LS, only zone B (*Water Garden*) has a significant difference in terms of the main activities undertaken by females and males. However, none of the zones has a significant difference for the time spent by the gender. This means that the males undertook a higher number of activities than females in zone B but within the same time spent in the zone, as throughout all of the zones. A summary of these grouping variables, in terms of the main activities undertaken and the time spent in the LS sensory garden, is presented in Table 4.4:

Grouping Variables	Main activities/ Time spent	Significant/ No significant difference	Main findings of the demographics	Key features of the functional zone where significant differences were found
User (student/ staff)	Main activities	Zone B significant (see Figure 4.5)	The students undertook a higher number of activities and spent a longer time than the staff in zone B.	Zone B: ***Water Garden*** (223 sq. metres) Seven individual behaviour settings: boardwalks, steps, an interactive fountain, talking tubes, a pong, marginal plants and slate stone channels.
	Time spent	Zone B significant (see Figure 4.6)		
Gender (female/ male)	Main activities	Zone B significant (see Figure 4.7)	Males undertook a higher number of activities than females in zone B but within the same time spent throughout all of the zones.	
	Time spent	All zones not significant (see Figure 4.8)		

Table 4.4: Grouping variables and main activity/ time spent in the LS sensory garden to discover, which zone has/has not any significant difference, with the main findings of the demographics.

In the LS, the main findings in terms of users and activities/time spent showed that the students undertook a higher number of activities and spent a longer time than the staff in *Water Garden* (zone B). This is probably because in this zone:

- The greatest amount of time spent on an activity was on making use of the access-way from the school building to private outdoor area rather than to the sensory garden.
- The ramp and stairs, which are adjacent to the school building, were hardly used due to their slippery surface and inaccessibility to wheelchair users. Thus, the teachers prefer to use another route for access (see Image 1.8, p.26).
- The water feature only worked on the first day of observation in May but did not work throughout the whole observation period in July because of

a pump failure. As a result, a few teachers expressed their frustration at not having the interactive fountain working because some of their students loved watching it and talking about this design feature.

- A number of potential affordances were recorded in the *Water Garden*. For example, students in wheelchairs wanted to continue their exploration on the boardwalk but did not manage to do so because the path came to an end (see Image 4.7, p.142). As a result, one of the physically able students who was walking with his friend who was in a wheelchair just sat with a female teacher on the end of the boardwalk.

Despite that, the results showed a significant difference between the users and activities/time spent in the *Water Garden* where 13 students and three staff engaged with the talking tubes, 11 students and three staff liked to watch the tadpoles in the pond while talking about them, five students threw stones in the pond and two students crossed the water channel. The median time spent per user in this functional zone was higher for the students (71 minutes) than for the staff (33 minutes) (see Table 5.2b, p.227).

4.2.4 Frequencies of the seated activity

Similar to the first case study, seated activity had the least number of frequencies compared to the other main activities, with a total of 14. Seated activity is important for children who may have mobility impairment or may not be able to stand or move around easily. The analysis of seated activity was undertaken to find out in which area the users spent most or least time sitting while engaging with the individual behaviour settings and whether the seating provided in the functional zones was used as it had been intended or if users preferred to sit on other individual behaviour settings of their choice. The researcher also recorded a number of barriers that obstructed access, resulting in fewer seated activities.

Legend:

zone A: *Rainbow Walk*

zone B: *Water Garden*

zone C: *Green Space*

zone D: *Woodland Garden*

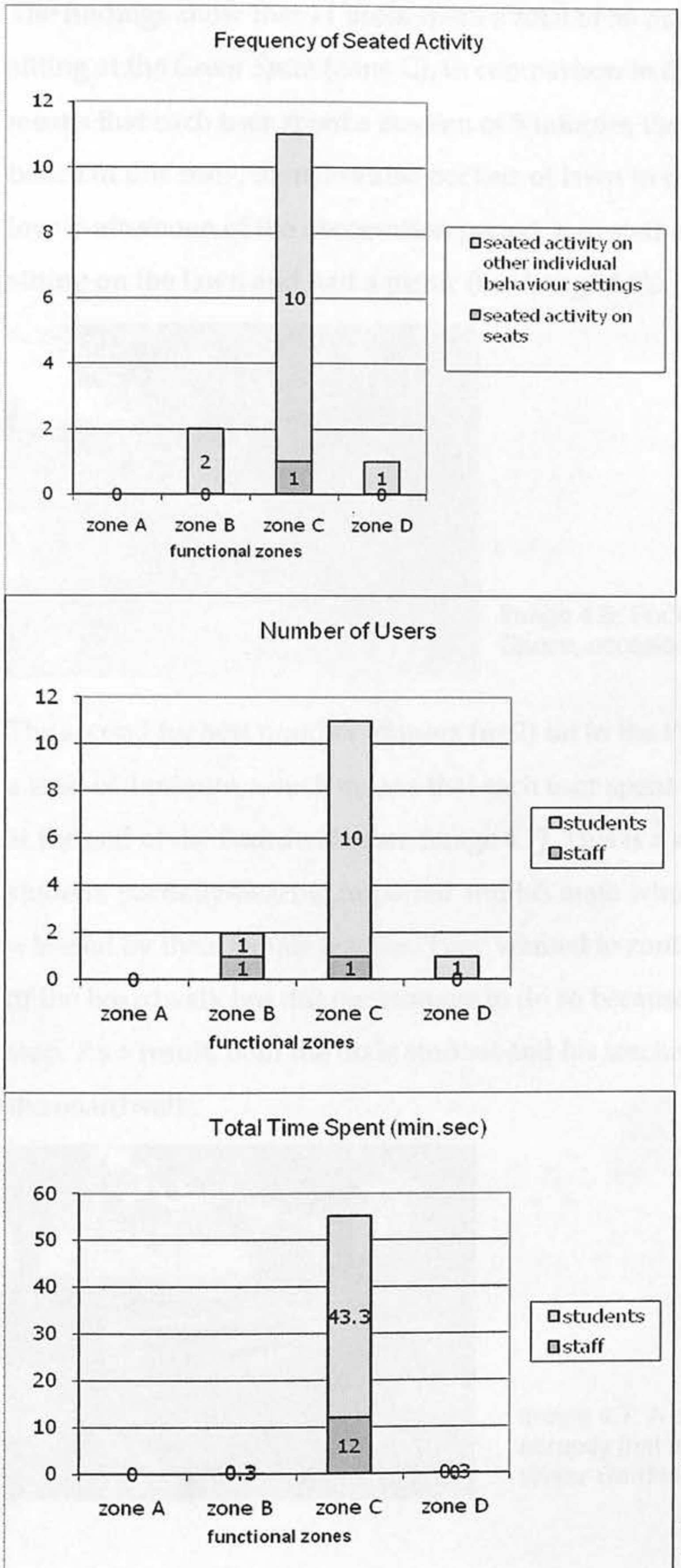


Chart 4.5: Frequencies of seated activity, the number of users and the total time spent recorded in the sensory garden of the LS, according to the functional zones.

The findings show that 11 users spent a total of 55 minutes and 30 seconds sitting at the *Green Space* (zone C), in comparison to the other zones. This means that each user spent a median of 5 minutes there. Apart from having a bench in this zone, there are also pockets of lawn to sit on. For example, on a lovely afternoon of the observation period, two staff and two students were sitting on the lawn and had a picnic (see Image 4.6).

Image 4.6: Pockets of lawn at the *Green Space*, occasionally used for sitting.

The second highest number of users (n=2) sat in the *Water Garden* (zone B) for a total of 1 minute, which means that each user spent only 30 seconds sitting at the end of the boardwalk (see Image 4.7). This is a reference to a male student, partially-hearing impaired and his mate who was in a wheelchair, wheeled by their female teacher. They wanted to continue their exploration of the boardwalk but did not manage to do so because the path came to a stop. As a result, both the male student and his teacher just sat on the end of the boardwalk.

Image 4.7: A pathway that stops abruptly that is used as seating at the *Water Garden*.

In contrast, the *Rainbow Walk* (zone A) had no users utilising the area for sitting, even though it is the largest area in the sensory garden. This is probably because no seats were provided and the pathway stops abruptly at the *Water Garden*. During the whole period of observation, none of the users complained about not having any seating. This is probably because this zone was used as an outdoor classroom for speech therapy, which affords jumping, stamping, skipping, clapping and singing.

On the other hand, the *Woodland Garden* (zone D) has no seats but a 3-D artwork display attracted a male student who chose to sit on the log platform for 30 seconds (see Image 4.8). Some students were observed engaging with the water trapped between logs while sitting on the artwork display.

Image 4.8: Log platform of an artwork display used as seating at the *Woodland Garden.*

Below is a summary of the frequencies of seated activity and the total area of all the functional zones in the sensory garden.

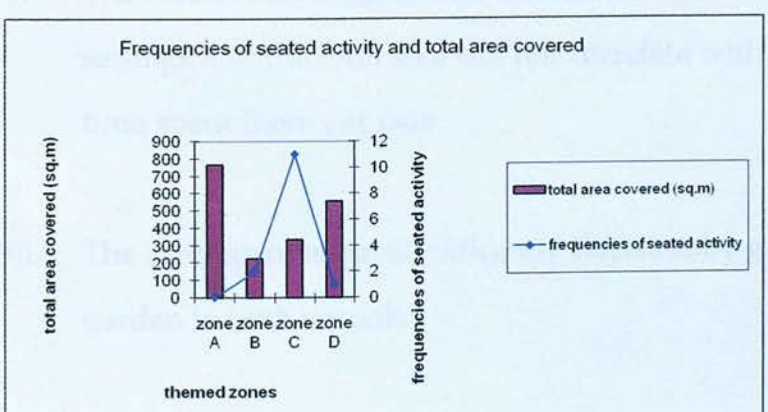


Chart 4.6: Frequencies of seated activity in which users engaged and the total area, recorded in the sensory garden of the LS.

Of all the zones in the sensory garden of the LS, zone C (*Green Space*) had the greatest frequency of seated activity with which users engaged. In terms of the median time spent per user, zone C had the longest median time spent per user of 5 minutes, followed by zones B (*Water Garden*) and D (*Woodlands Garden*), of 30 seconds. None of the users sat in zone A (*Rainbow Walk*). The results suggest that the number of users, the number of individual behaviour settings and the total area did not relate the median length of time spent per user but rather, it was the attractiveness and richness of the individual behaviour settings that were offered in the zone that did.

4.3 Key conclusions

This segment of the analysis correlated the total area of the sensory garden with the frequencies of users, the main activities and the seated activity that the researcher recorded during the behavioural mapping. The results signified that there are factors that influenced the pattern of use as follows:

i. The users' activities in the sensory garden were dependent neither on the size of the zone nor on the number of individual behaviour settings but rather on the functionality of the individual behaviour settings that were available.

ii. The results also suggest that the number of individual behaviour settings and the total area did not correlate with the median length of time spent there per user.

iii. The time spent is not significantly different by gender in the sensory garden in both schools.

iv. Correlations with the number of users and the time they spent sitting in the functional zones better related to the functionality of the individual behaviour settings than to the total area or the availability of seating. In other words, users used areas where they can sit in, rather than seats to sit on. Therefore, the focus on seated activity (sit-able) is an equal concern with moving because students with special educational needs sit in different individual behaviour settings than the staff.

In terms of the total area in each of the zones, a study by Bell (2006) reviewed the scale of spaces and described the differences in the way that children behave in differently sized spaces. Bell (2006:17) emphasised, '*children interact with spaces of different sizes in a variety of situations*'. He added that the size of a space proved to be significant in terms of the spatial interaction possibilities it offers between children (and adults) and their surroundings, based on research by Piaget and Inhelder (1956). Bell then concluded that the scale of an area could be considered as a vital variable in relation to behaviour, cognitive spatial development and the decision making of the users. However, the findings from this study did not support Bell's conclusions.

The next chapter describes the analysis of the actualised affordances, supplemented by selected anecdotal evidences.

CHAPTER FIVE

Analysis and Results of the Affordances

User behaviour in the sensory gardens was further analysed from the perspective of affordances. User behaviour was observed, recorded and listed under three affordances:

i. The level of affordances, i.e. actualised affordances (the potential affordances are listed in Appendix F). This signified the activities that were undertaken by the users in response to the individual behaviour settings.

ii. Unique affordances[55] and multiple affordances[56] (the unique and multiple affordances are listed in Appendix E). This illustrated whether there was a single or further opportunities for activities in which the users could be engaged.

iii. The types of affordances, i.e. positive affordances and negative affordances (the positive and negative affordances are listed in Appendix E). This differentiated the preferences and dislikes of the users in response to the individual behaviour settings of the sensory garden.

These affordances were tabulated to investigate the individual behaviour settings with which users' engaged the most or least, to give the researcher an idea about how sensory gardens could be structured and how they could offer a richness of affordances in their respective areas.

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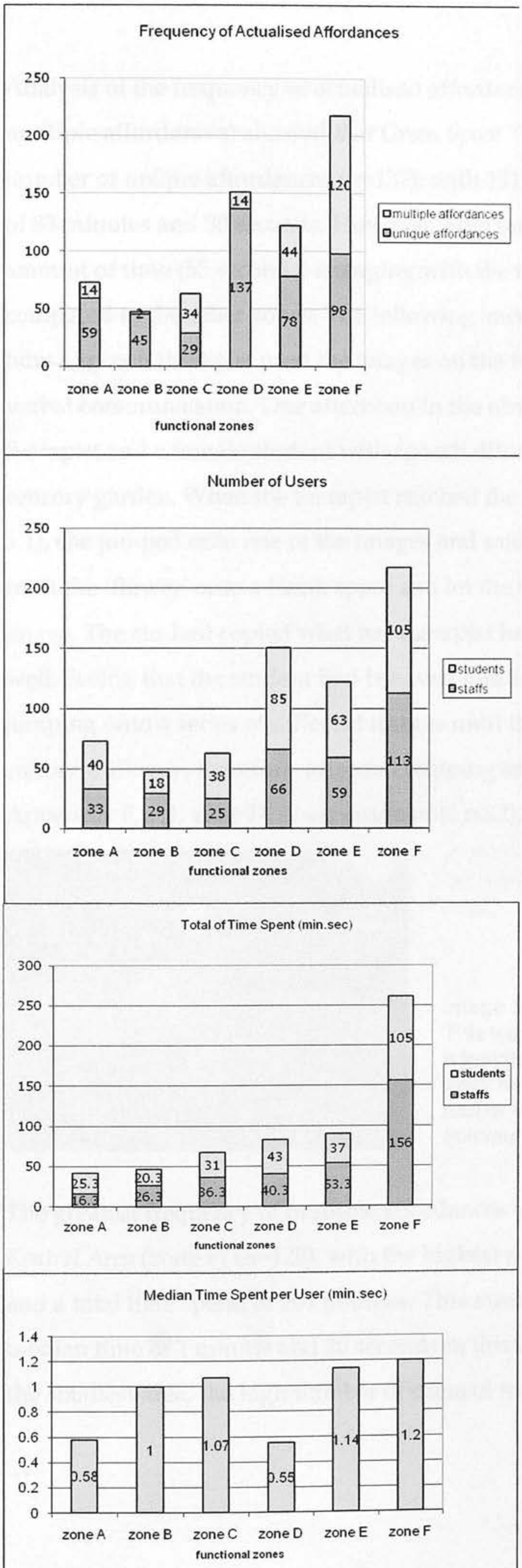
[55] Unique affordances mean a single opportunity of activity engaged in by users while in a specific setting.

[56] Multiple affordances mean two or more opportunities for the activities engaged in by users while in a specific setting.

5.1 CASE STUDY 1: Royal School of the Deaf and Communication Disorders (RSDCD)

The list of unique and multiple affordances that occurred, the number of users who engaged with the individual behaviour settings and the length of their engagement in the sensory garden of the RSDCD, according to the functional zones, have been tabled in Appendix E (see Tables 5.1a–5.1f). The affordances were then analysed by their frequencies (see Chart 5.1) and with the aid of a few selected photographs (see Images 5.1–5.8). Then a correlation between the total area with the frequencies of actualised affordances and the median time spent per user throughout all the functional zones in the sensory garden were analysed (see Chart 5.2).

5.1.1 Frequency of actualised affordances



Legend:

zone A: *Parents' Waiting Area*

zone B: *Exploraway*

zone C: *Green Space One*

zone D: *Green Space Two*

zone E: *Asteroids Arts Garden*

zone F: *Water Central Area*

Note:

The total time spent for the students and staff were combined in the median time spent per user.

Chart 5.1: Frequencies of actualised affordances recorded in the sensory garden of the RSDCD, according to the functional zones.

Analysis of the frequency of actualised affordances (unique affordances and multiple affordances) showed that *Green Space Two* (zone D) had the greatest number of unique affordances (n=137), with 151 users and a total time spend of 83 minutes and 30 seconds. However, here one user spent the least median amount of time (55 seconds) engaging with the individual behavior settings, compared to the other zones. The following anecdotal evidence illustrates how a speech therapist used the images on the rubber walkway to encourage verbal communication. One afternoon in the observation period, a female therapist and a female student with speech difficulties were strolling in the sensory garden. When the therapist reached the rubber walkway (see Image 5.1), she jumped onto one of the images and said, '*Flower!*' Then she jumped from the 'flower' onto a blank space and let the student jump onto the flower image. The student copied what her therapist had done and responded very well. Seeing that the student had behaved positively, the therapist continued jumping onto a series of different images until the end of the walkway. The rubber walkway, therefore, afforded jumping and communication (see Appendix F, F.1, zone D, observation note no.2).

Image 5.1: *Green Space Two* (zone D). This was where a speech therapist and a female student with speech difficulties were recorded using the images on the rubber walkway to encourage verbal communication.

The greatest frequency of multiple affordances was recorded at the *Water Central Area* (zone F) (n=120), with the highest number of users totalling 218 and a total time spend of 261 minutes. This means that each user spent a median time of 1 minute and 20 seconds in this zone. Even though zone F is the smallest area, the high number of users of it appears to be as a result of their enjoyment of the richness of individual behavior settings on offer, such as the pergola with scented climbers, raised beds with herbs and moss and seating, as well as the water feature. Of the actualised affordances observed at the *Water Central Area,* a hearing-impaired male student saw a slug on the raised bed while passing by the sensory garden. He picked it up and put it on his palm. His female teacher talked about it in sign language and with a facial expression that seemed to say, '*Eeugh... that's disgusting*!' She disliked it because it was slimy. The student laughed and put the slug back on the pathway (see Appendix F, F.1, zone F, observation note no.5). Another example of actualised affordances at the *Water Central Area* was when students on specially adapted bicycles liked to feel the moss on the raised beds while passing by (see Image 5.2).

Image 5.2: Students liked to feel the moss at raised beds.

There were three significant negative affordances recorded at the *Water Central Area.* Firstly, a female teaching assistant had a fear of getting wet at the water feature. She was sitting on the seat while another female teacher and a male student who was hearing-impaired, were busy playing with the water. Suddenly, the student scooped up the water with his hands and splashed it on his teacher who was sitting nearby. She jumped up and ran away. Both the remaining teacher and student had a good laugh (see Appendix F, F.1, zone F, observation note no.3). Secondly, the scented plants in the raised beds attracted wildlife, including bees, however, three staff and three students who passed by the sensory garden had a fear of getting stung.

Thirdly, a male student who was multi-disabled became agitated because it was too sunny. His accompanying female teaching assistant did not know what to do as the situation got out of control. A male teaching assistant, who happened to pass by, had to carry the student indoors (see Appendix F, F.1, zone F, observation note no.4).

On the other hand, potential affordances occurred at the *Water Central Area*. The water feature was not working due to pump failure (not until the 6th day of observation in May). As a result, a female teaching assistant (X1*) expressed her feelings that this was a pity because 'Daniel' (Y1*) loved to hear the sound of water and when he did, he would remain in the area for a longer period. When the water feature was working, students in wheelchairs wanted to feel the water but did not manage to do so because of the shrubs around the feature (see Appendix F, F.1, zone F, observation note no.6). This concurred with information provided in an interview the researcher conducted on with Walker and Barnett, teachers at the RSDCD (see pp.198-199). They also wanted to feel the plants in the raised beds but did not manage this either because of the height of the wall and for students who were more mobile, they had to step over or on the shrubs that were planted around the water feature before they managed to touch the water. Inevitably, some parts of the planting beds were sparse due to this (see Image 5.3).

Image 5.3: Shrubs planted around the water feature were seen by the users as a barrier to getting closer to this feature.

* This coding can be referred in the SPSS software data, p.257.

The *Asteroid Arts Garden* (zone E) had a total number of 122 users with the total time spent there slightly higher than for *Green Space Two* (zone C), at 90 minutes and 30 seconds. This denotes that each user spent a median time of 1 minute and 14 seconds in zone E. Although this zone is the second smallest area, compared to the other zones, the area offers a richness of individual behaviour settings, such as the balancing beam, the boardwalk, gravel, musical instruments, the rock sculpture and the wood edge. For instance, a male student, who was partially-hearing impaired, jumped over the low hedges to play with the musical instruments. He hit the keys for less than one minute and felt the vibration (see Image 5.4). His accompanying teacher had to wait for a while as he continued hitting the keys for another 30 seconds (see Appendix F, F.1, zone D, observation note no.1).

Image 5.4: *Asteroid Arts Garden* (zone E). A hearing-impaired male student was observed jumping over the low hedges. He wished to play with the musical instruments.

Another example of how users engaged with the musical instruments was where a female teacher would lift up and put one of the musical instruments in the lap of a male student who was in a wheelchair and in turn, he would hit it. Some students in wheelchairs wanted to play with all of the musical instruments but did not manage to do so because of the inaccessible surface material. On the other hand, a number of teachers and students who were not in wheelchairs enjoyed stamping on the boardwalk to make a noise.

Adjacent to the boardwalk, the wood edge had been engaged by a few users as a place in which to sit, balance and walk on it, while the rock sculpture was engaged by a male student with a hearing-impairment as a feature to step on, jump from, climb over, sit on and to take photographs of it (Appendix F, F.1, zone E, observation notes no.1-6).

The third smallest area, *Green Space One* (zone C) had 63 frequencies of actualised affordances with a total time spent there of 67 minutes and 30 seconds. This signifies that each user spent there a median of 1 minute and 7 seconds. Although this zone had one of the lowest frequencies of seated activity, it provided richness in terms of individual behaviour settings, which comprised lighting bollards, lawn patch, scented plants, seating, a *vaporised trail* with gravel and limestone block surfaces and a willow tunnel with bark chip surfaces. Among the settings mentioned, the willow tunnel had a less frequent number of users and actualised affordances due to its location at the end of the sensory garden (see Image 5.5), compared to the *vaporised trail*, seating, scented plants, lawn patch and lighting bollards, which are adjacent to the pathway. These individual behaviour settings had a greater number of actualised affordances as users liked to pass through the garden while stepping on the *vaporised trail*, touching and feeling the lighting bollards, smelling the scented plants or crossing over the lawn patch (see Image 5.6).

Image 5.5: The willow tunnel located at the end of the sensory garden has a number of potential affordances.

Image 5.6: Most users were seen stepping on the *vaporised trail*, touching the lighting bollards, smelling the scented plants or crossing over the lawn patch.

The following anecdote illustrates how users of the sensory garden utilised the willow tunnel:

One morning in the observation period, two female teachers decided to experience the willow tunnel with one male student who was in a wheelchair and one male student who was partially-sighted. The two teachers went through the willow tunnel and waited for more than five minutes as both of their students had a fear of going through the tunnel due to the changes in its material. One of the teachers tried to convince both students by saying, '*Come on, Steve…you can do it*!' while the other teacher walked through to the end of the willow tunnel and said, '*Look! I'm here*'. The students looked surprised. Then she walked back through the willow tunnel and cheered on both students to join them. The partially-sighted student put one foot tentatively on the chip-bark surfaces. He then smiled and walked slowly towards his teachers. As he approached, one of the teachers held his hands and said, '*Yes! You've made it!* The other student in his wheelchair was still on the pathway. He looked confidently at his mate and slowly wheeled his chair onto the bark surface. They continued to cheer him on. As he came closer to them, one of the teachers said, '*Well done, Steve!*' They then engaged with the willow tunnel. One teacher and one student played with some of the artwork displays while the other pair spread their arms wide while feeling the willow. The four of them finally walked towards the end of the willow tunnel and returned back to the pathway. The experience engaging with the willow tunnel increased the students' confidence.

The lowest frequency of actualised affordances was recorded at the *Exploraway* (zone B) with only 47 users and a total time spent there of 47 minutes. Although this is the second-largest area in terms of total area, one user spent one minute engaging with individual behaviour settings offered, namely, the lawn patch, lighting bollards, gravel and pathway. These settings are minimal compared to the other zones. The *Exploraway* with its gravel surface was underused due to its unsuitability for wheelchair users and mobility exercise (see Image 5.7). For example, students on a specially-adapted bicycle wanted to cycle on the *Exploraway* but they did not manage to do so because of the surface material. However, according to the designer, the *Exploraway* should be bumpier to offer mobility challenges.

Image 5.7: *Exploraway* with its gravel surface, which was inaccessible for wheelchair users, thus this area has the least number of actualised affordances.

When comparing the *Parents' Waiting Area* (zone A) and *Green Space Two* (zone D), the latter had a greater frequency of unique affordances (n=151) but both zones have the same frequency of multiple affordances (n=14). It was also recorded that users (n=73) spent the least time at the *Parents' Waiting Area* (only 42 minutes), which means each user spent a median of 58 seconds in this area (see Image 5.8).

Image 5.8: Users were recorded spending least time at the *Parents' Waiting Area* compared to the other zones.

To conclude, this signifies that the frequency of actualised affordances reflects the number of users, whereas the frequency of time spent cannot be taken to reflect the frequency of actualised affordances and the users, based on the evidence.

5.1.2 Patterns of use in the zones of the sensory garden

When the results for the total area were compared with the frequency of actualised affordances and the median time spent per user, this provided a better understanding of patterns of use (see Chart 5.2).

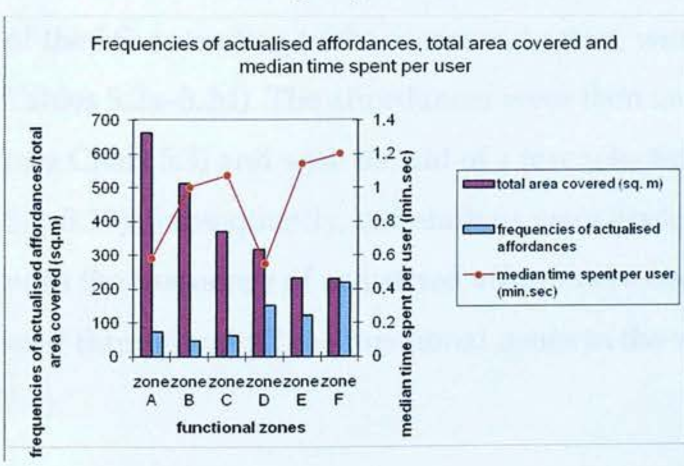


Chart 5.2: The pattern of actualised affordances with the total area, which users engaged and their median time spent per user, as recorded in the sensory garden of the RSDCD.

Note: The total frequency of actualised affordances is equivalent to the total number of users (shown as 'n' value).

Zone F (*Water Central Area*) had the greatest frequency of actualised affordances (n=218), the longest median time spent per user (1 minute 20 seconds) and offered eight individual behaviour settings. This zone had a high preference despite a few disadvantages mentioned by the interviewees and which were recorded during the observation and behaviour mapping (see p.151, para.2). In comparison to zone A (*Parents' Waiting Area*), which had the largest area, 58 seconds median time spent per user (73 users) and also offered eight individual behaviour settings, zone F was smaller but frequently used. The number of users, therefore, was influenced by the functional values of the individual behaviour settings, however, the number of individual behaviour settings and the total area of each zone did not appear to correlate with the median length of time spent there per user.

5.2 CASE STUDY 2: Lyndale School (LS)

Similar to the first case study, the list of unique and multiple affordances that were observed, the number of users who engaged with the individual behaviour settings and the length of their engagement in the sensory garden of the LS, according to the functional zones, were tabled in Appendix E (see Tables 5.2a–5.2d). The affordances were then analysed by their frequencies (see Chart 5.3) and with the aid of a few selected photographs (see Images 5.9–5.19). Subsequently, correlations were explored between the total area, with the frequency of actualised affordances and the median time spent per user throughout all the functional zones in the sensory garden (see Chart 5.4).

5.2.1 Frequency of actualised affordances

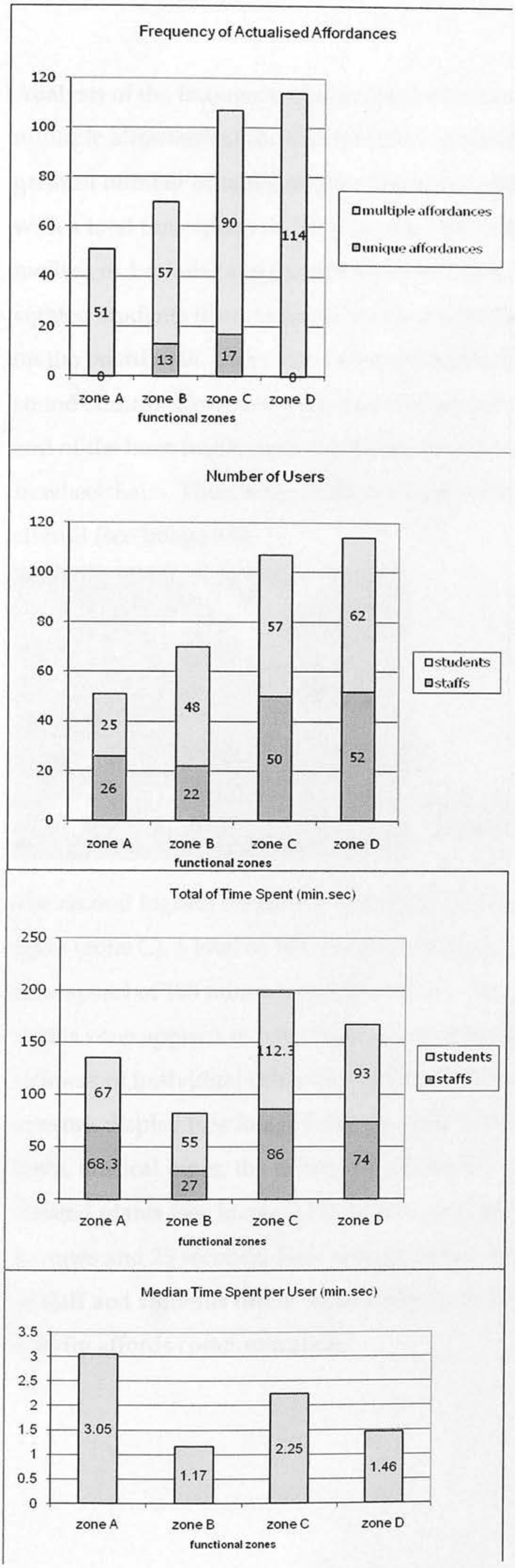
Legend:

zone A: *Rainbow Walk*

zone B: *Water Garden*

zone C: *Green Space*

zone D: *Woodland Garden*



Note:

The total time spent for the students and staff were combined in the median time spent per user.

Chart 5.3: Frequencies of actualised affordances recorded in the sensory garden of the LS, according to the functional zones.

Analysis of the frequency of actualised affordances (unique affordances and multiple affordances) showed that the *Woodland Garden* (zone D) had the greatest number of multiple affordances (n=114) but no unique affordances, with a total time spend of 167 minutes. This indicates that each user spent a median of 1 minute and 46 seconds in this zone. In this zone, partially-sighted students liked to touch, feel and hold the rope railing while walking on the boardwalk. Users also utilised the area to run about and listen to the sound stimuli. However, a few sound stimuli that had been installed at the end of the boardwalk created a 'bottle neck' for movement of those students in wheelchairs. Thus, some of them chose not to engage with the sound stimuli (see Image 5.9)

Image 5.9: One of the sound stimuli located at the end of the boardwalk.

The second highest frequency of actualised affordances was in the *Green Space* (zone C), a total of 107, adding both types of affordances, with a total time spend of 198 minutes and 30 seconds. The greatest amount of time spent in this zone appears to have been as a result of users' enjoyment of the richness of individual behaviour settings that were offered, such as the artwork display (see Image 5.10), covered tunnel (see Image 5.11), sloping lawn, musical pipes, the textured wall and the raised beds with herbs and scented plants (see Image 5.12). In this zone, each user spent a median of 2 minutes and 25 seconds. For example, in one speech therapy session, a group of staff and students threw water balloons at the textured wall. This fun activity affords communication.

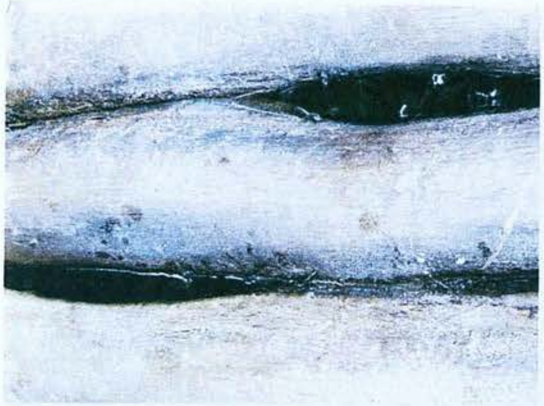


Image 5.10: Students were observed engaging with the water trapped between logs at the artwork display (see Image 4.8, p.143 for a more general view of the artwork display).

Image 5.11: A covered tunnel with climbers that had been installed in the sensory garden a few weeks before the observation period began in July 2007. It was woven by a group of students with the help of a specialist and their teacher. While walking underneath the covered tunnel, users were keen to take photographs of this feature.

Image 5.12: The richness of the individual behaviour settings at the *Green Space*.

Other actualised affordances observed at the *Green Space,* included students who were physically able, enjoying climbing up (sometimes using the log as a means to push off and then climb up) and coasting down the sloping lawn. Users also liked to walk on the pathway while brushing their legs and hands against the lavender (see Image 5.13).

Image 5.13: Lavender along the pathway at the *Green Space*.

One potential affordance was recorded at the Green Space. Students in wheelchairs could not reach up to touch and smell the herbs in the raised beds and often asked for staff assistance (see Image 5.14).

Image 5.14: Students in wheelchairs often asked for staff assistance (including via sign language), as they could not reach up to touch and smell the plants in the raised beds.

The smallest zone, *Water Garden* (zone B) had 70 frequencies of actualised affordances. Users spent the least time (82 minutes) in this zone due to the technical failure of the water feature. Instead, they used other individual behaviour settings such as, feeling the texture of slates, crossing over the water channel and/or watching tadpoles in the pond for a median time of 1 minute and 17 seconds per person (see Image 5.15). One of the teachers mentioned that it was unusual for the students and teachers to see tadpoles in the pond.

Image 5.15: The *Water Garden* offers the opportunity to feel the texture of the slates, watch tadpoles and to cross over the water channel.

A negative affordance was recorded at the *Water Garden*. Teachers were concerned about the surface of the boardwalk near the pond because it was slippery and hazardous for students. This corresponded with the teachers' interview where they said that this surface material was one of the least successful in terms of use. As a result, two staff and two students feared using the slippery boardwalk near the pond, so they used the steps instead (see Image 5.16).

Image 5.16: Some users preferred using the steps instead of the ramp at the end of the boardwalk, even though they were in their wheelchairs, due to the slippery surface.

Birds were also often seen taking a dip in the stone slate channels and chirping on trees in the sensory garden (see Image 5.17).

Image 5.17: A bird taking a dip in the stone slate channel.

Among the potential affordances that were observed, firstly, students in their wheelchairs wanted to continue their exploration of the boardwalk but did not manage to do so because the path came to an end (see Image 5.18). Secondly, the teachers expressed their frustration at the interactive fountain not working because some of their students loved watching and talking about this design feature.

Image 5.18: The boardwalk that stops abruptly at the *Water Garden*, hence students in wheelchairs had to turn back.

The least frequency was recorded at the *Rainbow Walk* (zone A) with only 51 multiple affordances but a greater total time spent there of 135 minutes and 30 seconds, compared to the *Water Garden*. This implies that each user spent a median of 3 minutes and 5 seconds in this zone. The teachers preferred to use this area as an outdoor classroom in support of the communication therapy. The activities that occurred there included cheering, singing, skipping, jumping, stamping their feet and clapping hands (see Image 5.19 and the anecdote evidence in p.110).

Image 5.19: Besides utilising the *Rainbow Walk* as an outdoor classroom, users also carried out tree-rubbing activities.

The following anecdote illustrates how users of the sensory garden utilised the *Rainbow Walk* as an outdoor classroom:

> One morning, a group of female staff and students with various kinds of impairment were walking hand in hand, through the sensory garden of the school to find the perfect tree to do some tree-rubbing. As they neared a huge shady tree, a teacher said, *'Let's feel this tree'*. She placed her hands on the tree trunk. A male student moved her hands over the bark and slid his arms around the trunk until they met. His face was touching the bark and he said, *'This is the perfect tree!'* So they all got out their paper and pencils and started a tree-rubbing activity (see Appendix F, F.2, zone A, observation note no.5).

In conclusion, similar to the RSDCD, the frequency of actualised affordances at the LS reflects the number of users. The frequency of time spent is different from the frequency of actualised affordances and the users.

5.2.2 Patterns of use in the zones of the sensory garden

A summary of the frequencies of the actualised affordances, the total area and the median time spent per user throughout all of the functional zones in the sensory garden of the LS as follows:

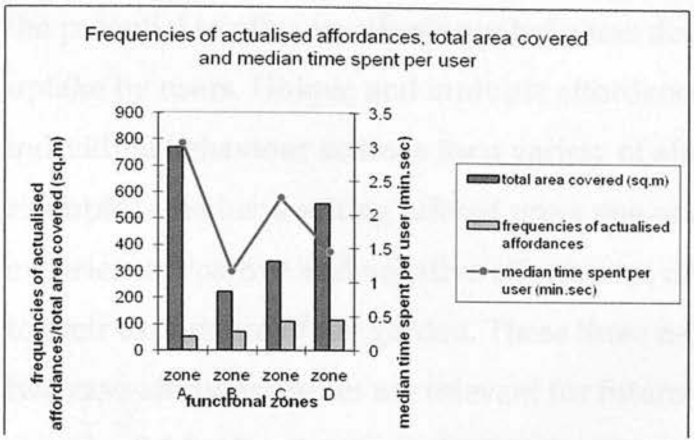


Chart 5.4: The pattern of actualised affordances with the total area, which users engaged and their median time spent per user, as recorded in the sensory garden of the LS.

Note: The total frequency of actualised affordances is equivalent to the total number of users (shown as 'n' value).

Although zone A (*Rainbow Walk*) had the lowest number of actualised affordances (n=51) and only offered four individual behaviour settings, the median time spent there per user was the highest, at 3 minutes and 5 seconds, compared to zone B, with more users (n=70), with seven individual behaviour settings on offer and with a median time spent per user of 1 minute and 17 seconds. Similar to the results for the RSDCD, the number of users was influenced by the functional properties of the garden features. However, the number of individual behaviour settings and the total area of the zone did not appear to correlate with the median length of time spent there per user. Zone A was used the most for speech therapy sessions and the water feature in zone B was not working during the observation period.

5.3 Key conclusions

This chapter describes the three types of affordances used in observing and recording the users' behaviour in the sensory garden: 1) the actualised and potential affordances; 2) the unique and multiple affordances; and 3) the positive and negative affordances. Actualised affordances recorded the activities users undertook that were afforded by the design of the garden as opposed to potential affordances, where an individual behaviour setting had

the potential to offer an affordance but some design limitation hindered uptake by users. Unique and multiple affordances assessed particular individual behaviour settings for a variety of affordances offered, for example, whether a setting offered users one or more affordances and a rich experience. Positive and negative affordances differentiated users' responses to their experience of the garden. These three recorded affordances for these two case-study examples are relevant for future designers of sensory gardens (see also 8.1.2, Users' engagement with the individual behaviour settings, pp.211-213).

Staff and students' activities in both special schools allowed these users to identify that the sensory gardens afforded them more benefits than disadvantages (see Tables 5.1a–5.1f and 5.2a–5.2d, pp.266-280). The results showed that both sensory gardens offered more positive affordances than negative ones, in terms of the engagement with sensory equipment, vegetation and wildlife as well as the social interaction among users (including via sign language).

The attributes of the sensory gardens that enabled user engagement with the individual behaviour settings and a variety of activities in the sensory garden were:

i. A functional circulation network from the school building to the sensory garden.

ii. A variety of individual behaviour settings placed adjacent to the pathway, which afforded diverse activities and easy wayfinding in the sensory garden and back to the school building.

iii. An appropriate gradient and hard surface material for a range of users, including wheelchair users and students on specially-adapted bicycles.

iv. Lush, rich flora and fauna, creating natural environments for ecological and sensory learning.

As a result, the functional values of the individual behaviour settings and good circulation networks were the properties of the sensory garden that afforded users the greatest chance to engage in a variety of activities and affordances. This concurred with Cosco's (2006) study on physical activity affordances in preschool play centres that diverse areas comprising pathways and features are likely to be the most active.

The next chapter describes the richness of the affordances and the experiences to be had in the sensory gardens, by producing a matrix of the actualised affordances in relation to the landscape design categories and three categories of activity that are afforded by: the **sensory stimulation** (touch, taste, smell, hearing, sight); **physical** (mobility) and **social skills** (speech), according to the functional zones in the sensory gardens. The landscape design categories comprise 'Soft Landscape', 'Hard Landscape' and 'Landscape Furniture'.

CHAPTER SIX

Analysis of the Actualised Affordances in relation to the Landscape Design Categories

'All landscapes induce sensory responses but it is the concentration of them which gives sensory school grounds their identity. Many landscape architects make the mistake of assuming that, because a child has a reduced sensory range, he or she needs an emphasis of the remaining senses'

(Lucas, 1996:27)

The purpose of this part of analysis was to examine 'sensory function' based on observations of how users engage their senses to receive, interpret and, consequently, to behave in relation to the individual behaviour settings in the sensory gardens of the RSDCD and the LS. This was achieved by:

i. **Recording the numbers of individual behaviour settings with which users engaged, specifically, the number of items of sensory equipment, design features, vegetation and the animals with which users played in/amongst, visited or encountered during the observation period.**

Based on the actualised affordances that occurred in both case-study gardens, these were then categorised as relating to **'Soft Landscape', 'Hard Landscape'** or **'Landscape Furniture'**. Soft landscape consists of planted areas, trees, shrubs, grass (Hill, 1995:317). Hard landscape consists of hard surfaces, structures, planters (Hill, 1995: 241). Landscape furniture consists of seating, litter bins, lighting, signs, bollards, play structures, shelters (Hill, 1995:291).

Other categories include Animals (for example bees, butterflies, birds, slugs, cats), Microclimate (such as thunder, rainwater, sun, wind) and Artefacts (includes planes, log, artworks, crane, chimes). Animals and Microclimate belong to the Soft Landscape category while Artefacts belongs to the Hard Landscape category. A water feature was a feature in each of the sensory gardens. It has been classified as a hard landscape feature because the construction of both involved using a hard durable material; the water itself is, of course, a natural feature.

ii. **Looking into the types of activities undertaken by the users, the number of users and the total length of time spent per user in the sensory gardens.**

These actualised affordances were then put into three categories: **sensory stimulation** (touch, taste, smell, hearing, sight); **physical** (mobility) and **social skills** (speech and communication) in a matrix form. These categories were produced from a combination of the taxonomy of environmental qualities by Heft (1988, 1999) and Kytta (2002, 2003) (see Table 2, p.60) and drawing on this research experience, especially when dealing with students with special educational needs.

A matrix of the actualised affordances in relation to the landscape design categories, the number of users (staff and students) and the median time they spent there was produced according to the functional zones in the respective sensory garden (see Appendix G).

6.1 CASE STUDY 1: Royal School for the Deaf and Communication Disorders (RSDCD)

> The weather forecast had been correct: it had rained heavily the night before. Early next morning, a young boy was passing through the sensory garden with his teaching assistant on his way to class. As they were walking past the water feature, the boy stopped and wanted to play with the water but the fountain was not working. He turned around, looking disappointed. Then he saw a big puddle in the middle of the pathway. He ran towards it and began to splash the water with his feet. He was very excited when some water sprinkled onto his hands. His teacher let him play for a while and later signed to him that it was time to go (see Appendix F, F.1, zone D, observation note no.3).

What were, and how did, the individual behaviour settings of the sensory garden, as engaged with by the users, contribute to their behaviour? The sensory garden of the RSDCD was divided into six functional zones with 49 individual behaviour settings (see Plan 3.1, p.97). These settings, such as plants afforded users for wayfinding (see p.105, para.3), the chance to encounter some familiar features, such as lavender (see p.100) and unfamiliar features such as the willow tunnel (see the anecdotal evidence, p.154). These examples illustrate that the students respond in fundamentally different ways when they encounter familiar or unfamiliar features.

In addition, the individual behaviour settings also afforded the students the opportunity to interact with other users of the sensory garden, such as their peers, teachers and therapists. Many social skills were recorded, including talking about the scented plants, greeting each other, singing, laughing, communicating (including via sign language) and cheering. As such, students' use of utilising the sensory garden at the RSDCD appeared to offer students a stimulating experience as well as influence their behaviour and their development in terms of social relationships.

6.1.1 Patterns of use with the individual behaviour settings

As mentioned earlier in this chapter, the actualised affordances that occurred in case-study sensory garden were categorised into three categories: 'Soft Landscape', 'Hard Landscape' or 'Landscape Furniture'.

6.1.1a Individual behaviour settings of soft landscape

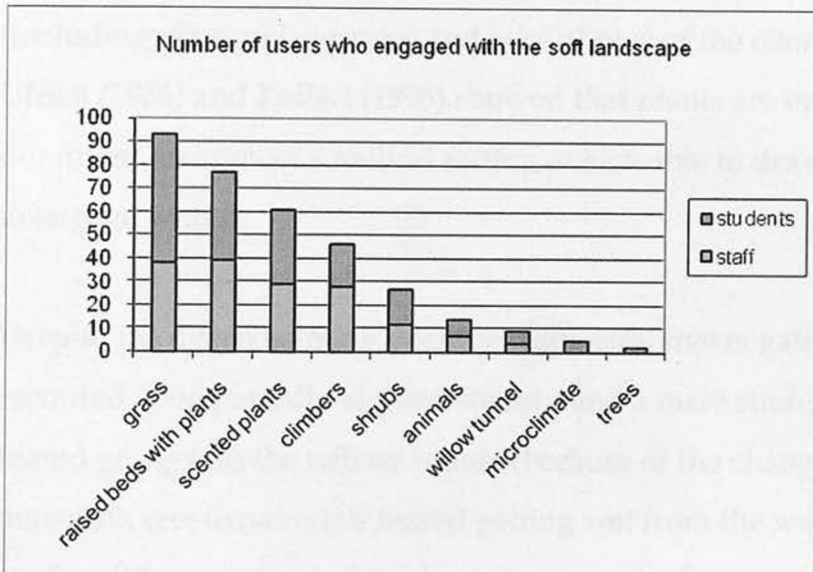


Figure 6.1: Individual behaviour settings of soft landscape with which users engaged and the median time spent per user in the sensory garden of the RSDCD.

Behaviour settings of soft landscape	Number of users	Median time spent per user (min.sec)
Grass	93	1.17
Raised beds with plants	77	1.29
Scented plants	61	0.56
Climbers	46	1.33
Shrubs	27	3.26
Animals	14	1.43
Willow tunnel	9	4.28
Microclimate	5	1.06
Trees	2	0.30
TOTAL	334	426.0

In terms of the median time spent per user, the results were highest in relation to the willow tunnel and shrubs. These individual behaviour settings recorded more than twice as long spent there as on any other settings. In the case of the willow tunnel, almost exactly three times the time spent on animals, the next most popular affordance after shrubs.

In summary, the soft landscape features that offered positive affordances were grass, raised beds with plants, scented plants, climbers, shrubs and trees. Users felt connected to the climbers, which were planted for the pergola, because they offered scented flowers with vibrant colour and provided shade for the users while they walked underneath them. This soft landscape feature afforded users the chance to pluck, feel, smell, talk about it (including via sign language) and take photos of the climbers. Findings from Ulrich (1986) and Kellert (1993) showed that plants are one of the most dominant features in a natural setting, which able to draw and attract users to engage with it.

Despite the overwhelming positive responses, five negative responses were recorded. One partially-sighted student and a male student in a wheelchair feared going into the willow tunnel (because of the change in the surface material), one female staff feared getting wet from the water feature, three staff and three students feared getting stung by bees, one female staff disliked the slug because it was slimy and one student with multiple disabilities got agitated by the microclimate (see the anecdotal evidence, pp.150-151). According to Ulrich (1993), fear of natural landscapes, including animals such as bees is known as a *'biophobia'*. This term refers to a behavioural reaction in individuals, who have a fear of animals or plants, which they feel are threatening to them. In the RSDCD, those users who had a fear of getting stung by bees and a fear of the depth of the willow tunnel were clearly showing negative responses that they sensed very strongly, such that it inhibited their full enjoyment of the RSDCD garden. The recorded behaviour shows that users recognised bees and the willow tunnel, which they felt offered negative affordances, thus their cognitive functioning was sufficiently acute, such that it allowed them to recognise the potential threats of the bees and the willow tunnel.

6.1.1b Individual behaviour settings of hard landscape

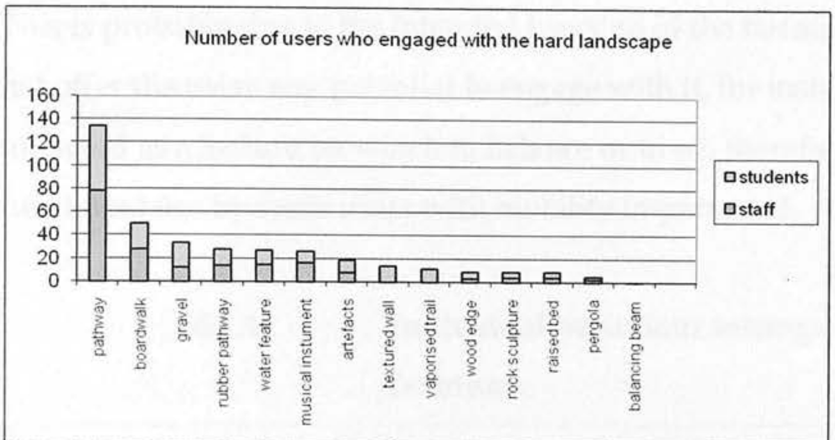


Figure 6.2: Individual behaviour settings of hard landscape with which users engaged and the median time spent per user in the sensory garden of the RSDCD.

Behaviour settings of hard landscape	**Number of users**	**Median time spent per user (min.sec)**
Pathway	134	1.19
Boardwalk	50	0.5
Gravel	34	0.5
Rubber pathway	28	0.5
Water feature	27	3.05
Musical instruments	26	1.28
Artefacts	19	2.23
Textured wall	14	0.5
Vaporised trail	11	0.48
Wood edge	9	1.10
Rock sculpture	9	1.14
Raised beds	9	3.25
Pergola	5	0.46
Balancing beam	1	1.3
TOTAL	**376**	**383.0**

In terms of the median time spent per user, it is interesting to note that, apart from artefacts, users spent more than twice as long at the water feature and the raised beds as on any other affordance. In terms of the hard landscape, it was recorded that users preferred to engage with the individual behaviour settings, which are placed along the pathway that afforded many functional and different activities. This result supports the finding from Chart 5.2 (see p.156) that the numbers of users were influenced by the functional properties of the individual behaviour settings. However, the number of users did not appear to correlate with the median length of time spent there per user. The results also suggest that users engaged least with the balancing beam (n=1). This is probably due to the intended function of the beam, such that it did not offer the users any potential to engage with it, for instance, it was intended as a feature on which to balance or to sit, therefore, it had limited functional use by some users with mobility impairment.

6.1.1c Individual behaviour settings of landscape furniture

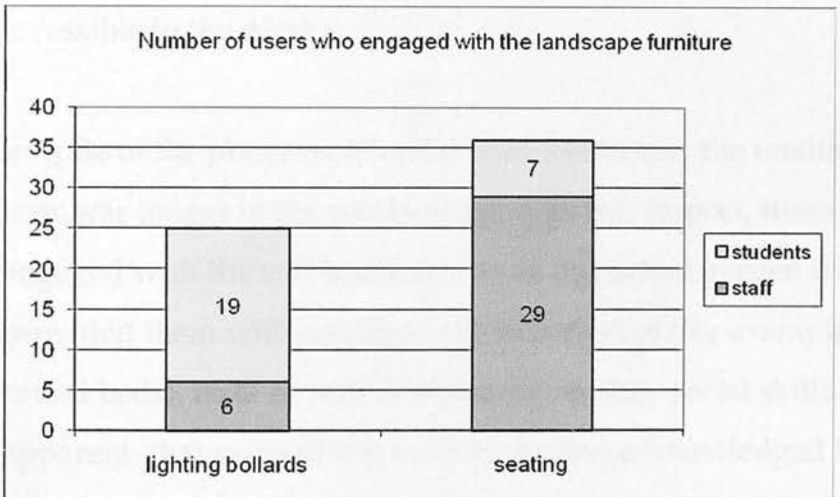


Figure 6.3: Individual behaviour setting of landscape furniture with which users engaged and the median time spent per user in the sensory garden of the RSDCD.

Behaviour settings of landscape furniture	Number of users	Median time spent per user (min.sec)
Seating	36	2.23
Lighting bollards	25	0.52
TOTAL	**61**	**3.15**

In the observation notes taken during the behaviour mapping, it was clear that the lighting bollards had not worked since day one of the opening of the sensory garden. Instead, they had been used for touching, shaking, holding, feeling and staring while passing through the garden. Some lighting bollards had been broken into pieces while some were not attached to the stand. Conversely, besides sitting on the seating, some students used it for lying on.

Triangulation of the results above suggested that the number of users who engaged with hard landscape affordances was higher than the number of users who engaged with soft landscape. Here, the users identified the functional properties of the hard landscape that offered them diverse activities. This finding also concurred with a research study by Moore and Cosco (2007:99) on inclusive parks that found '*users were more attracted by the areas with manufactured play structures…*' From the researcher's observation, this is probably because the water feature and musical instruments are located along pathway, while the boardwalk and rubber pathway are accessible to the users.

In spite of the preference for the hard landscape, the median time spent per user was longer in the soft landscape. In this respect, users seem more engaged with the soft landscape as an important garden feature, which provided them with scents, tactile experiences (for example, moss on the raised beds), taste as well as encouraging their social skills. It also seem apparent that users of this sensory garden acknowledged hard landscape as a significant feature in the garden also recognising soft landscape as a feature with which to engage in a garden. As such, when either the hard or soft landscape was unavailable, the user would miss some of the opportunities presented by the sensory garden.

It is important to offer a diversity of experiences in a sensory garden to meet all types of user need and ability. For example, a small group of students with disabilities might want to do something that the other students do not want to do. The full range of needs, expectations and aspirations of all users should be taken into account.

6.1.2 Frequencies of sensory stimulation, physical and social skills

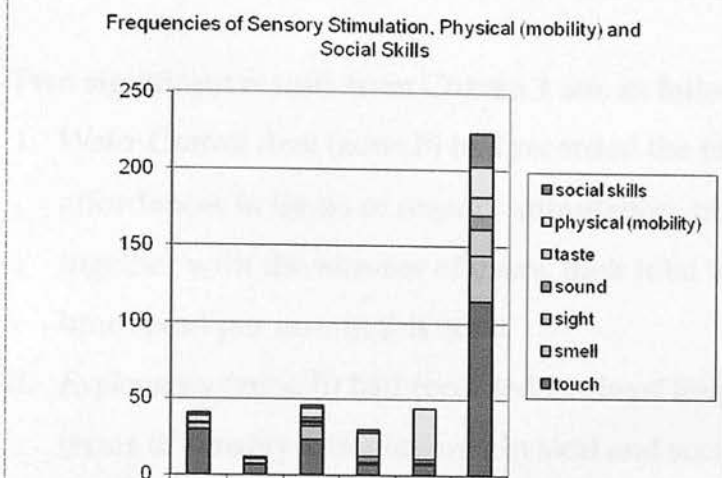
A summary from the matrix in Appendix G (Tables 6.1a–6.1f) of the actualised affordances throughout all the functional zones in the sensory garden (see Table 6.1, p.177) and Chart 6.1 (see p.178) were analysed as follows:

<u>Legend</u>

Soft L.	Soft Landscape
Hard L.	Hard Landscape
Land. F.	Landscape Furniture
NoU	Number of Users
TTS/TTSPU	Total Time Spent/Total Time Spent Per User
F	Staff
T	Students
Phy.Soc.	Physical and Social skills
Act.	Activities

Functional zone/ Total area	Affords	The Landscape Design Categories, the Number of Users and the Total Time Spent/User (min.sec)														
	SENSORY STI. PHYSICAL and SOCIAL SKILLS	Soft L.	NoU		TTS/TTSPP		Hard L.	NoU		TTS/TTSPP		Land. F.	NoU		TTS/TTSPP	
			F	T	F	T		F	T	F	T		F	T	F	T
Zone A/ *Parents Waiting Area* 660 sq.metres	3 senses (10 act)/ 2 phy.soc. (5 act)	13	9	21	4.30 /.30	10.30 /.30	10	32	30	16.0 /.30	20.30 /.30	17	17	0	25.30 /1.49	0
Zone B/ *Exploraway* 511 sq.metres	2 senses (6 act)/ 2 phy.soc. (4 act)	3	9	9	10.30 /1.14	10.30 /1.14	7	20	8	26.0 /1.30	20.30 /2.54	1	3	3	1.30 /.30	1.30 /.30
Zone C/*Green Space One* 316 sq.metres	5 senses (14 act)/ 2 phy.soc. (6 act)	39	44	49	62.30 /1.42	60.0 /1.22	2	3	12	12.30 /4.1	17.0 /1.42	5	1	4	.30	2.0
Zone D/*Green Space Two* 370 sq.metres	2 senses (9 act)/ 2 phy.soc. (6 act)	11	32	42	23.30 /1.07	21.0 /.30	13	40	39	20.0 /.30	19.30 /.30	5	3	12	1.30 /.30	6.30 /.30
Zone E/ *Asteroid Arts Garden* 231 sq.metres	3 senses (5 act)/ 1 phy.soc.(11 act)	1	1	2	.30	.30	42	85	83	89.30 /1.05	55.0 /1.06	0	0	0	0	0
Zone F/*Water Central Area* 230 sq.metres	5 senses (36 act)/ 2 phy.soc.(13 act)	137	215	169	433.0 /2.01	342.0 /2.02	78	68	76	186.0 /2.74	185.0 /2.43	15	11	7	16.30 /1.48	9.30 /1.33

Table 6.1: Summary from the matrix of the actualised affordances in relation to the landscape design categories, the number of users and the total time spent per user, utilising their sensory stimulation, physical and social skills, throughout all the functional zones in the sensory garden of the RSDCD.



	zone A	zone B	zone C	zone D	zone E	zone F
social skills	2	1	2	2	0	22
physical (mobility)	4	3	6	15	33	20
taste	0	0	2	0	0	12
sound	0	0	1	4	2	9
sight	1	1	2	1	1	17
smell	4	0	9	0	0	30
touch	29	6	23	7	7	114

Legend:

zone A: *Parents' Waiting Area*

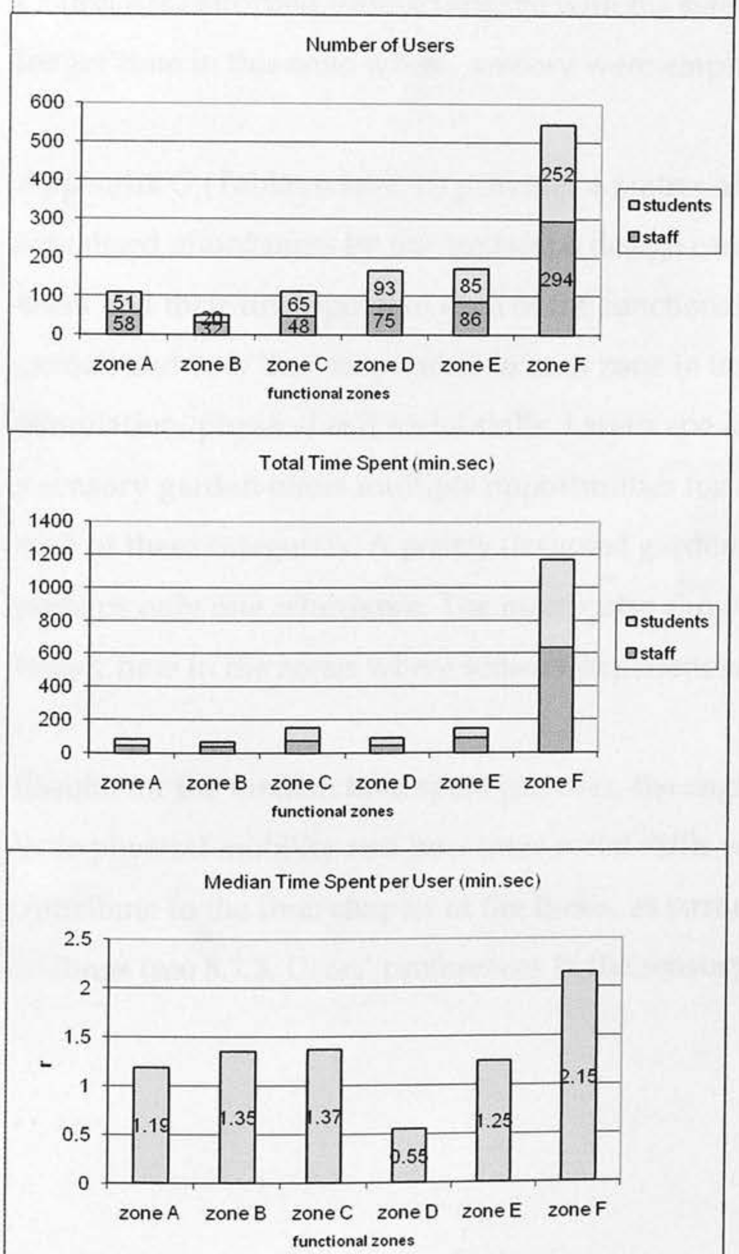
zone B: *Exploraway*

zone C: *Green Space One*

zone D: *Green Space Two*

zone E: *Asteroids Arts Garden*

zone F: *Water Central Area*



Note:

The total time spent for the students and staff were combined in the median time spent per user.

Chart 6.1: Summary of sensory stimulation, physical (mobility) and social skills recorded in the sensory garden of the RSDCD, according to the functional zones.

Two significant results from Chart 6.1 are, as follows:

i. *Water Central Area* (zone F) had recorded the highest frequencies of affordances in terms of sensory stimulation, physical and social skills, together with the number of users, their total time spent and the median time spent per user in this zone.
ii. *Exploraway* (zone B) had recorded the least frequencies of affordances in terms of sensory stimulation, physical and social skills, together with the number of users and the total time spent. However, the least median time spent per user was recorded in *Green Space Two* (zone D).

The results show that the richness and functionality of individual behaviour settings, located along an accessible and continuous pathways at the *Water Central Area* afforded users to engage with the settings, thus will spend a longer time in this zone where, sensory were emphasised.

Appendix G (Tables 6.1a–6.1f) provides a matrix of the frequencies of actualised affordances by the landscape design categories, the number of users and their time spend in each of the functional zones in the sensory garden and how they responded to each zone in terms of their sensory stimulation, physical and social skills. Landscape architects must ensure that a sensory garden offers multiple opportunities for affordances in terms of each of these categories. A poorly designed garden would offer none or perhaps only one affordance. The matrix also showed that users spent a longer time in the zones where sensory experiences were offered.

Results for the median time spent per user, the engagement of their senses, their physical mobility and how their social skills were encouraged, contribute to the final chapter of the thesis, as part of the research main findings (see 8.1.3, Users' preferences in the sensory garden, pp.213-214).

6.2 CASE STUDY 2: Lyndale School (LS)

It was a misty morning. A young boy with his teaching assistant was having a leisurely walk in the *Woodland Garden*. As they walked on the boardwalk underneath a shady canopy, the teaching assistant jumped and grabbed a branch. The boy looked at her and wondered why she had done that. *'I have a surprise for you… are you ready?'* she asked. Both of his hands were holding the rope railing while jumping with excitement. The teaching assistant had a good grip of the branch, ready to give him a big surprise. She shook it hard with both of her hands and down came drips of rainwater from the leaves. The boy was so surprised; he let go of his hands that were holding the rope railing and lifted his arms up while his face looked up to the sky. He was feeling and touching the rainwater. At one point, he opened his mouth to taste it. When the rainwater became less, the teaching assistant stopped and laughed, as both of them got wet (see Appendix F, F.2, zone D, observation note no.5).

Comparable to the RSDCD case study, further analysis of the users' roles (students and staff) and the total time spent per user engaging with the individual behavior settings in the sensory garden of the LS were divided into three categories: Soft Landscape, Hard Landscape and Landscape Furniture. From this, a matrix of the actualised affordances in relation to the landscape design categories, the number of users and the median time spent per user was produced, according to the functional zones in the sensory garden (see Appendix G, Tables 6.2a–6.2d).

What were, and how did, the individual behaviour settings of the sensory garden, as engaged with by the users, contribute to their behaviour? The sensory garden of the LS was divided into four zones with 27 individual behaviour settings (see Plan 3.2, p.108). These settings, afforded the students the chance to encounter some familiar features, such as the apple trees (see p.207) and unfamiliar features such as the tadpoles which the users found unusual to have in their pond (see Image 5.15, p.162). Both of these examples illustrate that the students respond differently when they encounter familiar or unfamiliar features.

The individual behaviour settings also afforded the students the opportunity to interact with other users of the sensory garden, such as their peers, teachers and therapists. Many social skills were recorded, including talking about the scented plants and herbs, singing, laughing, cheering, communicating (including via sign language), reading and counting. As such, students' use of utilising the sensory garden at the LS appeared to offer students a stimulating experience as well as influence their behaviour and their development in terms of social relationships.

6.2.1 Patterns of use with the individual behaviour settings

As mentioned earlier in this chapter, the actualised affordances that occurred in case-study sensory garden were categorised into three categories: 'Soft Landscape', 'Hard Landscape' or 'Landscape Furniture'.

6.2.1a Individual behaviour settings of soft landscape

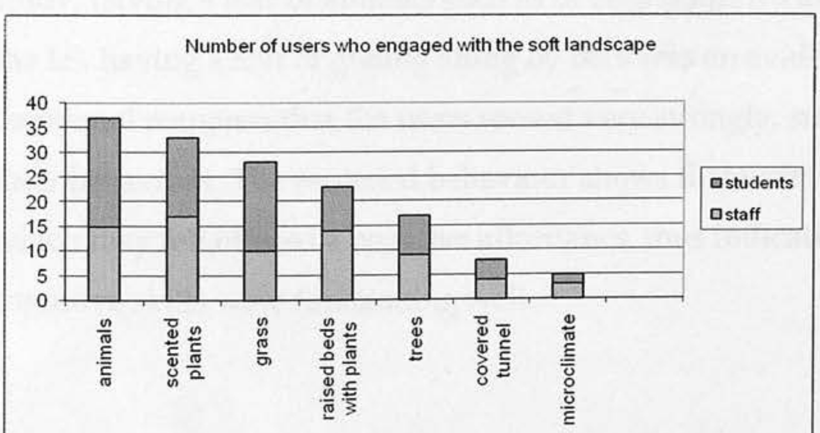


Figure 6.4: Individual behaviour settings of soft landscape with which users engaged and the median time spent per user in the sensory garden of the LS.

Behaviour settings of soft landscape	Number of users	Median time spent per user (min.sec)

Animals	37	1.52
Scented plants	33	1.21
Grass	28	1.43
Raised beds with plants	23	1.07
Trees	17	2.25
Covered tunnel	8	1.25
Microclimate	5	0.46
TOTAL	**151**	**190.0**

In summary, the soft landscape features that offered positive affordances were scented plants, grass, raised beds with plants, trees, a covered tunnel and microclimate. Users were connected to the trees (see the anecdotal evidence, p.164) for tree-rubbing activities. This soft landscape features afforded users the chance to touch, feel and talk about what they experienced (including via sign language). According to Ulrich (1988) and Kellert (1993), plants are one of the most dominant features in a natural setting that able to draw and attract users to engage with it. The highest number of users recorded on animals, i.e. tadpoles. One of the teachers mentioned that it was unusual for the students and teachers to see tadpoles in the pond. They like to watch the tadpoles while talking about it.

Despite the positive responses, one negative response was recorded: one staff and one student feared getting stung by bees. As stated in the first case study, having a fear of animals such as of bees is known as a *'biophobia'*. In the LS, having a fear of getting stung by bees was an evident negative emotional response that the users sensed very strongly, such that it inhibited their behaviour. The recorded behaviour shows that users identified bees, which they felt offered a negative affordance, thus indicating that their cognitive skills were functioning well.

6.2.1b Individual behaviour settings of hard landscape

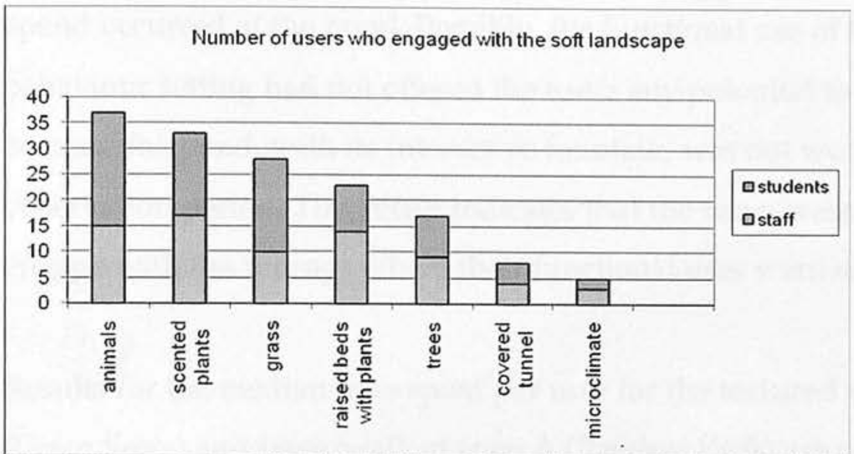


Figure 6.5: Individual behaviour setting of hard landscape with which users engaged and the median time spent per user in the sensory garden of the LS.

Behaviour settings of hard landscape	Number of users	Median time spent per user (min.sec)
Sound stimuli	75	2.0
Boardwalk	31	3.35
Boardwalk with rope railing	30	1.58
Pathway	22	1.47
Musical pipe	18	2.23
Talking tubes	16	1.50
Slate stone channels	10	1.20
Covered tunnel	8	1.25
Textured wall	8	6.0
Pond	6	0.30
Artefacts	6	1.5
Stones	6	1.33
TOTAL	**236**	**460.0**

In terms of the hard landscape, it was recorded that users preferred to engage with the sound stimuli at the *Woodland Garden* (zone D), which was placed along the boardwalk with a rope railing. This individual behaviour setting afforded many functional and different activities. However, in terms of the median time spent per user, the sound stimuli recorded three times less than the textured wall, which was engaged with by only eight users. This result supports the finding as described in Chart 5.4 (see p.165) that the numbers of users are influenced by the functional properties of the garden features. However, the number of users did not appear to correlate with the median length of time spent there per user.

Results also suggested that the least number of users and a low median time spend occurred at the pond. Possibly, the functional use of this individual behaviour setting had not offered the users any potential to engage with it, because the pond, with its interactive fountain, was not working during the observation period. This result indicates that the users were less keen to engage with the settings where their functional uses were not clear to them.

Results for the median time spent per user for the textured wall at zone C (*Green Space*) and boardwalk at zone A (*Rainbow Walk*) are comparable because both of these individual behaviour settings recorded the longest time spent there. As mentioned in Chapters Three and Five, teachers preferred using both of these features in support of the communication therapy (see Image 5.12, p.160 and the anecdotal evidence in p.110).

With reference to analysis of the landscape furniture, the LS only contained one seat at the *Green Space* (zone C). It was recorded that one staff only occupied the seat for a duration of twelve minutes.

Similar to the RSDCD case study, the number of users who engaged with the hard landscape affordances was higher than the number of users who engaged with the soft landscape. In terms of the median time spent per user, users of the hard landscape affordances recorded a longer time spent there than users of the soft landscape. This is the opposite of the RSDCD findings, and appears to be for the following reasons:

i. The number of the soft landscape features is less in the LS, where there were no climbers and shrubs recorded as soft landscape affordances.

ii. The individual behaviour settings appeared to be more complex than in the RSDCD and many afforded communication, resulting in a longer median time spent in the LS. For example, the textured wall and boardwalk (see p.159, para.2 and p.163, para.2).

6.2.2 Frequencies of sensory stimulation, physical and social skills

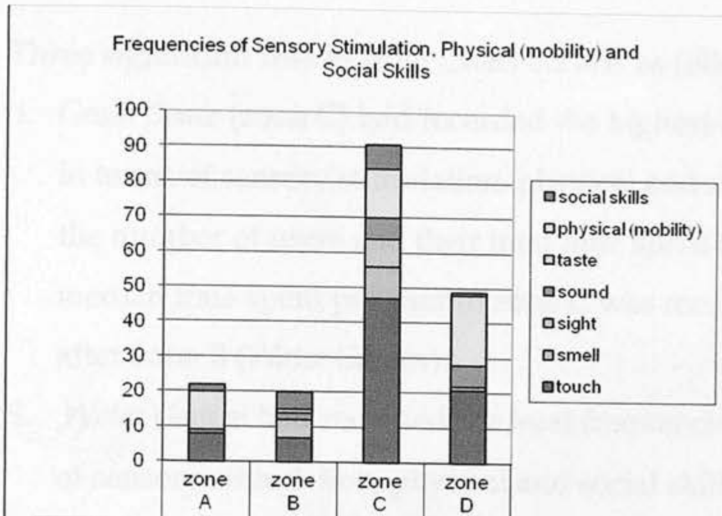
A summary from the matrix in Appendix G (Tables 6.2a–6.2d) of the actualised affordances throughout all the functional zones in the sensory garden (see Table 6.2, p.186) and Chart 6.2 (see p.187) were analysed as follows.

Legend

Soft L.	Soft Landscape
Hard L.	Hard Landscape
Land. F.	Landscape Furniture
NoU	Number of Users
TTS/TTSPU	Total Time Spent/Total Time Spent Per User
F	Staff
T	Students
Phy.Soc.	Physical and Social skills
Act.	Activities

Functional zone/ Total area	Affords	The Landscape Design Categories, the Number of Users and the Total Time Spent/Person (min.sec)														
	SENSORY STI. PHYSICAL and SOCIAL SKILLS	Soft L.	NoU		TTS/TTSPP		Hard L.	NoU		TTS/TTSPP		Land. F.	NoU		TTS/TTSPP	
			F	T	F	T		F	T	F	T		F	T	F	T
Zone A/ *Rainbow Walk* 767sq.metres	2 senses (8 act)/ 2 phy.soc. (8 act)	7	22	21	57.0 /2.6	51.30 /2.44	15	57	61	231.30 /4.06	235.30 /4.26	0	0	0	0	0
Zone B/ *Water Garden* 223 sq.metres	3 senses (10 act)/ 2 phy.soc. (3 act)	9	28	43	48.0 /1.71	85.30 /2.38	11	13	41	16.30 /1.25	51.30 /1.25	0	0	0	0	0
Zone C/*Green Space* 337 sq.metres	4 senses (23 act)/ 2 phy.soc. (12act)	41	91	87	94.30 /2.07	83.0 /1.35	49	71	109	195.30 /3.15	350.0 /3.21	1	1	0	12.0	0
Zone D/*Woodland Garden* 556 sq.metres	3 senses (12 act)/ 2 phy.soc. (8 act)	20	18	23	9.30 /.52	13.30 /.58	29	154	170	289.0 /2.28	361.0 /2.12	0	0	0	0	0

Table 6.2: Summary from the matrix of the actualised affordances in relation to the landscape design categories, the number of users and the total time spent per user, utilising their sensory stimulation, physical and social skills throughout all the functional zones in the sensory garden of the LS.



	zone A	zone B	zone C	zone D
social skills	2	5	7	1
physical (mobility)	11	1	14	20
taste	0	0	0	0
sound	1	2	6	6
sight	0	5	8	1
smell	0	0	9	0
touch	8	7	47	21

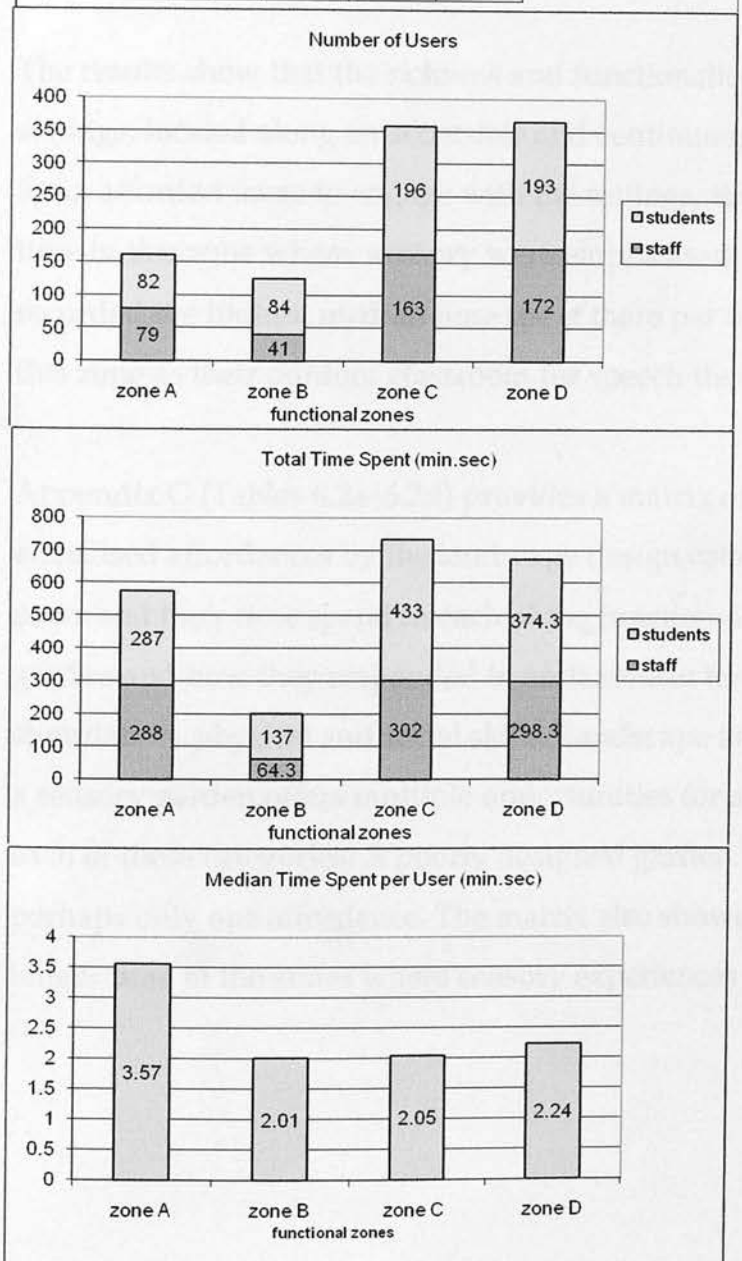
Legend:

zone A: *Rainbow Walk*

zone B: *Water Garden*

zone C: *Green Space*

zone D: *Woodland Garden*



The total time spent for the students and staff were combined in the median time spent per user.

Chart 6.2: Frequencies of sensory stimulation, physical (mobility) and social skills recorded in the sensory garden of the LS, according to the functional zones.

Three significant results from Chart 6.2 are, as follows:

i. *Green Space* (zone C) had recorded the highest frequencies of affordances in terms of sensory stimulation, physical and social skills, together with the number of users and their total time spent there. However, the median time spent per user in zone C was recorded as the second lowest, after zone B (*Water Garden*).
ii. *Water Garden* had recorded the least frequencies of affordances in terms of sensory stimulation, physical and social skills, the number of users, their total time spent there and the median time spent per user.
iii. *Rainbow Walk* (zone A) had recorded the highest median time spent there per user but among the lowest frequencies of affordances in terms of sensory stimulation, physical and social skills.

The results show that the richness and functionality of individual behaviour settings, located along an accessible and continuous pathways at the *Green Space* afforded users to engage with the settings, thus will spend a longer time in this zone where, sensory were emphasised. *Rainbow Walk* had recorded the highest median time spent there per user. The teachers utilised this zone as their outdoor classroom for speech therapy.

Appendix G (Tables 6.2a–6.2d) provides a matrix of the frequencies of actualised affordances by the landscape design categories, the number of users and their time spend in each of the functional zones in the sensory garden and how they responded to each zone in terms of their sensory stimulation, physical and social skills. Landscape architects must ensure that a sensory garden offers multiple opportunities for affordances in terms of each of these categories. A poorly designed garden would offer none or perhaps only one affordance. The matrix also showed that users spent a longer time in the zones where sensory experiences were offered.

6.3 Key conclusions

The users responded to both sensory gardens' affordances in terms of the following values:

i. Charts 8.1 and 8.2 evidently show that the sense of touch had the highest frequencies compared to the other senses. This reflects Olds' view (2001: 231) that *'touch is the most important sense for young children'*. She added that, feeling through textures enhanced tactile stimulation among children with special needs, thus developing their form and space perception of being in the outdoor environment.

ii. The individual behaviour settings (soft landscape, hard landscape and landscape furniture) were important features, which helped to stimulate their senses and encourage physical activities as well as social skills. For example, hearing the sound of the water, wind in trees, observing animals, engaging with the microclimatic, talking about the scented plants, greeting each other, singing and communicating (including via sign language). This also involved movement among the users, such as running, skipping, jumping, walking, climbing and scooping stones as well as some explorative activities, such as searching for plants, and eating herbs and fruits.

iii. Users appeared to feel a physical attraction to and affection for the sensory garden as their educational outdoor space. This was reflected in their behaviour changes, such as feeling fascinated while engaging with any familiar and obvious functional features or feeling a sense of fear and trying to escape from being in contact with animals or plants, which they think have negative threats in the sensory garden.

The analysis in Chapters Five and Six shows that a good circulatory system in a garden offers affordances in terms of gaining access to individual behaviour settings if they are placed adjacent to the pathway. Individual behaviour settings next to the pathway offer the potential for engagement but actually they are poor in experience. For example, zone D (*Green Space Two*), RSDCD, recorded the least frequency of sensory affordances but had slightly higher usage than zone E (*Asteroids Arts Garden*), however, zone D recorded the lowest median time spend per user, compared to the rest of the zones, because the sensory experiences offered there were limited.

A high quality affordance experience would encourage users to stop, to engage with the various features and perhaps repeat the activity, as occurred in zone F (*Water Central Area*) of the RSDCD. Zones also existed in each garden where an affordance offered greater scope for engagement with the individual behaviour settings but they recorded fewer users because, for example, the zone was slightly away from the main circulatory pathway, had poor access from the main building or it had limited access from the other garden zones, such as zone A (*Rainbow Walk*) of the LS.

These observation results highlight the range and specifics of the case-study analyses. The implications of the analysis and a subset of design recommendations will be discussed in the final chapter, pp.219-222.

CHAPTER SEVEN

Analysis and Results of the Interviews

7.1 CASE STUDY 1: Royal School for the Deaf and Communication Disorders (RSDCD)

The sensory garden named the Multi Sensory Millennium Maze was designed in 2000 by Sue Robinson, a landscape architect from Stockport Metropolitan Borough Council. The researcher had conducted an interview with Robinson and this was conducted over two sessions. The first interview was undertaken at a place of the landscape architect's choosing and the second interview involved a walk-through of the sensory garden.

7.1.1 Interview with the landscape architect

'The sensory garden is particularly geared towards the Royal School for the Deaf's particular needs and they highlighted to me that they had a problem that their students...were often faced by, things like meeting a curb with their wheelchair or meeting rough ground...'

Robinson, S. (May 26th, 2007)

QUESTIONS	LANDSCAPE ARCHITECT'S RESPONSE
What are the key principles in your design?	To create a multi-sensory garden, which would cater for a wide variety of user capability (people from two to twenty-two years, with extremely complicated disabilities including deafness, deaf blind, severe learning difficulties, autism, epilepsy and/or physical disabilities); to offer an attractive location to young people whilst providing varied sensory perceptions and good educational value.
Can you explain the design process you have carried out in designing the sensory garden?	Prior research. Close collaboration with staff and students. Site survey and analysis. The design objectives were to offer 'everyday experiences', by widening opportunities and to provide a variety of different forms, textures, colours, shade, touch and sound; to accommodate access from almost all directions to this centrally located site; to achieve maximum potential by providing a series of linked mini gardens or 'pockets of experience'.

What were the main challenges you had to deal with?	The main challenge was to design for and accommodate an extensive range of user capabilities and needs. Despite the said challenge, the landscape architect thought that it had worked quite well from the perspective of satisfying all the users' needs. However, she mentioned that there were a few detailed designs that should not have been implemented.
What do you think is the most successful about your design?	The landscape architect thought that the design of the sensory garden has met users' requirements and has assisted the students in accommodating the transition from a protective school environment to meeting the everyday experiences that they will encounter when they leave school. The sensory garden is very helpful in that regard.
Referred guidelines	In designing the sensory garden, the landscape architect referred to guidelines from books and journals (DfES bulletin, LTL guide and Landscape Design Journal). However, she did not come across any specific design guidelines for designing such gardens.
Designer involvement	The landscape architect was only involved in the sketch design and was not involved in the detailed design and construction stage as the school sought to achieve cost savings. She mentioned that the school has its own in-house management and maintenance, which was asked to carry out the work directly from the master plan drawing, with no detailed drawings having been prepared.
What do you think is the least successful about your design?	Whilst most of the spatial arrangements were followed fairly closely and worked out reasonably well, some of the detailed interpretation is not quite as the landscape architect had envisaged, for example: • The humps and bumps at the *Exploraway* should have been more dramatic (see Image 7.1). • The *vaporised trail* should have been surfaced with 38mm stone to allow challenging wheelchair access, not with the large stone blocks, which prevent wheelchair access (see Image 7.2). • The Sculptural Sun that the landscape architect had intended would provide a sense of welcome to the sensory garden had not been implemented as envisaged (see Image 7.3). • The use of timber where steel was envisaged (thus altering the overall theme, which was designed to be attractive to the students who would be using it) such as the pergola and seating in the *Asteroid Arts Garden*, was a problem (see Image 7.4). • Old-style park seating has been used which, though it is functional, it is not exciting, neither was the textured wall as the landscape architect had envisaged (see Image 7.5). • It was not intended originally to plant shrubs all around the water feature. The intention was to have a smooth, steel reflective dome with water flowing over it (see Image 7.6). • The planting, including a hedging species to form a maze, was not adhered to as had been planned and the planting of species was not carried out to any visibly prepared plan, hence there were lost opportunities.

Image 7.1: *Exploraway.*

Image 7.2: *Vaporised trail* at the *Green Space One*.

Image 7.3: The Sculptural Sun had been envisaged originally as being located at the *Parents' Waiting Area*.

Image 7.4: Timber pergola with scented flowers at the *Water Central Area*.

Image 7.5: Textured wall at the *Parents' Waiting Area*.

Image 7.6: Shrubs all around the water feature with old-style park timber seating in the background at the *Water Central Area*.

The researcher also asked the landscape architect, which design aspects of a sensory garden, she thought might enable the use of its area. The design aspects are accessibility, aesthetic[57] value, maintenance, planting, the quality of sensory equipment, quantity of sensory equipment, quantity of surface equipment (hard and soft), safety and spatial location of the garden in relation to building and context. These design aspects were gathered during the preliminary site studies conducted earlier (see p.28) Answers were obtained and graded according to the degree of importance, ranging from 'have not', to 'very much'.

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[57] The philosophy or theory of taste, or the perception of the beautiful in nature and art (Oxford English Dictionary, quoted by Hill, 1995:170). This research uses the term 'aesthetic' to describe the visual composition of the respective sensory gardens.

DESIGN ASPECTS that enable the use of area	LANDSCAPE ARCHITECT'S RESPONSE
Accessibility	Very much *'…it can easily be replaced. You can't replace the structure of the site; you can't replace its accessibility. You know, these are things you have got to get right. They are so influential. But if say, you know, something wasn't quite right with a piece of furniture, you could replace it…'.* Robinson, S. (May 26th, 2007)
Aesthetic value	Very much
Maintenance	Very much
Planting	Very much
Quality of sensory equipment	Pretty much
Quantity of sensory equipment	Pretty much
Quantity of surface equipment (hard and soft)	Very much
Safety	Very much
Spatial location of the garden in relation to building and context	Very much
How well do you think you can predict which area (s) you think users will utilise most, based on the design aspects you have considered? Why?	The landscape architect predicted that users would utilise the *Asteroid Arts Garden* and the *Water Central Area* the most. This is because the *Asteroid Arts Garden* was requested by one of the teachers during the sketch design phase and the *Water Central Area* is a central area, which she thought would be fairly well maintained.
Which area do you think users will least utilise? Why?	The landscape architect predicted that the *Parents' Waiting Area* that was intentionally designed to display students' artworks, would be least utilised due to its close positioning to the car park. Instead of displaying the students' artworks, the school had signage with the name of the sponsors who had funded the garden. Another area the landscape architect thought would be least utilised was the *vaporised trail* at *Green Space One.* This, she felt, was due to the unsuitable selection of the surface material in relation to the initial design proposal.

Table 7.1: Summary of the interview with the landscape architect of the RSDCD sensory garden.

7.1.2 Walk-through interview with the landscape architect

QUESTIONS	LANDSCAPE ARCHITECT'S RESPONSE
Are all designed areas being used as they were intended to?	The landscape architect mentioned that she had not seen students utilise the areas in the sensory garden, therefore, she could not say whether or not the designed areas were being used as she had intended, or whether any use surprised her. However, she had seen how users utilised the pathway; directionally and criss-crossing from one end to another. *'Yeah, I think, basically they are but I can't really comment on that because I haven't seen how they used it. So I'll reserve comment on that'* Robinson, S. (May 27th, 2007)
What is the most successful feature/area in terms of use?	The landscape architect reserved her comments.
What is the least successful feature/area in terms of use?	The landscape architect reserved her comments.
Has any used surprised you?	The landscape architect reserved her comments.
Have all design problems being solved upon the completion of the sensory garden? If not, what would you like to see improved?	The landscape architect concluded that although there were minor design issues that could have been improved; the school's management and maintenance department had kept fairly well to the spatial arrangement and concept (see Images 7.1-7.6).
If you were given another opportunity to design a sensory garden, how would you do things differently, at all?	The landscape architect was not involved in the implementation stage and she believes that, had she been given the opportunity to be involved in the design detail and planting phase, she would have assisted in creating a better design of the sensory garden. Thus it would have been more enjoyable and aesthetically pleasing and at the same time, it would have offered students the chance to encounter everyday experiences within the shelter of the school environment.

Table 7.2: Walk-through interview with the landscape architect at the RSDCD.

7.1.3 Interview with the teachers and therapists

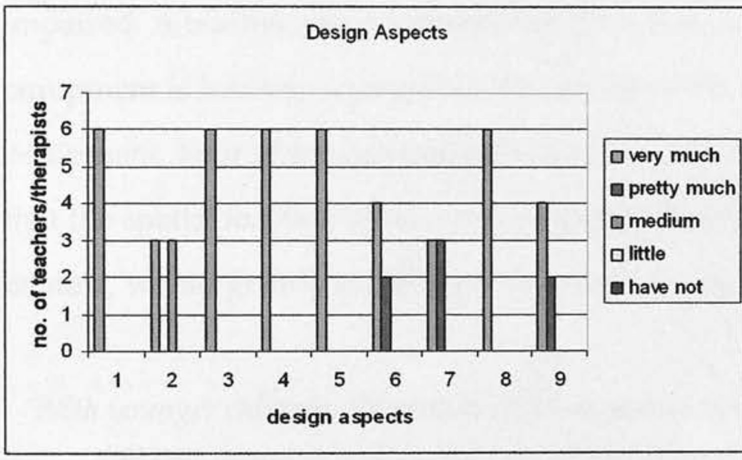
Teachers (n=4) and therapists (n=2) were interviewed to get their thoughts and experiences with reference to the benefits and problems in having the sensory garden (number of teachers and therapists are shown as 'n' value).

QUESTIONS	TEACHERS AND THERAPISTS' RESPONSES
Describe the benefits you found in the student's educational development and social interaction since having a sensory garden.	Response to the environment (n=6) Enjoyment (n=3) Calming (n=2) Mobility practice (n=1) Flexibility and use (n=1) Broadens experience (n=1)
Did you discover any problems with the sensory garden when children are using the area? If so, please describe and give examples of any constraints or problems.	Inaccessible water feature (n=3) Inaccessible raised beds (n=2) Narrow space in certain areas (n=1) Path surfaces: *Exploraway* and *Vaporised trail* (n=1)
What is the most successful feature/area in terms of use?	Mobility in pathway (n=4) Water feature (n=3) Mobility in path surfaces (n=2) Variety of pathways (n=1) Herbs and scented plants (n=1)
What is the least successful feature/area in terms of use?	Lack of variety and detached musical instruments (n=3) Inaccessible raised beds (n=2) Location of willow tunnel (n=1) Surface material of *Exploraway* (n=1)
Has any usage surprised you?	Sensory story requested by some students. Students like feeling the moss at the raised beds. The majority of students have been drawn to the water feature although it is inaccessible.
What would you like to see improved?	A greater variety in musical instruments (n=4) A greater variety in planting selection (n=4) A greater variety in pathway surfaces (n=4) Accessible water feature (n=3) Accessible raised beds (n=2)
If you had it designed again, what would you like to see done differently?	Would propose a **sensory trail**[58] (n=3) Would propose a designated area (n=1) Accessible water feature (n=1) Variety and detachable musical instruments (n=1)

Table 7.3: Summary of the interview with teachers and therapists of the RSDCD.

[58] See Glossary, p.245

The researcher also asked the teachers and therapists, which design aspects of a sensory garden, they thought might enable the use of its area. The design aspects are accessibility, aesthetic value, maintenance, planting, the quality of sensory equipment, quantity of sensory equipment, quantity of surface equipment (hard and soft), safety and spatial location of the garden in relation to building and context. These design aspects were gathered during the preliminary site studies conducted earlier (see p.28) Answers were obtained according to the degree of importance, ranging from 'have not' to 'very much' (see Chart 7.1).



1 – Accessibility
2 – Aesthetic value
3 – Maintenance
4 – Planting
5 – Quality of the sensory equipment
6 – Quantity of the sensory equipment
7 – Quality of the surfacing (hard and soft)
8 – Safety
9 – Spatial location

Chart 7.1: Design aspects that the teachers and therapists thought might enable the use of area in the sensory garden of the RSDCD.

Based on the results above, all the teachers (n=4) and therapists (n=2) thought that the designs aspect of accessibility, maintenance, planting, the quality of the sensory equipment and safety might enable the use of area in the sensory garden.

'The main problem that I've undergone is the access for students who use wheelchairs and may be have sort of quite limited movement in their arms. The flowerbeds are really, they are deep. So obviously in the middle, you can't get to...'.

Barnet, R.; a teacher of the RSDCD (April 30th, 2007)

'The water fountain. Although we have a good time with it, the autistic students, students in a wheelchair, can't reach the water fountain. Some of our students, the visually impaired and the hearing impaired, they would know it's THERE without touching it but because there are bushes around the fountain, it's not possible to get them in there...'.

Walker, H.; a teacher of the RSDCD (April 30th, 2007)

Half of the total respondents (teachers n=2; therapist n=1) had no strong views on the aesthetic value of the garden in relation to the use of area. This was because some of their students were partially sighted and visually impaired. A teacher and a therapist believed that the quantity of sensory equipment is less important when compared to the quality of the sensory equipment. Four of the respondents (teachers n=2; therapists n=2) thought that the spatial location of the sensory garden in relation to the buildings and context, would greatly encourage the use of its area.

'With younger children, I'll probably walk down the black path and comment on the different things that they could see at that picture. I probably would say, 'Ooo! Butterfly! Ooo!...' So you will be bringing language in there'.

Barker, J.; a speech therapist of the RSDCD (April 30th, 2007)

'So we are looking at meeting that sensory need, the smell, the touch, the sound of the rustling leaf, the feel of water. I've seen they are really enjoying that and those effects on your well-being. It makes you feel better. Just being outside in the sunshine. Being able to smell the plants, feel them, see them, can make you feel a whole lot better in yourself. That can actually help with your condition. If you are feeling a bit low, if you are not feeling too well, it can lift your mood completely and that's important from an occupational therapy point of view'.

Smith, S.; an occupational therapist of the RSDCD (April 30th, 2007)

7.1.4 Walk-through interview with the students

Only three students with moderate learning disability (with age range from ten to twelve years old) managed to participate in the walk-through interview, due to the tight end-of-term schedule at the school.

QUESTIONS	STUDENTS' RESPONSES
Do you come to the sensory garden by yourself or with your teacher or friend?	All of the students prefer to go to the sensory garden with their teacher.
What would you like to do in the sensory garden if you were on your own or with a teacher or your friend? Where would you do that?	All of the students like riding their bicycle, strolling and running around in the sensory garden. They would undertake those activities along the primary pathway of the sensory garden i.e. around the water feature to the pergola at the *Water Central Area* and to the boardwalk at the *Asteroids Arts Garden.*
What is your favourite area in the sensory garden? Why is that your favourite area?	All of their favourite area is the *Water Central Area* as they enjoy smelling herbs and scented plants. They also like the willow tunnel because it offers privacy, shade and a different kind of surface material.
Are there any other areas you don't like? What don't you like about it? Why don't you like it?	They don't have anything they don't like.
Are there any other things you don't like about the sensory garden?	Nil.
Are there some places you would like to use but can't?	They seem not to experience any constraints in using the sensory garden.

Table 7.4: Summary of the walk-through interview with students of the RSDCD.

7.2 CASE STUDY 2: Lyndale School (LS)

The planning and design work was prepared by a landscape architect, Mark Boothroyd of the Groundwork Wirral, with a range of consultation activities undertaken with the whole school community. The development was completed in September 2005, having been inspired by the school's Deputy Head, Dave Jones, who had died in summer 2002. Similar to the first case study, the researcher had conducted two interviews with Boothroyd. One was undertaken at a place of the landscape architect's choosing and another interview involved a walk-through of the sensory garden.

7.2.1 Interview with the landscape architect

'The client was not one person, it was the whole school…They did collage work where they encouraged people to bring images of feel, texture, colours… to me as a landscape architect; the collage that they produced is more useful than the huge amount of consultation data, questionnaire, responses and reports because it shows exactly the kind of atmosphere, kind of feel for the place that they wanted'.

Boothroyd, M. (May 14th, 2007)

QUESTIONS	LANDSCAPE ARCHITECT'S RESPONSE
What are the key principles in your design?	The key principle was to transform the sloping grounds into a stimulating environment where the children could explore, with some degree of independence, allowing for maximum enjoyment to enhance their learning experience through natural features.
Can you explain the design process you have carried out in designing the sensory garden?	Consultation with the school community during the design stage. Collage work with staff and students in the school. Site survey and analysis. Prior research. Design brief. The design objectives were to make the area accessible and to maximise the potential of the site; and to bring out the principles that govern the indoors to the outdoor environment.
What were the main challenges you had to	The main challenge was to accommodate the ambition to have a sensory garden on a limited fund as well as the technical use of a water feature and maintenance in general (due to funding constraints, the long-term master plan was divided into phases, as mentioned in p.119). The

deal with?	landscape architect also needed to develop an understanding of the particular needs of the users as the scope of his work ranged from a conceptual development to the master plan.
What do you think is the most successful about your design?	The landscape architect thought the most successful design was the path network. This pathway network had been well integrated with the topography of the sensory garden such that it provides continuous accessibility.
Referred guidelines	In designing the sensory garden, the landscape architect had referred to the anthropometrics for a variety of users, as he did not discover any particular design guidelines for designing sensory gardens.
Designer involvement	The landscape architect was involved from the site survey analysis to the construction stage.
What do you think is the least successful about your design?	The landscape architect felt that the planting should have been done at an earlier stage rather than as the last one, as planting takes time to become established.

Similar to the first case-study, the researcher also asked the landscape architect, which design aspects of a sensory garden, he thought might enable the use of its area, namely, accessibility, aesthetic value, maintenance, planting, the quality of sensory equipment, quantity of sensory equipment, quantity of surface equipment (hard and soft), safety and spatial location of the garden in relation to building and context. Answers were obtained and graded according to the degree of importance, ranging from 'have not', to 'very much'.

DESIGN ASPECTS that enable the use of area	LANDSCAPE ARCHITECT'S RESPONSE
Accessibility	Very much *'The number one priority was to provide good accessibility throughout the garden. That was going to mean running past the cross gradient and changing the gradient to suit'.* Boothroyd, M. (May 15th, 2007)
Aesthetic value	Very much
Maintenance	Very much
Planting	Very much
Quality of sensory equipment	Pretty much

Quantity of sensory equipment	Pretty much
Quantity of surface equipment (hard and soft)	Very much
Safety	Very much
Spatial location of the garden in relation to building and context	Very much
How well do you think you can predict which area (s) you think users will utilise most, based on the design aspects you have considered? Why?	The landscape architect predicted that users would utilise the *Water Garden* the most, because he thought that the water feature had been designed creatively to make the most of natural materials such as using loose cobbles in the water channel and a natural pond, with marginal planting at the bottom. Furthermore, the pond has an interactive fountain in the middle, with talking tubes, where the voice of users controls the height of the fountain. These features are always a hugely magnetic attraction that draws users to the water area. Another area that Boothroyd thought would be frequently used and popular was the sound stimuli at the *Woodland Garden*.
Which area do you think users will least utilise? Why?	The landscape architect predicted that the least utilised area would be beyond the *Rainbow Walk*. This, he felt, would be due to the relative poverty of features and lack of maintenance.

Table 7.5: Summary of the interview with the landscape architect of the LS sensory garden.

7.2.2 Walk-through interview with the landscape architect

QUESTIONS	LANDSCAPE ARCHITECT'S RESPONSE
Are all designed areas being used as they were intended to?	The landscape architect mentioned that on his last visit to the sensory garden, he had been in the process of establishing the planting. Nevertheless, there were no users utilising the sensory garden, therefore, he could not say whether the designed areas were being used as he had intended or whether any use particularly surprised him.
What is the most successful feature/area in terms of use?	Water feature at the *Water Garden* and sound installations at the *Woodland Garden*.
What is the least successful feature/area in terms of use?	When the interview was conducted, the water fountain was not fully working, thus, the landscape architect thought that it was an unsuccessful technical feature at that particular time.

Has any used surprised you?	The landscape architect reserved his comments.
Have all design problems being solved upon the completion of the sensory garden? If not, what would you like to see improved?	Technical problem with the pond. Maintenance is another significant factor that should have given serious consideration. At the moment, the school relies on volunteer work.
If you were given another opportunity to design a sensory garden, how would you do things differently, at all?	The landscape architect believed that, ideally, the path network had to be implemented first to provide physical access throughout the sensory garden, closely followed by the planting. In this case, the planting was carried out last. As a result, the sensory garden was not seen at its best.

Table 7.6: Summary of the walk-through interview with the landscape architect at the LS.

7.2.3 Interview with the teachers and therapists

Teachers (n=6) and therapists (n=3) were interviewed to get their thoughts and experiences with reference to the benefits and problems in having the sensory garden (number of teachers and therapists are shown as 'n' value).

QUESTIONS	TEACHERS AND THERAPISTS' RESPONSES
Describe the benefits you found in the student's educational development and social interaction since having a sensory garden.	Educational resource (n=4) Response to the environment (n=3) Encourages team work (n=2) Supports educational curriculum (n=1) Pleasant and stimulating place (n=1) As a meeting point (n=1)
Did you discover any problems with the sensory garden when children are using the area? If so, please describe and give examples of any constraints or problems.	Access to and around the sensory garden (n=4) Discontinuous path network (n=4) Slippery and steep decking (n=2) Non boundary area (n=1) Unable to experience different weather (n=1)
What is the most successful	Water feature (n=4)

feature/area in terms of use?	Sound stimulations (n=4) *Rainbow Walk* (n=3) *Woodland Garden* (n=1)
What is the least successful feature/area in terms of use?	Surface material (n=1) Lawn area (n=1) Slope and access (n=1) Path network (n=1)
Has any usage surprised you?	The majority of students were drawn towards the sound stimulation in the *Woodland Garden* and the *Water Garden*.
What would you like to see improved?	A greater variety in planting selection (n=3) Continuous pathways (n=2) More seating (n=2)
If you had it designed again, what would you like to see done differently?	Would propose shelter from cold and rainy weather (n=3) Continuous pathways (n=3) Would propose area with boundaries (n=1) Would propose multi-purpose area (n=1)

Table 7.7: Summary of the interview with teachers and therapists of the LS.

The researcher also asked the teachers, which design aspects of a sensory garden, they thought might enable the use of its area. Therapists namely, a physio-therapist, a speech therapist and an occupational therapist, did not participate in answering this question as they do not use the sensory garden because their sessions are class based.

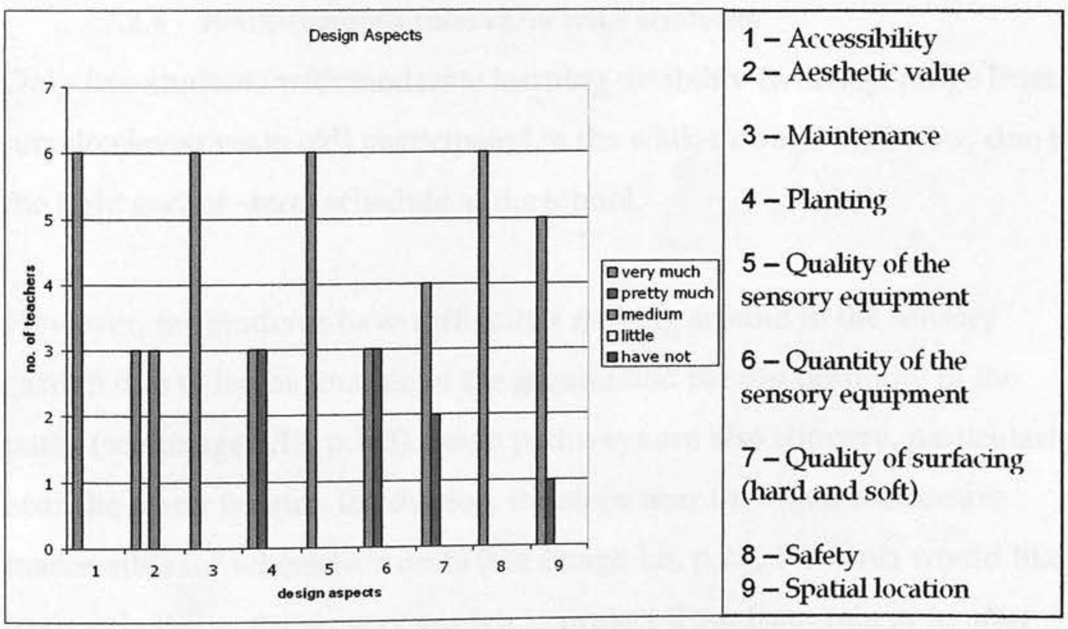


Chart 7.2: Design aspects that the teachers and therapists thought might enable the use of area in the sensory garden of the LS.

Based on the results above, all the teachers (n=6) thought that the design aspects of accessibility, maintenance, the quality of the sensory equipment and safety might enable the use of area in the sensory garden.

'I would like to see an improved level of maintenance. That's a biggie'.
Jefferies, K.; retired deputy head of the LS (May 16th, 2007)

'A good play equipment is more important than the quantity, really. Play equipment that has been sought out with particular children's needs in mind would actually encourage their language ability and also the way children are going to be able to use their body within certain spaces. I think that's really important'.
Lawrence, J.; a teacher of the LS (May 17th, 2007)

Half of the total respondents held no firm views on the aesthetic value in relation to the use of area. This was because some of their students were partially sighted and visually impaired. The majority of the respondents (n=5) believed that the spatial location of the sensory garden in relation to buildings and context would greatly encourage the use of the area.

7.2.4 Walk-through interview with students

Only five students with moderate learning disability (with age range from nine to eleven years old) participated in the walk-through interview, due to the tight end-of -term schedule at the school.

However, the students have difficulties moving around in the sensory garden due to the inclination of the ground and the discontinuity of the paths (see Image 5.18, p.163). Some pathways are also slippery, particularly near the water feature. In addition, the steps near the water feature are inaccessible for wheelchair users (see Image 1.8, p.26). Students would like to have a shelter in the sensory garden to protect them from rain or to offer them a secret hiding place.

QUESTIONS	STUDENTS' RESPONSES
Do you come to the sensory garden by yourself or with your teacher or friend?	All of the students preferred to go to the sensory garden with their teacher.
What would you like to do in the sensory garden if you were on your own or with a teacher or your friend? Where would you do that?	Two of the students enjoy picking apples, collecting pinecones, listening to the sound stimuli at the *Woodland Garden*. Two of the students like using the talking tubes and strolling at the *Water Garden*. They also enjoyed watching the tadpoles in the pond and watching the movement of the water. One student fond of willow weaving and engaging with the artwork display at the *Green Space*.
What is your favourite area in the sensory garden? Why is that your favourite area?	Two of the students like to be at the woodlands because the area has a variety of sound stimuli. They get excited when listening to the different sounds. Two of the students like to be at the water feature; particularly the talking tubes at the pond because they can control the height of the fountain by talking through the tubes. One student's favourite area is the artwork display because the feature offers a place to sit while playing with the water trapped between logs (see Image 5.10, p.160)
Are there any other areas you don't like? What don't you like about it? Why don't you like it?	Two of the students don't like the slippery pathway (see Image 1.8, p.26) near the pond and another pathway that stops abruptly at the *Water Garden*, going to the *Rainbow Walk* (see Image 5.18, p.163) Three of the students don't like to use the sound stimuli located at the end of the boardwalk because it created a 'bottle neck' for their peers in wheelchairs (see Image 5.9, p.159)
Are there any other things you don't like about the sensory garden?	All of the students mentioned that they don't like when it rains because there is no shelter.
Are there some places you would like to use but can't?	All of the students pointed out the area (near the raised beds) is unusable because it is inaccessible to the most of the users (entrance always locked due to safety)

	 Image 7.7: An area at the *Green Space* is inaccessible for most users of the sensory garden, except for staff and students who are using the classroom. The classroom is attached to the *Green Space*.

Table 7.8: Summary of the walk-through interview with students of the LS.

7.3 Key conclusions

It is clear that both landscape architects of the RSDCD and LS sensory gardens agreed on the same design aspects which enable the use of area in a sensory garden. These include users' accessibility, aesthetic value, maintenance, planting, the quality of surfacing equipment (hard and soft), safety and the spatial location of the garden in relation to the site context.

Meanwhile, teachers and therapists in both schools concurred that accessibility, maintenance, the quality of sensory equipment and safety would greatly enable the use of area in the sensory garden. Both schools also showed similar results insofar as half of the total respondents had no strong views on the aesthetic value in relation to the use of area in the sensory garden. Another comparable outcome is that the majority of teachers and therapists believed that relating the spatial location of the sensory garden to the site context would greatly encourage the use of area.

Students in both special schools preferred to go to the sensory garden with their teachers. Both interview sessions recorded that students with special educational needs prefer areas that offers sensory stimulation to them. For example, pleasant smells, wonderful tastes, shade and hiding places.

The interview outcomes from the landscape architects, teachers, therapists and students showed that the interviewees preferred:

i. Zones with a hard surface pathway, allowing accessibility and easy wayfinding into the sensory garden and back to the school building.

ii. Zones with a variety of individual behaviour settings that are placed adjacent to the pathway, which offered users to easily engage with it, thus afforded them a richness of activities in the sensory garden.

Therefore, the functional individual behaviour settings and good circulation network were the properties of the sensory garden that afforded users the opportunity to undertake a variety of activities. This concurred with Cosco's (2006) study on physical activity affordances in preschool play centres that diverse areas comprising pathways and features are likely to be the most active.

CHAPTER EIGHT

Discussion and Conclusion

This chapter discusses the research questions and conclusion, which is based upon the interviews, observations and behavioural mapping of the entire research investigation. This chapter also produces a sub-set of design recommendations based on both case-study examples. The chapter ends with suggestions to improve the research methodology, limitations of the research and final conclusion.

8.1 Discussion of research questions

Findings related to the four research questions are discussed as follows:

8.1.1 The use of area in sensory garden

In the use of area in both case-study sensory gardens, it is clear that wherever there is access, the students will undertake a variety of activities and engage more with the individual behavior settings compared to the staff. This contributed to the finding that the number of individual behaviour settings, the number of activities undertaken and the time spent engaged in that activity by the users was not dependent on the total area of the zone nor did it relate to the median time spent there per user but rather what did enable the usage was the functioning of the individual behaviour settings and access to them.

Drawing attention to the aesthetic value in relation to the use of area in the sensory garden, landscape architects put this design aspect high on their list of priorities. The concept of affordance and the essential qualities of a children's natural environment have been described by Sebba as follows: *'children judge the natural setting not by its aesthetics but by how they interact with the environment'* (Sebba, 1991, quoted in White and Stoecklin, 1998). Based on the anecdotal evidence and research findings, it is clear that students with special educational needs do not appear to care about the aesthetics of a garden as they use the individual behaviour settings the way they want to use them (as long as there was access to the behaviour settings).

It is possible that for a disabled student, sensory experiences are much more important. Landscape architects need to consider, but should undertake more research to find out, if certain sensory experiences are richer or more vivid experiences for students with disabilities than for able-bodied staff. It is important, therefore, to look at the different range of sensory experiences that could be made available, for example, the growth of moss on the raised planters, the wildlife, microclimate and weather factors. These features, which offer sensory stimuli could introduce students with special educational needs to different aspects of landscape and help them to learn and understand more about the cycle of growth.

8.1.2 Users' engagement with the individual behaviour settings

This raised some questions, namely: *Why should landscape architects pay attention to the three affordances (see Chapter Five)? How are these affordances valuable to landscape architects?* This study observed and recorded three types of affordances as follows:

<u>1. Actualised and potential affordances</u>

Actualised affordances let landscape architects know the opportunities with which users engage, while potential affordances are those which seem to be offered in a sensory garden. For example, in one of the case-study sites, students in wheelchairs wanted to play with all the musical instruments on offer but did not manage to because the surface material made that impossible. In that case, what originally must have seemed to the landscape architect as offering potential affordances was, in practice, impossible for the students in wheelchairs, who may have seen the potential but they were unable to engage with the full range of instruments because the surface material on which they had to run their wheelchairs, made this impracticable. Landscape architects of sensory gardens may think they have designed to allow potential affordances to occur, however, these case-study examples show that landscape architects need to think of the design of a sensory garden as requiring further refinement once it is in use to ensure that users are fully able to realise all actual and potential affordances.

<u>2. Unique and multiple affordances</u>

A sensory garden feature that affords more than one experience is potentially of greater value than a feature that offers only one affordance because it provides a range of affordances and a richer experience for the users. For example, in one of the case-study sites, the lighting bollards had not worked since the sensory garden had been opened. Instead, the bollards were touched only by passing through the garden. This feature was engaged with only by students with disabilities, with a time spend of less than 1 minute per user. Another landscape furniture, seating, afforded multiple affordances, such as sitting and lying down; for example, a hearing-impaired male student sat beside his teacher on a seat. After a while, the student stretched out on the seat, with his head on his teacher's lap. They were communicating (including via sign language) and sat there for 1-2 minutes. Landscape architects of future sensory gardens will want to consider the full range of affordances so that they know the value and use of the gardens, such that are likely to enhance users' sensory, physical and social capabilities.

<u>3. Positive and negative affordances</u>

Most literature on the multi-sensory environment (Building Bulletin 102, 2008; Woolley, 2003; Frank, 1996; Stoneham, 1996; Titman, 1994a) has discussed the rich sensory experiences that users encounter. The literature shows, and this study's observations confirm, that affordances can offer unpleasant as well as pleasant experiences. Landscape architects should not assume that every experience is positive and this study has differentiated pleasant from unpleasant by observing and recording users' experiences in each garden. Teachers and therapists, however, at the case-study sites, thought that some negative experiences were important in terms of users' sensory, environmental and social learning.

As the examples of actualised and potential, unique and multiple, positive and negative affordances show, i.e. users' engagement with the individual behaviour settings, landscape architects might want to consider all these affordances when designing for sensory gardens.

8.1.3 Users' preferences in the sensory garden

What were the differences between zones where there were the highest number of actualised affordance? What was the highest number of users and in which zones did users spend a longer time? What were the individual behaviour settings that users engaged with the most and where did they spend the longest time? Why did users engage the most with these individual behaviour settings?

Listed below are the findings of the functional zones and individual behaviour settings that users preferred recorded in both case-study sensory gardens.

FUNCTIONAL ZONES	INDIVIDUAL BEHAVIOUR SETTINGS
Water Central Garden - Highest frequency of actualised affordances (multiple affordances=120; unique affordances=98); Highest number of users (n=218); longest time spent per user (1 minute and 20 seconds); 5 senses (36 activities), physical and social skills (13 activities).	Soft landscape Grass - Highest number of users (n=93). Willow tunnel - Longest time spent per user (4 minutes and 28 seconds). Hard landscape Pathway - Highest number of users (n=134). Raised beds - Longest time spent per user (3 minutes and 25 seconds). Landscape furniture Seating - Highest number of users

	(n=36); Longest time spent per user (2 minutes and 23 seconds).
Woodland Garden – Highest frequency of actualised affordances (multiple affordances=114; unique affordances=0); highest number of users (n=114). *Rainbow Walk* – Longest time spent per user (3 minutes and 5 seconds). *Green Space* – 4 senses (23 activities), physical and social skills (12 act.).	<u>Soft landscape</u> Animals – Highest number of users (n=37). Trees – Longest time spent per user (2 minutes and 25 seconds). <u>Hard landscape</u> Sound stimuli – Highest number of users (n=75). Textured wall – Longest time spent per user (6 minutes).

Table 8.1: The findings of the functional zones and individual behaviour settings that user preferred recorded in both case-study sensory gardens.

The fact that highest number of users in both special schools were engaged with the grass, the pathway, seating, the animals and sound stimuli is because the layout of the pathway network that connects the garden to the site context is good, for example, the entrance to the school building and secondary pathways link the functional zones around the garden to other individual behaviour settings placed strategically along the pathway. Thus a combination of soft, hard landscape and landscape furniture will encourage users to engage more closely with the wildlife that comes into the garden.

Although the pathway, sound stimuli, grass and animals had the highest number of users, these individual behaviour settings offered a shorter experience, where users who engaged with them had an immediate response. In contrast, the willow tunnel, raised beds, seating, trees and textured wall had the longest median time spend per user. Users chose to engage longer with these features because it afforded them various activities such as communicating (including sign language); sitting; bark rubbing; grabbing and shaking the tree branch; pulling the tree branch, plucking and feeling the leaf; juggling, throwing, smashing water balloons and taking photos.

8.1.4 Landscape architect involvement and understanding

Nebelong[59] (2008:20) stated that, *'Designing sensory gardens and play spaces for children with physical or mental diseases is a question of designing accessible spaces that work for all children, irrespective of abilities and skills'*. It is clear that Nebelong feels that it is crucial for landscape architects to understand the engagement that occurs between users and their surrounding environment. One of the examples is to look into Personal Projects by Little, 1983 (Ward Thompson: 2004).

In special education environments, it is particularly hard to generalise about design requirements, as schools tend to vary enormously in the range of special needs and ages that they cater for, as well as the more predictable variability they offer in terms of their total area and site context. Success may rely upon a close partnership between the landscape architects and environmental professionals, and the teachers and children (Stoneham, 1997:26).

Noel Farrer (2008:11), of Farrer Huxley Associates, also noted that, *'successful school grounds depend on getting the input and backing of one key group: You have to get close to the teachers, particularly ones prepared to push boundaries…'* Farrer stressed also the importance of collaboration between design professionals and users when designing, to cater for users' needs. While Stoneham and Farrer encourage teamwork, in the two case-study examples, the respective landscape architects reported the following:

- Sue Robinson, the landscape architect who designed the sensory garden of

[59] Helle Nebelong is a landscape architect based in Denmark who specialises in the design of natural spaces for children, young disabled people and the elderly. She is also the President of the Danish Playground Association, Vice-president of International Play Association Denmark and since 2007, has been a member of the leadership team for the Nature Action Collaboration for Children.

the RSDCD, mentioned that there were a few minor designs she would change and she would have wanted to have been involved at the detailed design and construction stage. Thus the detailed interpretation would have been implemented as she had envisaged.

- Mark Boothroyd, a landscape architect who undertook the sensory garden project of the LS, believed that the path network had to be constructed first to provide physical access throughout the sensory garden, closely followed by the planting, however, the planting had been carried out last. As a result, the sensory garden was not at its best when evaluated by Boothroyd. Maintenance is another important issue that should have been taken into serious consideration in terms of making the sensory garden look its best.

The respective landscape architects of the RSDCD and LS sensory gardens agreed that various design aspects, including accessibility, aesthetic value (this research uses the term 'aesthetic' to describe the visual composition of the respective sensory gardens), maintenance, planting, the quality of the surfacing (hard and soft), safety and the spatial location of the garden in relation to site context, all enable the use of area in a sensory garden. However, the teachers and therapists in both special schools had no strong views on aesthetic value in relation to the use of area in the sensory garden because they have to work with some students who are partially sighted or visually impaired.

Landscape architects put aesthetic value high on their list of priorities. Hill (1995:171) cited that aesthetics comprise *'unity, form, character and sensation'*. He further added, *'With some imagination, a complete composition of experiences – touch, smell and sound – can be created in a landscape design, with no reference to* *sight at all'* (Hill, 1995:195). *How can the researcher translate this design aspect and assist landscape architects to reframe their ideas?*

Landscape architects think aesthetic value should be the key goal but **'sensory value'** is the crucial design aspect, given that users of the two case-study sensory gardens engaged with the individual behaviour settings, involving greater use of their senses than just the visual and appreciation of the aesthetics. The matrices produced (see Charts 6.1, p.178 and 6.2, p.187; Appendix G), could be a way to show landscape architects that the individual behaviour settings are connected much more to all the senses, rather than just visual or compositional. For landscape architects, while it is a concept that can be understood intellectually, it can be very difficult to translate into physical design, especially when designing for people with disabilities. Thus, to identify and suggest how 'sensory value' could become integrated into design theory and implemented in practice, would be a useful contribution to new knowledge.

8.2 Comparison between the interviews with landscape architects, teachers and/or therapists and the observation results

The difference between how the landscape architects, teachers and therapists anticipated users would behave at the time of the interviews, and what the researcher recorded during the observation periods in both special schools, is an important finding to highlight in this research conclusion (Hussein, 2009) Listed below are the correspondences and differences for the interviews and observation outcomes, based on the case studies.

THE CORRESPONDENCES	THE DIFFERENCES
The most successful areas/features in terms of usage were: • The mobility that was possible on the pathways. • The variety of pathways.	• Musical instruments at the *Asteroid Arts Garden.* • Raised planters at the *Water Central Area.*

• Water feature at the *Water Central Area.* • Herbs and scented plants. • The sound stimuli in the *Woodland Garden.* The least used areas/features in terms of usage were: • *Exploraway* • *Vaporised trail* • The path network. • The slope and access.	• Willow tunnel at *Green Space One.* • *Parents' Waiting Area.* • Water feature at the *Water Garden.* • *Rainbow Walk.* • Lawn area.

Table 8.2: The correspondences and differences for the interviews and observation outcomes.

Table 8.2 summarise the following:

1. Good pathway design and planning that connects school buildings to the sensory garden as well as having the ability to move around the garden promotes educational development and social skills. This is one of the significant factors in encouraging the use of area in both special schools.

2. The differences between the interviews and observation outcomes could be used to inform landscape architects' future practice when designing for sensory gardens. For example, they should ensure that all users are offered a variety of activities and engage with affordances as well as minimising barriers to allow users full access to the garden.

The findings above illustrate that users, especially students, enjoyed having functional and a variety of individual behavior settings positioned bordering an accessible and continuous pathway. Thus a higher number of users and a longer time spend were recorded in relation to these design qualities. This matched the idea the teachers of the RSDCD had, of having a **'sensory trail**[60]**'**.

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[60] A sensory trail has similar objectives to the sensory garden in providing a range of experiences but it has more association with movement. It can, therefore, have a direct

8.3 Discussion of the sub-set of design recommendations

This research has gone one step further in producing a subset of design recommendations, which landscape architects should pay attention to. This subset is applicable across all (or most) sensory gardens relevant to the researcher's particular case-study examples (see also Appendix H for general design recommendations when creating a sensory garden, pp.298-303).

In conclusion, it was a **combination of soft, hard landscape and landscape furniture placed adjacent to a continuous primary pathway that offered easy access to the functional individual behaviour settings, and recorded the highest preferences.** In other words, the layout of the pathway network linking the sensory garden to the overall site context is crucial in encouraging the number of users who will engage with the behaviour settings placed along it. It does not matter what sort of behaviour settings are included (a combination of soft, hard landscape and landscape furniture) to offer variety to users - as long as they are accessible and functional, users will be engaged by them.

This finding echoed research undertaken by Moore and Cosco (2007) on inclusive parks, which showed that a highly positive feature and the one that was the most popular among the users, was a wide pathway that gave access to the facilities that were readily accessible. Another of their findings was that a meandering pathway afforded inclusion and added visual interest to the pedestrian experience. This raised another question in the researcher's mind about the direct pathway at the RSDCD compared to the curvy one at the LS. *Does the formation of a path play an important role in encouraging the*

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application to teaching orientation skills, for example through people learning to recognize different sounds, textures and scents along the trail and gaining confidence in their own abilities to interpret the environment and find their own way (http://www.sensorytrust.org.uk/information/factsheets/sensory_ip.html).

richness of affordances and behaviour? The study looked back at the overall design framework related to the path layout of both sensory gardens.

The landscape architect intended, when designing the RSDCD's sensory garden, to provide a strong overall framework which would channel and encourage movement from one area to the other individual areas; to improve the sense of direction, to offer paths of different widths and textures and to provide areas which offered a rich experience within a protected environment. For the LS, the landscape designer intended to maximise the potential of the site with landform and to create a meandering pathway network that would provide a range of options and opportunities to move through spaces along the way. When the distribution of users and frequencies of use in both sensory gardens were compared, which were recorded throughout the observation period (see Plans 4.1, p.121 and 4.2, p.136; Tables 4.1l, p.119 and 4.2j, p.134), it seemed apparent that users preferred to stroll on continuous pathways, which linked one zone to the next with readily accessible and functional individual behaviour settings that were adjacent to the pathways.

It is the **layout of the pathway**, therefore, that enables user behaviour and use of area rather than users seeking out corners or zones which have particular individual behaviour settings. This is significant new knowledge, from a design point of view, indicating that pathway layout is more important than the particular design of individual behaviour settings, as long as the pathways are accessible. What they should be designing is something more like a **'sensory trail'**. *How is a 'sensory trail' different from a sensory garden?*

In the sensory garden, users are encouraged to maximize their enjoyment and engagement of their senses. The behaviour settings, which they have in their sensory garden that the landscape architect wants to be enjoyed particularly, need to be adjacent to the pathway. Ideally, a sensory garden should have a continuous circulation network that links all zones of the garden with easy access to the different behaviour settings. Thus, what a landscape architect should be designing is a garden that is linked by a sensory trail but the sensory trail in one sense becomes a sensory garden.

The findings from Charts 5.2 and 5.4 (see p.156 and p.165, respectively) and Chapter Eight (see p.175), further suggested that a successful sensory trail comprises a combination of hard and soft landscape in a functional zone, along with a sufficient quantity of landscape furniture, such as seating, lighting and shelters, to make the composition into a coherent whole in the sensory garden for easy wayfinding, generating activities and responses. With further design recommendations suggested, landscape architects can be guided about how spaces in the garden could be structured, offer a richness of affordances and lessen the number of barriers that obstruct access.

Another contribution to knowledge is the design aspect of **sensory value**. As mentioned earlier, the teachers and therapists in both special schools had no strong views on aesthetic value in relation to the use of area in the sensory garden. However, the landscape architects disagreed with their views. When the researcher conducted interviews with both landscape architects, they often talked about the beautification of the site. On the other hand, users of the sensory garden thought that the behaviour settings should not just be aesthetically pleasant to see but also they should be nice to touch, hear, smell and taste. In other words, aesthetic value is not as important as sensory value. What the site or behaviour settings look like visually is much less important than how it feels, sounds, smells and tastes, as users getting access to the behaviour settings is very important. The fact that users can get access to and engage with them is the key point when designing for a sensory garden. It is more to do with where the behaviour settings are sited rather than what they are.

In order to support the sensory value, the study divided the actualised affordances, in relation to the landscape design categories, in terms of the five senses (touch, smell, sight, sound and taste), physical (mobility) and the social skills (speech) that every zone had to offer. Charts 5.1 (see p.148) and 5.3 (see p.158) were compared with Charts 6.1 and 6.2 (see p.178 and p.187, respectively) to find out whether there was any significant difference or similarity in the median time spent per user throughout the functional zones. The results could highlight the importance of sensory value as one key design recommendation when designing for sensory gardens.

The outcomes of these findings support the initial idea of having a good pathway layout and linking the sensory garden to site context by providing easy access to functional behaviour settings placed along it. Thus zones with this design quality will offer a high sensory value and will have a higher frequency of user engagement with a greater time spend per user.

8.4 Summary of the conceptual framework from the study

Diagram 8 summarises the conceptual framework from the study.

1. Measures undertaken to enable user participation and the usability of the sensory garden.

- **Activities and affordances** (the number of main activities and actualised affordances)
- **Individual behaviour settings engaged with** (the number of items, users encountered)
- **Length of engagement** (duration of main activities and actualised affordances/users)

The link between the individual behaviour settings, number of actualised affordances, number of users and the median time spent per user in each zone of the sensory garden.

RESULTS

i. The number of activities in the sensory garden was not dependent on the total area of the zone or the number of its individual behaviour settings.
ii. The number of individual behaviour settings and the total area of the zone were not related to the median length of time spent per user.
iii. The frequencies of actualised affordances did not relate to the number of users, the main activities and the total time spent.
iv. What encourages the number of users are **accessibility** to and **functionality** of the individual behaviour settings. Whenever there is access, the students will undertake a variety of activities and engage more with the behaviour settings compared to the staff.
v. Users spent a longer time in zones where **sensory**, rather than aesthetic value, were emphasised.

2. What makes an engaging multi-sensory environment?

- A good circulation network and a variety of garden accessories affording easy wayfinding in the sensory garden and back to the school building.
- A variety of behaviour settings positioned in strategic places, such as along pathways and areas with easy access, afford diverse activities for environmental and sensory learning.

ASPECTS

i. **Accessibility to** and **functionality of** the behaviour settings.
ii. **The layout of the circulation network,** i.e. **sensory trail.**
iii. **Sensory value,** not focusing only on the aesthetics (visual composition).
iv. **Safety** and **maintenance.**

3. A renewal of functioning in users through sensory, environmental and social learning.

- **Senses:** Increase in sensory stimulation, memories and preferences.
- **Physical (mobility):** Increase in movement and physical abilities.
- **Social (speech):** Increase in positive social skills, including communication and sharing.

BENEFITS

i. **Promotes multi-sensory learning**: Responses to the environment, educational resource, mobility practice, flexibility and usability, broadens experience (pleasant and stimulating), supports national curriculum and offers a meeting point or social gatherings.
ii. **Users develop a relationship with nature**: Helps to promote an understanding of and respect for nature in everyday life.

Diagram 8: Diagram of the conceptual framework from the study, based on the case-study examples.

This study constructed a methodology (see Diagram 1.1, p.33) based on methods that others had used, including Moore and Cosco's research (2007). The researcher further developed it in the context of a sensory garden and showed how it can be used in combination with other research. Moore and Cosco employed methods of behaviour mapping, behaviour tracking, park visits with people with disabilities, setting observations and interviews with users, and the researcher applied some of these methods. She demonstrated that they are applicable and can be used effectively in a British context. In addition, she added interviews/walk-through interviews with the landscape architects of the sensory gardens, specifically for this study, which is a useful tool that could be used by other researchers.

8.5 Summary of the research limitations

The research outcomes were limited because they were based on:

- The behavioural responses of all users in the two case-study special schools only. The researcher did not explore the specific disabilities of each student in the case-study schools, or their particular usage of the sensory garden; students in each school have individual schedules. It would have been impossible to undertake research on each student's usage of the garden in terms of how their specific needs or disability allowed them or created barriers to full use of the garden since the data collection was restricted to spring and summer school terms. Hence, the findings cover the range of user disabilities in both special schools.

- Walk-through interviews with the students were not undertaken extensively but only with a few who were suggested by the school itself. The researcher found it was particularly difficult to get first-hand information from students because of the communication difficulties, thus she observed them using the sensory garden by behavioural mapping methods.

- The preliminary site studies were carried out over five months (from July to October 2006 and February 2007), covering fourteen sites. Then the actual period of data collection for the two special schools was just five weeks to coincide with the school term periods and the researcher thought the months of May and July offered the best outdoor conditions. Other research into multi sensory environments was carried out over substantially longer periods. Long and Haigh (1992) had a pre-pilot period of two months, followed by observation over a six month period.

8.6 Outline of the potential research on sensory gardens and suggestions to improve the research methodology.

Several research proposals could be further explored on the design and use of sensory gardens in special schools:

- It would be interesting to explore the impact of sensory gardens on specific disabilities. This would produce distinct research on the affordances of sensory gardens. As a result, the result of future research would produce further knowledge into how the composition of the behaviour settings and the spatial design of the sensory garden would enable particular users' engagement and usability of the garden. Thus, additional recommendations and improvements for future use, planning and the design of sensory gardens in special schools could be suggested.

- Ward Thompson (1998) mentioned that personal construct psychology method can be used with children with special needs and learning difficulties. Another potential method to undertake is the 'Talking Mats' (Cameron, L., et al., 2004). This method may assist future researchers and landscape architects to communicate with a range of users with special educational needs.

- This study observed two pairs of distinctive users, namely, a visually-impaired male student (Y1*) and a female teacher (X1*) (see p.47, p.128, p.151; and Appendix F, F.1, zone F, observation note no.6); a female student in her wheelchair (X3*) and a female teaching assistant (X2*) (see the anecdotal evidence, p.116; and Appendix F, F.1, zone A, observation note no.3). However, as noted in the description of the research limitations, it was impossible to conduct lengthy observations. If time permitted, it would be effective to carry out data collection over a minimum of six months with a more specific sample group, which would allow for a greater degree of observable change, namely, with a group of individuals, all of whom were known to have some degree of the same physical or cognitive impairment, who could then be observed. * This coding can be referred in the SPSS software data in p.257.

8.7 Final conclusion

As the two case studies showed, the integration of sensory garden design into the overall design of special schools, and its inclusion in the curriculum, could encourage the creation of an outdoor environment which could offer a wide range of multi-sensory learning experiences for students with special educational needs. The students' experiences at the RSDCD and LS showed positive user functioning in three respects: sensory stimulation, physical (mobility), and social (speech and communication). For example, for students with special needs (RSDCD), getting to, and around the sensory garden, then back to the school building (wayfinding), was particularly important to them as many, if not all, had some form of mobility impairment.

Landscape architects should recommend, firstly, that sensory garden design should be integrated into the overall planning phases of a special school's development (or re-development). Secondly, they should recommend students' (and their carers') involvement in sensory garden design. These two recommendations, if followed, would foster greater design integrity of the entire school plan. Giving consideration to students' (and their carers') views on garden design and how it could be made appropriate to their range of needs and mobility capabilities, would improve, also, students' own wellbeing (Kytta, 2004).

Thirdly, landscape architects should observe and record users' daily routines, to better understand the affordances the way they perceive them. In so doing, the architect, teachers and therapists, could make the design phase and its realisation, part of the school curriculum, and view the garden as an area which offers the potential *for* learning, rather than just as an outdoor area which is there to be used only in breaks *from* classroom learning.

Fourthly, landscape architects should consider accessibility to, and the functionality of, the hard landscapes (including water features and artefacts), soft landscapes (including animals and microclimate) and landscape furniture (for example, seating, lighting, signage and shelters). With a continuous circulatory pathway network, user enjoyment of, and engagement with, the individual behaviour settings is likely to be enhanced; and the sensory trail is one very good way to achieve that.

Landscape architects must also consider health and safety, and risk assessment concerns when providing challenges to meet different user abilities (see the *Exploraway* and *Vaporised trail* at the RSDCD). None-the-less, landscape architects should try to offer as wide a range of challenges in a garden as matches the ability range and ages of the students. Where a school's intake is likely to change over time, landscape architects should consider leaving scope for further constructs to be built. This would allow levels of challenge to be added later, for uptake by users whose capabilities were suited to them, or who, with the encouragement of their teachers and carers, could rise to such new challenges, for example, the willow tunnel at the RSDCD and a *'wibbly-wobbly way'* in a special school but wheelchair accessible (Stoneham, 1996: 50). How far landscape architects can construct features that offer users challenges that are within their capabilities, with the right support, while observing health and safety concerns, needs further study. They should, though, review the likely impact of challenging areas on users at all the design phases, in consultation with students and their carers, and working to health and safety guidelines.

This study examined critically the design and use of sensory gardens in two special schools by evaluating their functional zones and how they were utilized, especially by children with different degrees of special educational needs, and their adult carers. When the researcher interviewed Jane Stoneham (2006), director of the Sensory Trust in the United Kingdom, she said that landscape architects make many assumptions about how disabled people navigate and benefit from an outdoor environment. She added that detailed guidelines for sensory garden design are few, a view endorsed by designers, Petrow (2006), Mathias (2006), Robinson (2007) and Boothroyd (2007) (see p.27, para.2). The researcher's findings and her sub-set of design recommendations, can support a further improvement in, and the creation of, a higher standard of sensory garden design by landscape architects. These recommendations, when integrated into detailed guidelines, as Stoneham, et al. recommend, would support better design of coherent garden spaces, further learning experiences and greater user enjoyment, within users' physical, mental and sensory capabilities. In a recent talk given by Clare Cooper Marcus, an expert in healing gardens at Edinburgh College of Art (March 6th, 2009), she said, *'Landscape architects should design gardens, not architects. You do not want a brain surgeon to replace your hip, do you?'*

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GLOSSARY

Access survey
An access survey is a tool to gauge an external space performance in terms of accessibility for disabled persons. The method is structured in a format that consists of a set of questions and guided by the particular country's legislative codes, standards and guidelines. The tool enables one to record the dimensions and existing specification of an external space element, and hence provides for an evaluative method. One goes through and checks whether the specification is according to the standards and guidelines. One or many persons must create a realistic route, often starting from the drop-off point and go around the premises and record the information that will be processed later. The analytical tool also guides the correct specification, which can contribute to the formation of an access audit. This in turn could enable the quantity surveyor or contractor to cost the specifications and help to quicken the implementation process. The client could easily see if the costs could be met from the budget that they have and could plan when to install the specifications. This evaluation came about because the disabled persons need to communicate technically and effectively concerning the lack of access features in an external space (Yaacob, N.M., 2000).

Actualised affordances
Actualised affordances of an environment are what the children encountered during their independent mobility, perception and engagement with the environmental features (Heft, 1988, 1999; Kytta, 2002, 2003, 2004, 2006).

Aesthetic
The philosophy or theory of taste, or the perception of the beautiful in nature and art (Oxford English Dictionary, quoted by Hill, 1993:170). This research uses the term 'aesthetic' to describe the visual composition of the respective sensory gardens.

Affordance
'Affordance is the perceived functional significance of an object, event or place for an individual' (Heft, 2001:123).

Animals
Animals include bees, butterflies, birds, slugs and cats.

Artefacts
Artefacts include planes, log, artworks, crane and chimes.

Behavioural mapping
'Behavioural mapping is a commonly used time-sampling technique. At pre-arranged times, an observer codes the activities and location of all the people in a space' (Friedman, et al., 1978:203).

Behaviour setting
A small-scale system composed of physical objects of people, which are confirmed in such a way as to carry out a routine programme or actions within specific time and place limits or bounds (Wicker, 1984).

Case study
'A well-documented and systematic examination of the process, decision-making and outcomes of a project, which is undertaken for the purpose of informing future practise, policy, theory and/or education' (Francis, 2001:16).

Communication therapist
'A communication therapist evaluates, diagnoses and treats speech and language disorders, assesses the quality and quantity of sounds in a student's repertoire and identifies other non-verbal means of communication' (Pagliano, 1999:61).

Disability
Any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being (World Health Organisation, 1980)

Disabled person
An individual who has a physical or mental impairment that has a substantial and long-term adverse effect on his/her ability to carry out normal day-to-day activities (Disability Discrimination Act 1995).

Error bar
Error bar looks at the differences between groups of people (Field, 2005). *'The Error Bar chart displays not only the mean, but also the 95% confidence interval of the mean of each experimental condition'* (Field, 2005:274). *'The basic idea behind confidence intervals is to construct a range of values within which the experimental value falls'* (Field. 2005:17).

Grouping categories
The grouping categories were 'student alone', 'staff alone', '1 student with 1 staff', '1 student with staff', 'students with staff', 'staff', 'students' and 'students with 1 staff'.

Handicap
A disadvantage for a given individual, resulting from an impairment or disability, that limits or prevents the fulfilment of a role (depending on age, sex and social and cultural factors) for that individual (World Health Organisation).

Hard landscape
Hard landscape consists of hard surfaces, structures, planters (Hill, 1995:241).

Impairment
Any loss or abnormality of psychological, physiological or anatomical structure or function (World Health Organisation, 1980).

Individual interviews using walk-through
'The designer walks through the completed design and comments on the experience he or she has had and intended users are likely to have in various areas of the project' (Bechtel and Srivastava, 1978:442).

Interviews
'With a well-composed interview, you will be able to gather data on how far people have travelled to this place, how often they come, what they like best about it, what they would like to see changed, how they feel different after being in the space, and so on' (Cooper Marcus, 2002:220).

Kruskal Wallis
Kruskal Wallis test is *'if you have non-normally distributed data or have violated some other assumption, then this test can be a useful way around the problem'* (Field, 2005:542).

Landscape design categories
Comprise of 'Soft Landscape', 'Hard Landscape' and 'Landscape Furniture'.

Landscape furniture
'Landscape furniture consists of seating, litter bins, lighting, signs, bollards, play structures, shelters' (Hill, 1995:291).

Man-Whitney U
Man-Whitney U test is *'when you want to test differences between two conditions and different participants have been used in each condition'* (Field, 2005:522).

Main activities
Main activities were walking/passing through, walking fast, walking together, walking with wheelchair, stopping/standing, stop/stand and talking, sitting, sitting together, sitting and talking, playing with the sensory equipment, laying down and singing.

Microclimate
Microclimate comprises thunder, rainwater, sun and wind.

Mobility
'Mobility is the ability to travel through the surroundings' (Bell, 1993:155).

Multiple affordances
Multiple affordances mean two or more opportunities for the activities engaged in by users while in a specific setting.

Multiple disabilities
The term is used by Orelove and Sobsey (1991) to refer to individuals with *'severe or profound learning difficulties and one or more significant motor or sensory impairments and /or special health care needs'* (quoted in McLinden, 1997:318).

Multi-sensory
Describes the multiple bodily senses, which involve exposing users of the sensory garden, particularly students with multiple disabilities to a stimulating environment that is designed to offer sensory stimulation using textures, colours, scents, sounds, etc.

Negative affordances
Negative affordances induce feelings of avoidance, danger, escape and fear (Heft, 1999; Kytta, 2003).

Occupational therapist
'An occupational therapist specialises in the development and maintenance of functions and skills necessary for daily living, especially fine motor functions and skills' (Pagliano, 1999:60).

Outdoor environmental learning
'The opportunities initiated by teachers or students to complement or supplement the formal curricula indoors' (Malone and Tranter, 2003:285).

Positive affordances
Positive affordances relate to the children's movement and their perceptions of the environment, resulting in them offering satisfaction, finding it appealing and friendly (Heft, 1999; Kytta, 2003).

Potential affordances
Potential affordances of an environment or an object can be looked at in relation to the individual's qualities such as children's physical skills or bodily proportions, social needs

and personal intentions are matched with the environmental features (Kytta, 2002, 2003, 2006).

Seated activity
Seated activity refers to users who sat either on seats or other individual behaviour settings in the sensory garden, including wheelchair users.

Sense
'A faculty by which the body perceives an external stimulus: one of the faculties of sight, hearing, taste and touch, smell' (Definition quoted from the Oxford American Dictionaries).

Sensory
Relating to the senses or the power of sensation (Robinson, 2008).

Sensory garden
A sensory garden is a self-contained area that concentrates a wide range of sensory experiences. Such an area, if designed well, provides a valuable resource for a wide range of uses, from education to recreation (http://www.sensorytrust.org.uk/information/factsheets/sensory_ip.html).

Sensory trail
A sensory trail has similar objectives to the sensory garden in providing a range of experiences but it has more association with movement. It can, therefore, have a direct application to teaching orientation skills, for example through people learning to recognise different sounds, textures and scents along the trail and gaining confidence in their own abilities to interpret the environment and find their own way (http://www.sensorytrust.org.uk/information/factsheets/sensory_ip.html).

Sensory Trust
The Sensory Trust was established in 1989 and grew put of a multi-disciplinary consultation resulting in a wide network of disability and environmental organisations working together to promote and implement an inclusive approach to design and manage outdoor spaces; richer connections between people and place; and equality of access for all people (http://www.sensorytrust.org.uk).

Snoezelen
The word 'Snoezelen' is *'a contraction of two Dutch words, meaning to smell and to doze. The idea came from Hulsegge and Verhuel (1987), and was developed in residential institutions related to recreation and leisure for adults rather than in educational institutions for children'* (Pagliano, 1998:8).

Soft landscape
Soft landscape consists of planted areas, trees, shrubs, grass (Hill, 1995:317).

Special educational needs
Includes specific learning disability, moderate learning disability, severe learning disability, profound and multiple learning disability, emotional and behavioural difficulty, speech, language and communication needs, hearing impairment, visual impairment, multi-sensory impairment, physical difficulty, autism spectrum disorder and others (Special Educational Needs Code of Practise (2001). In this study, the term 'special educational needs' will be used when describing the 'students' of the two case-study sensory gardens.

Special education teacher
'A teacher may work in a special school and be responsible for a class of children, all with special needs' (Pagliano, 1999:59).

Speech
Type of communication with a multi sensory deprived student can take many forms: signals, gestures, class cues, finger spelling.

Staff
Staff include teachers, therapists, teaching assistants and gardeners.

'Staff alone'
'Staff alone' means either a member of the school staff who either engaged with the essential features or simply passed through the sensory garden by him- or herself.

Students
Students who are mainly children with special educational needs.

'Students'
'Students' means a group of students (2-3 students) who passed through the sensory garden either walking at a slower or faster pace than their adult carers or teachers. Students were not allowed to wander around the garden by themselves.

Synomorphy
Synomorphy means *'similar to nature'* (LeCompte, 1974:185). Moore, Gary.T (1979:53) stated that 'synomorphy' means *'if the setting components are in harmony with the behaviour and its rules or purposes, there is a fit between environment and behaviour, between form and purpose and the behavior setting'.*

Timescale
The timescale to record user activity were categorised as less than 1 minute, 1–2 minutes, 2–5 minutes, and more than 5 minutes.

Time spent
The time spent was measured by number(s) of users x median of the timescale.

Unique affordances
Unique affordances mean a single opportunity of activity engaged in by users while in a specific setting.

Vaporised trail
Vaporised trail was the term of used by the landscape architect who designed the sensory garden. It was designed for wheelchair users to offer challenges, with a surface of gravel and limestone blocks and it is located at the *Green Space One.*

Visual composition
By definition, 'visual' means 'able to be seen by the eyes', while 'composition' means 'arrangement', therefore, 'visual composition' in the context of the two sensory gardens selected, means *appearance.*

Wheeling stream
Wheeling stream was the term used by Jane Stoneham, who designed this feature in a special school for wheelchair users, to give them a feeling of wheeling in the water through shallow water that is safe to cross over.

Water feature
The water feature has been classified as a hard landscape feature because the construction involved using a hard durable material; the water itself, of course, a natural feature.

APPENDIX A
Details of the Preliminary Site Studies and Location

A.1 Edinburgh
Scotland Yard Adventure Centre
22 Eyre Place Lane EH3 5EH

St. Crispin's School
19 Watertoun Road EH9 3HZ

The Royal Blind School (Craigmillar Campus)
Craigmillar Park, Newington EH16 5NA

A.2 Glasgow
Kelvin School
69 Nairn Street G3 8SE

Carnbooth Residential School for Dual Sensory Impaired
Carnbooth House, 80 Busby Road, Carmunnock G76 9EG

Cranhill Sensory Garden

A.3 Manchester
Royal School for the Deaf & Communication Disorders
Stanley Road, Cheadle Hulme, Cheshire SK8 6RQ

Stockport Metropolitan Borough Council
Environment & Economy Directorate, Parks & Recreation - Landscape Development
4th Floor Stopford House / Town Hall Stockport Cheshire SK1 3XE

A.4 Liverpool
All Saints Catholic High School
Bewley Drive, Kirkby, Merseyside L32 9PQ

The Hidden Garden
23 Paradise Lane Formby, Merseyside L37 7EH

Lyndale School
Lyndale Avenue, Eastham, Wirral CH62 8DE

Groundwork Wirral
7, Royal Standard Way, Expressway Business Park, New Chester Road, Birkenhead
CH42 1NB

A.5 Nottingham
Rutland House School
Elm Bank NG3 5AJ

A.6 London - Reading
Redgates School
489 Purley Way, Croydon CR0 4RG

Woodlands Sensory Garden
Sutton and Merton Primary Care Trust, Main Administration, Orchard Hill, Fountain Drive, Carshalton, Surrey SM5 4NR

St. Ann's School
Bordesley Road, Morden, Surrey SM4 5LT

Robert Petrow Associates Chartered Landscape Architect
The Studio, 57 Lime Grove, New Malden, Surrey KT3 3TP

Iver Nature Study Centre
Slough Road, Iver Heath, Buckinghamshire SL0 0EB

A.7 Cornwall
The Sensory Trust
Watering Lane Nursery, Pentewan, St. Austell PL26 6BE

APPENDIX B

The Interview Material

B.1 Interview questionnaire for the landscape architects

Date:

Name of the landscape architect:

Name of the sensory garden:

1. What are the key principles in your design?
2. Can you briefly explain the design process you have carried out in designing the sensory garden?
3. What were the main challenges you had to deal with?
4. What do you think is the most successful about your design?
5. What do you think is the least successful about your design?
6. Please indicate the degree to which you think the following design aspects of a sensory garden enable the use that of area.

1=have not; 2=little; 3=medium; 4=pretty much; 5=very much

DESIGN ASPECTS	RANGE				
	1	2	3	4	5
Accessibility					
Aesthetic value					
Maintenance					
Planting					
Quality of sensory equipment					
Quantity of sensory equipment					
Quality of surface equipment (hard and soft)					
Safety					
Spatial location of the garden in relation to buildings and context					

7. How well do you think you can predict which area(s) you think users will utilise most, based on the design aspects you have considered? Why?
8. Which area do you think users will least utilise? Why?

B.2 Walk-through interview questionnaire for the landscape architects

1. Are all the designed areas being used as they were intended to?
2. What is the most successful feature/area in terms of use?
3. What is the least successful feature/area in terms of use?
4. Has any use surprised you?
5. Have all design problems been solved upon the completion of the sensory garden? If not, what would you like to see improved?
6. If you were given another opportunity to design a sensory garden, how would you do things differently, if at all?

B.3 Interview questionnaire for the teachers and therapists

Date:

Name of the teacher/therapist:

Name of the sensory garden:

1. Do you see any improvements in the student's educational development and social interaction after having a sensory garden in the school? If yes, please describe and give examples of any benefits you have discovered.
2. Did you discover any problems with the sensory garden when children are using the area? If so, please describe and give examples of any constraints or problems.
3. What is the most successful feature/area in terms of use?
4. What is the least successful feature/area in terms of use?
5. Has any use surprised you?
6. Please indicate the degree to which you think the following design aspects of a sensory garden enable the use of that area.

1=have not; 2=little; 3=medium; 4=pretty much; 5=very much

DESIGN ASPECTS	RANGE				
	1	2	3	4	5
Accessibility					
Aesthetic value					
Maintenance					
Planting					
Quality of sensory equipment					
Quantity of sensory equipment					
Quality of surfacing equipment (hard and soft)					
Safety					
Spatial location of the garden in relation to buildings and context					

7. What would you like to see improved in the sensory garden?
8. If you had it designed again, what, if anything, would you like to see done differently?

B.4 Interview questionnaire for the students

Student's Age/Disability(s):

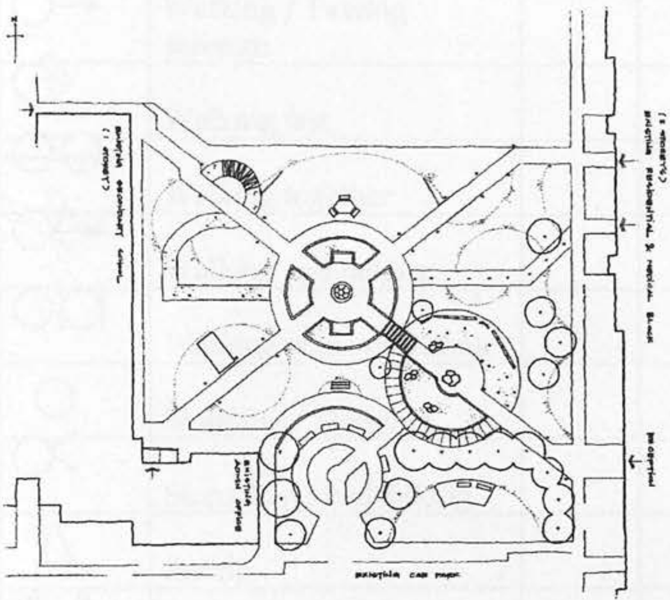
Name of the teacher/teaching assistant:

1. Do you come to the sensory garden by yourself or with a teacher or a friend?
2. What would you like to do in the sensory garden if you were on your own or with a teacher or your friend? Where would you do that?
3. What is your favourite area in the sensory garden? Why is that your favourite area?
4. Are there any other areas you don't like? What don't you like about it? Why don't you like about it?
5. Are there any other things you don't like about the sensory garden?
6. Are there some areas you would like to use but can't?

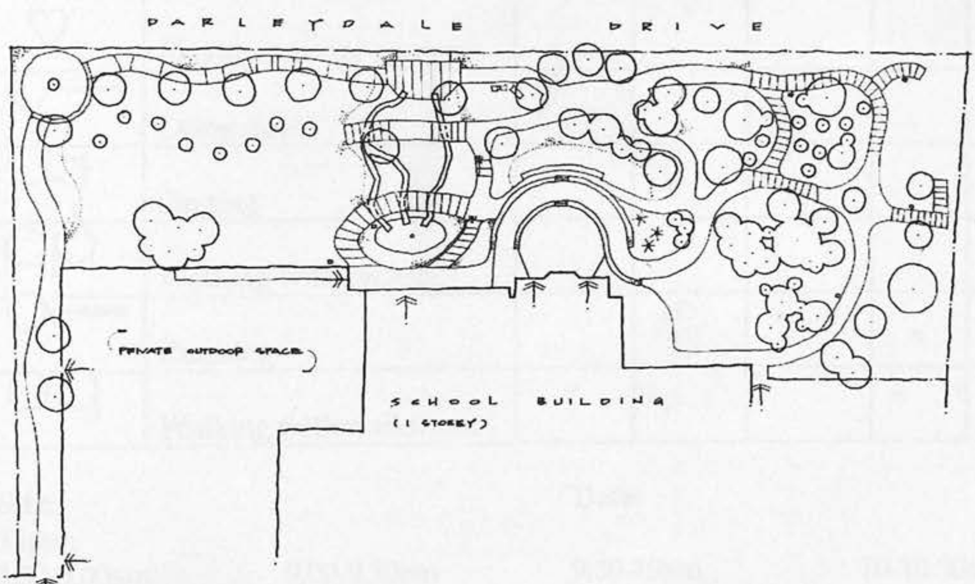
APPENDIX C

The Observation and Behaviour Mapping Material

C.1 Map to record observation

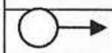
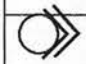
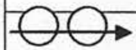
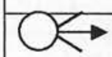
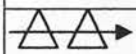
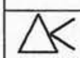
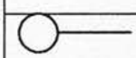
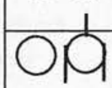


Royal School for the Deaf and Communication Disorders, Cheshire



Lyndale School, Wirral

C.2 The behaviour mapping table

SYMBOL	MAIN ACTIVITIES	FEMALE (outline)		MALE (solid)		NOTES
		Student	Staff	Student	Staff	
	Walking / Passing through					
	Walking fast					
	Walking together					
	Walking and talking					
	Walking with wheelchair					
	Stopping / Standing					
	Stop/Stand and talking					
	Sitting					
	Sitting together					
	Sitting and talking					
	Playing sensory equipmt					
	Lying down					
	Singing					
	Walking with cyclist					
	Running					
	Walking with walkframe					

Site: **Date:**

Time:

8.30-9.00am 9.00-9.30am 9.30-10am 10-10.30am
10.30-11am 11-11.30am 11.30-12pm 12-12.30pm
12.30-1pm 1-1.30pm 1.30-2pm 2-2.30pm
2.30-3.00pm 3.00-3.30pm

Timescale:

1=less than 1min 2=1-2min 3=2-5min 4=more than 5min.

Weather conditions:

Breezy/Windy Drizzle/Rainy Damp/Dry Cloudy/Sunny

C.3 Environmental qualities that support certain affordances

ENV. QUALITIES	AFFORDANCES	OCCURENCE	FEMALE (outline)		MALE (solid)		NOTES
			Student	Staff	Student	Staff	
Flat surfaces	Running, skipping, crawling sitting, jumping, crossing over, splashing; stepping; playing puddle, squatting, laying, singing, walking fast, walking, squatting, stopping hopping.	Lawn, rubbery, pathway.					
Smooth/ rough surfaces	Coasting down, stamping, running, stepping, skipping, singing, leaning against, sitting, jumping, walking, cheering, clapping, fear of slippery, feeling, laughing.	Slope, decking (boardwalk), *vaporised trail,* raised beds.					
Attached objects	Swinging, hanging, playing, hitting, touching, shaking, stepping on, balancing, sitting, taking photos, climbing on, feeling, jumping from, staring, walking, lifting, running hands, touching, holding, hearing, counting, reading notes, talking, listening, pressing, laughing, clapping, taking photos.	Textured wall, log, boulders (rock sculpture), musical instruments; pipes, lighting bollard, wood edge, talking tubes, sound stimuli.					
Detached objects	Throwing, digging, moulding, lying down, kicking, running, walking, crushing, jumping, squatting, sitting, lifting, carrying, crossing, feeling, talking about it (including via sign language), scooping, digging.	Seating, sand, gravel, chipping, slate stone channels, stones.					
Shelter	Hiding, privacy, touching, playing, cheering, fear in getting in, taking photos, staring, talking about it (including via sign language), spreading both arms, feeling the column, passing through, pointing.	Willow tunnel, covered tunnel, building.					
Water	Splashing, playing, pouring, sprinkling, talking about it (including	Water feature.					

	via sign language), stepping over, washing hands, pointing, feeling water; surface of 'pineapple', crossing over, taking photos, laughing, drinking, hand dipping, tasting, scooping, repairing, throwing stones, watching, looking over, greeting, fear of getting wet, hearing, touching, squatting, staring, scooping,						
Plants	Playing, sniffing, smelling, plucking, rubbing, touching, jumping over, eating, tasting, spitting, brushing legs; body; hands, collecting, searching, pointing, talking about it (including via language), holding, giving, keeping, cutting, picking, sitting, throwing, feeling, sweeping, running hands, digging, keeping, climbing, crawling, coasting down, blowing, running, taking photos, smelling hands, grabbing, shaking, pulling, stepping over, skipping, walking, crossing over, standing.	Raised planters, trees, shrubs, climbers, grass moss.					
Artefacts	Waving, pointing, listening, talking about it (including si via language), watching, step walking, jumping, sitting, knocking, climbing, feeling, shaking, pu	Planes, log, artworks, crane, chimes.					
Animals	Fear of stung, pointing, picking, holding, talking about it (including via sign language), listening, disgusting, putting on palm, burying, watching, loo communicating.	Bees, butterflies, birds, slugs, cats.					
Microclimate	Listening, talking about it (including via sign language), pouring, sprinkling, scooping, feeling, affords getting agitated.	Thunder, rain water, sun, wind.					

APPENDIX D

Coding of the SPSS software and the Frequencies of Patterns of Use

D.1 Coding from the observation and behaviour mapping

Month (Mth)	**Code**	**Gender (Gen)**	**Code**
May	1	Female	1
July	2	Male	2
Day (Day)	**Code**	**Users (Use)**	**Code**
1	1	Student	1
2	2	Staff	2
3	3		
4	4	**Grouping categories (ICG)**	**Code**
5	5	Student alone	1
6	6	Staff alone	2
7	7	1 student with 1 staff	3
		1 student with staff	4
Time (Tme)	**Code**	Students with staff	5
8.30-9.00am	1	Staff	6
9.00-9.30am	2	Students	7
9.30-10.00am	3	Students with 1 staff	8
10.00-10.30am	4		
10.30-11.00am	5	**Zones (Zon)**	**Code**
11.00-11.30am	6	Zone A	1
11.30-12.00pm	7	Zone B	2
12.00-12.30pm	8	Zone C	3
12.30-1.00pm	9	Zone D	4
1.00-1.30pm	10	Zone E	5
1.30-2.00pm	11	Zone F	6
2.00-2.30pm	12		
2.30-3.00pm	13	**Activities (Act)**	**Code**
3.00-3.30pm	14	Walking/passing through	1
		Walking fast	

Weather (Wea)	Code
Dry, sunny	1
Windy, dry, sunny	2
Windy, dry, cloudy	3
Windy, damp, cloudy	4
Dry, cloudy	5
Rainy, cloudy	6
Damp, cloudy	7
Damp, sunny	8

Walking together	2
Walking and talking	
Walking with a wheel chair	3
Walking with a cyclist	
Stopping/standing	4
Stopping/standing and talking	
Sitting	5
Sitting together	
Sitting and talking	
Affordances (Aff)	**Code**
Unique	1
Multiple	2
Timescale (Tsc) (minute)	**Code**
Less than 1 min.	1
1 - 2 mins.	2
2 - 5 mins.	3
More than 5 mins.	4

Observation and behavioural mapping of users X1, Y1 and X3, X2 at the RSCDC.

Mt	Da	Tm	We	Te	Ge	Us	IC	Zo	Ac	Af	Ts	Zo	Ac	Af	Ts	Zo	Ac	Af	Ts	Zo	Ac	Af	Ts	Zo	Ac	Af	Ts	Zo	Ac	Af	Tsp	
1	2	6	1	5	2	1	3	1	3		1													5	3		1	6	5	2	4	Y1
1	2	6	1	5	1	2	3	1	3		1													5	3		1	6	5	2	4	X1
1	**3**	**9**	**3**	**5**	**1**	**1**	**3**	**1**	**3**	**1**	**4**	**2**	**3**	**1**	**4**					**4**	**3**	**1**	**4**	**5**	**3**	**1**	**4**	**6**	**3**	**1**	**4**	**X3**
1	**3**	**9**	**3**	**5**	**1**	**2**	**3**	**1**	**3**		**4**	**2**	**3**		**4**					**4**	**3**		**4**	**5**	**3**		**4**	**6**	**3**		**4**	**X2**
1	4	8	4	2	1	1	3	1	3	1	4	2	3	1	4					4	3	1	4	5	3	1	4	6	3	1	4	X3
1	4	8	4	2	1	2	3	1	3		4	2	3		4					4	3		4	5	3		4	6	3		4	X2
1	**4**	**9**	**4**	**2**	**1**	**1**	**3**	**1**	**3**	**1**	**4**	**2**	**3**	**1**	**4**					**4**	**3**	**1**	**4**	**5**	**3**	**1**	**4**	**6**	**3**	**1**	**4**	**X3**
1	**4**	**9**	**4**	**2**	**1**	**2**	**3**	**1**	**3**		**4**	**2**	**3**		**4**					**4**	**3**		**4**	**5**	**3**		**4**	**6**	**3**		**4**	**X2**
1	6	6	3	3	1	2	3	1	3	2	3																					X1
1	6	6	3	3	2	1	3	1	3	2	3																					Y1
1	**6**	**9**	**3**	**3**	**1**	**1**	**3**	**1**	**3**	**1**	**4**	**2**	**3**	**1**	**4**					**4**	**3**	**1**	**4**	**5**	**3**	**1**	**4**	**6**	**3**	**1**	**4**	**X3**
1	**6**	**9**	**3**	**3**	**1**	**2**	**3**	**1**	**3**		**4**	**2**	**3**		**4**					**4**	**3**		**4**	**5**	**3**		**4**	**6**	**3**		**4**	**X2**
1	7	9	2	2	1	1	3	1	3	1	4	2	3	1	4					4	3	1	4	5	3	1	4	6	3	2	4	X3
1	7	9	2	2	1	2	3	1	3		4	2	3		4					4	3		4	5	3	2	4	6	3	2	4	X2
1	**1**	**11**	**2**	**8**	**2**	**1**	**3**	**1**	**3**		**1**	**2**	**3**		**1**									**5**	**3**		**1**	**6**	**5**	**2**	**4**	**X1**
1	**1**	**11**	**2**	**8**	**1**	**2**	**3**	**1**	**3**		**1**	**2**	**3**		**1**									**5**	**3**		**1**	**6**	**5**	**2**	**4**	**Y1**
1	1	12	1	8	2	1	3	1	5	2	4																					Y1
1	1	12	1	8	1	2	3	1	5	2	4																					X1
1	**3**	**12**	**3**	**3**	**1**	**1**	**3**	**1**	**3**	**1**	**4**	**2**	**3**	**1**	**4**					**4**	**3**	**1**	**4**	**5**	**3**	**1**	**4**	**6**	**3**	**1**	**4**	**X3**
1	**3**	**12**	**3**	**3**	**1**	**2**	**3**	**1**	**3**		**4**	**2**	**3**		**4**					**4**	**3**		**4**	**5**	**3**		**4**	**6**	**3**		**4**	**X2**
1	3	13	3	4	1	1	3	1	3	1	4	2	3	1	4					4	3	1	4	5	3	1	4	6	3	1	4	X3
1	3	13	3	4	1	2	3	1	3		4	2	3		4					4	3		4	5	3		4	6	3		4	X2
1	**5**	**10**	**3**	**3**	**1**	**1**	**3**	**1**	**3**		**1**									**4**	**3**		**1**	**5**	**3**		**1**	**6**	**3**		**1**	**X3**
1	**5**	**10**	**3**	**3**	**1**	**2**	**3**	**1**	**3**		**1**									**4**	**3**		**1**	**5**	**3**		**1**	**6**	**3**		**1**	**X2**
1	5	11	3	3	1	2	3	1	5	2	4																					X1
1	5	11	3	3	2	1	3	1	5	2	4																					Y1
1	**6**	**10**	**3**	**4**	**1**	**1**	**3**	**1**	**3**	**1**	**4**	**2**	**3**	**1**	**4**					**4**	**3**	**1**	**4**	**5**	**3**	**1**	**4**	**6**	**3**	**1**	**4**	**X3**
1	**6**	**10**	**3**	**4**	**1**	**2**	**3**	**1**	**3**		**4**	**2**	**3**		**4**					**4**	**3**		**4**	**5**	**3**	**2**	**4**	**6**	**3**	**2**	**4**	**X2**
1	7	10	3	2	1	1	3	1	3	1	2									4	3	1	2	5	3	1	2	6	3		2	X3
1	7	10	3	2	1	2	3	1	3		2									4	3		2	5	3		2	6	3		2	X2
1	**7**	**11**	**3**	**3**	**1**	**1**	**5**	**1**	**3**	**1**	**3**									**4**	**3**	**1**	**3**	**5**	**3**	**1**	**3**	**6**	**3**	**1**	**3**	**X3**
1	**7**	**11**	**3**	**3**	**1**	**2**	**5**	**1**	**3**		**3**									**4**	**3**		**3**	**5**	**3**		**3**	**6**	**3**		**3**	**X2**
1	7	13	2	4	1	1	3	1	3	1	4	2	3	1	4					4	3	1	4	5	3	1	4	6	3	1	4	X3
1	7	13	2	4	1	2	3	1	3		4	2	3		4					4	3		4	5	3		4	6	3		4	X2
2	**6**	**4**	**2**	**7**	**1**	**1**	**3**	**1**	**3**	**1**	**4**	**2**	**3**	**1**	**4**					**4**	**3**	**1**	**4**	**5**	**3**	**1**	**4**	**6**	**3**	**1**	**1**	**X3**
2	**6**	**4**	**2**	**7**	**1**	**2**	**3**	**1**	**3**		**4**	**2**	**3**		**4**					**4**	**3**		**4**	**5**	**3**		**4**	**6**	**3**		**1**	**X2**
2	2	5	3	7	1	1	3													4	3	1	3	5	3	1	3	6	3	1	3	X3
2	2	5	3	7	1	2	3													4	3		3	5	3		3	6	3		3	X2
2	**4**	**7**	**2**	**7**	**1**	**1**	**3**	**1**	**3**	**1**	**4**	**2**	**3**	**1**	**4**					**4**	**3**	**1**	**4**	**5**	**3**	**1**	**4**	**6**	**3**	**1**	**4**	**X3**
2	**4**	**7**	**2**	**7**	**1**	**2**	**3**	**1**	**3**		**4**	**2**	**3**		**4**					**4**	**3**		**4**	**5**	**3**		**4**	**6**	**3**		**4**	**X2**
2	5	9	6	8	1	1	3	1	3	1	1									4	3	1	1	5	3	1	1	6	3	1	1	X3
2	5	9	6	8	1	2	3	1	3		1									4	3		1	5	3		1	6	3		1	X2
2	**5**	**10**	**6**	**9**	**1**	**1**	**3**	**1**	**3**	**1**	**1**									**4**	**3**	**1**	**1**	**5**	**3**	**1**	**1**	**6**	**3**	**1**	**1**	**X3**
2	**5**	**10**	**6**	**9**	**1**	**2**	**3**	**1**	**3**		**1**									**4**	**3**		**1**	**5**	**3**		**1**	**6**	**3**		**1**	**X2**
2	5	12	6	9	1	1	3	1	3	1	1									4	3	1	1	5	3	1	1	6	3	1	1	X3
2	5	12	6	9	1	2	3	1	3		1									4	3		1	5	3		1	6	3		1	X2
2	**5**	**13**	**6**	**9**	**1**	**1**	**3**	**1**	**3**	**1**	**4**	**2**	**3**	**1**	**4**					**4**	**3**	**1**	**4**	**5**	**3**	**1**	**4**	**6**	**3**	**1**	**4**	**X3**
2	**5**	**13**	**6**	**9**	**1**	**2**	**3**	**1**	**3**		**4**	**2**	**3**		**4**					**4**	**3**		**4**	**5**	**3**		**4**	**6**	**3**		**4**	**X2**

D.2 The frequencies of patterns of use in the sensory garden at the RSDCD

Tme

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	530	11.7	11.7	11.7
	2	545	12.1	12.1	23.8
	3	364	8.1	8.1	31.9
	4	274	6.1	6.1	37.9
	5	234	5.2	5.2	43.1
	6	335	7.4	7.4	50.5
	7	272	6.0	6.0	56.6
	8	224	5.0	5.0	61.5
	9	276	6.1	6.1	67.6
	10	378	8.4	8.4	76.0
	11	260	5.8	5.8	81.8
	12	321	7.1	7.1	88.9
	13	503	11.1	11.1	100.0
	Total	4516	100.0	100.0	

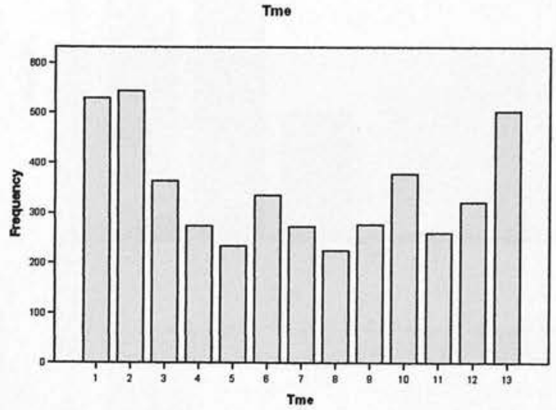
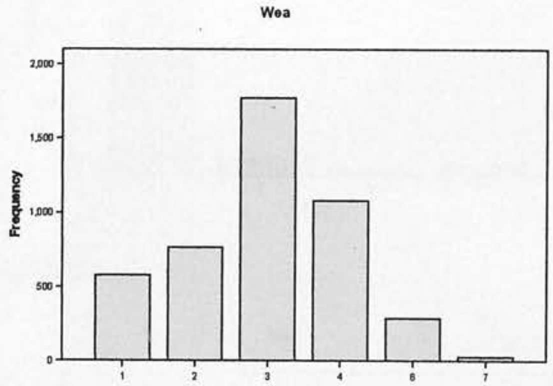


Table 4.1a: Frequency of time.

Wea

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	578	12.8	12.8	12.8
	2	765	16.9	16.9	29.7
	3	1777	39.3	39.3	69.1
	4	1083	24.0	24.0	93.1
	6	285	6.3	6.3	99.4
	7	28	.6	.6	100.0
	Total	4516	100.0	100.0	

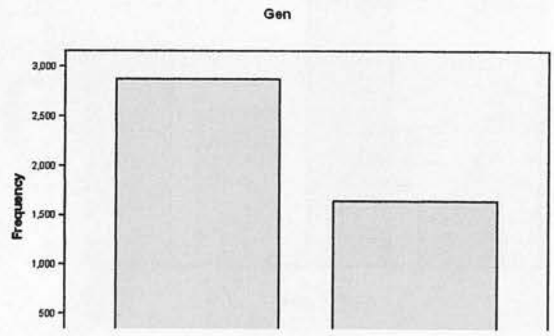
Table 4.1b: Frequency of weather.



Gen

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2874	63.6	63.7	63.7
	2	1639	36.3	36.3	100.0
	Total	4513	99.9	100.0	
Missing	System	3	.1		
Total		4516	100.0		

Table 4.1c: Frequency of gender.



Use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1165	25.8	25.8	25.8
	2	3348	74.1	74.2	100.0
	Total	4513	99.9	100.0	
Missing	System	3	.1		
Total		4516	100.0		

Table 4.1d: Frequency of users.

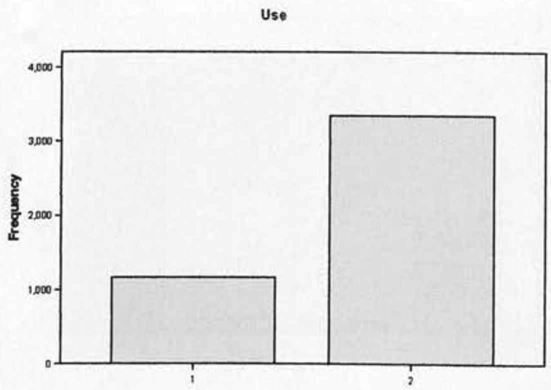
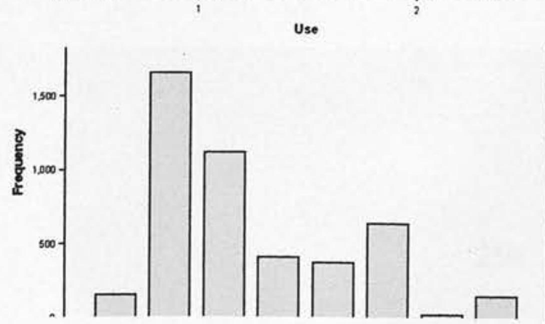


Table 4.1e: Frequency of grouping (ICG).

ICG

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	151	3.3	3.3	3.3
	2	1660	36.8	36.8	40.1
	3	1118	24.8	24.8	64.9
	4	406	9.0	9.0	73.9
	5	373	8.3	8.3	82.2
	6	636	14.1	14.1	96.3
	7	20	.4	.4	96.7
	8	149	3.3	3.3	100.0
	Total	4513	99.9	100.0	
Missing	System	3	.1		
Total		4516	100.0		



Zon1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	4254	94.2	100.0	100.0
Missing	System	262	5.8		
Total		4516	100.0		

Act1

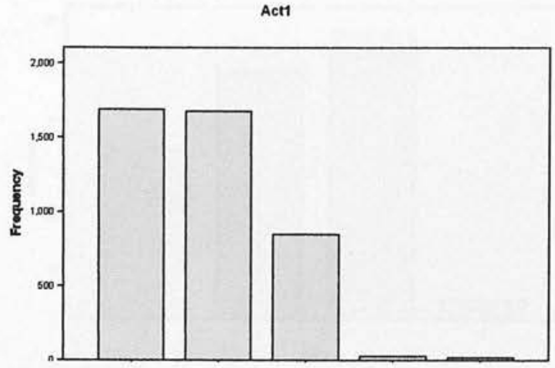
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1687	37.4	39.7	39.7
	2	1677	37.1	39.4	79.1
	3	845	18.7	19.9	98.9
	4	27	.6	.6	99.6
	5	18	.4	.4	100.0
	Total	4254	94.2	100.0	
Missing	System	262	5.8		
Total		4516	100.0		

Aff1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	59	1.3	80.8	80.8
	2	14	.3	19.2	100.0
	Total	73	1.6	100.0	
Missing	System	4443	98.4		
Total		4516	100.0		

Tsp1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3824	84.7	90.0	90.0
	2	219	4.8	5.2	95.1
	3	61	1.4	1.4	96.6
	4	146	3.2	3.4	100.0
	Total	4250	94.1	100.0	
Missing	System	266	5.9		
Total		4516	100.0		



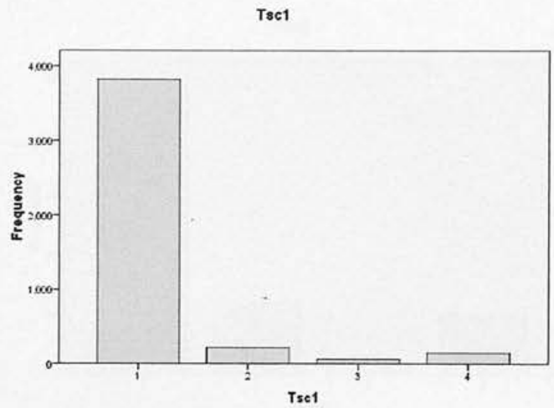


Table 4.1f: Frequency of *Parents' Waiting Area*.

Zon2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	397	8.8	100.0	100.0
Missing	System	4119	91.2		
Total		4516	100.0		

Act2

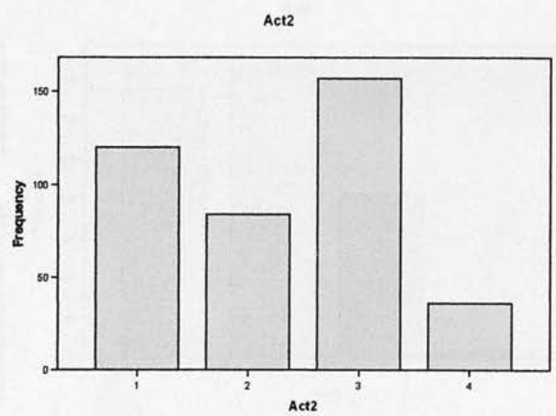
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	120	2.7	30.2	30.2
	2	84	1.9	21.2	51.4
	3	157	3.5	39.5	90.9
	4	36	.8	9.1	100.0
	Total	397	8.8	100.0	
Missing	System	4119	91.2		
Total		4516	100.0		

Aff2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	45	1.0	95.7	95.7
	2	2	.0	4.3	100.0
	Total	47	1.0	100.0	
Missing	System	4469	99.0		
Total		4516	100.0		

Tsp2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	252	5.6	63.5	63.5
	2	15	.3	3.8	67.3
	3	11	.2	2.8	70.0
	4	119	2.6	30.0	100.0
	Total	397	8.8	100.0	
Missing	System	4119	91.2		
Total		4516	100.0		



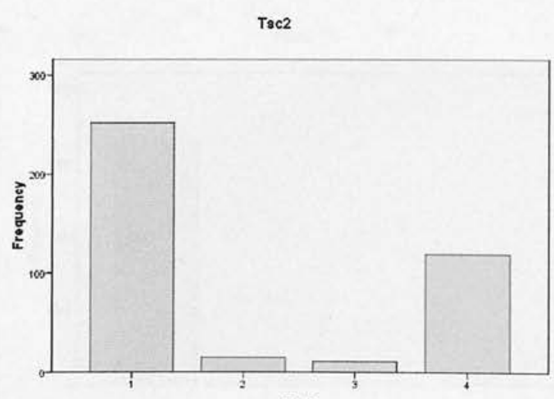


Table 4.1g: Frequency of *Exploraway*.

Zon3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	73	1.6	100.0	100.0
Missing	System	4443	98.4		
Total		4516	100.0		

Act3

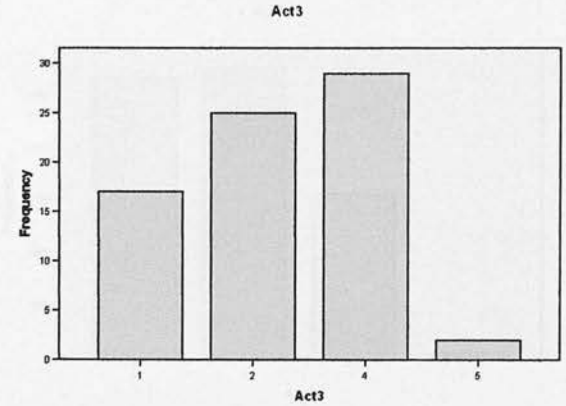
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	17	.4	23.3	23.3
	2	25	.6	34.2	57.5
	4	29	.6	39.7	97.3
	5	2	.0	2.7	100.0
	Total	73	1.6	100.0	
Missing	System	4443	98.4		
Total		4516	100.0		

Aff3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	29	.6	46.0	46.0
	2	34	.8	54.0	100.0
	Total	63	1.4	100.0	
Missing	System	4453	98.6		
Total		4516	100.0		

Tsp3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	49	1.1	67.1	67.1
	2	12	.3	16.4	83.6
	3	2	.0	2.7	86.3
	4	10	.2	13.7	100.0
	Total	73	1.6	100.0	
Missing	System	4443	98.4		
Total		4516	100.0		



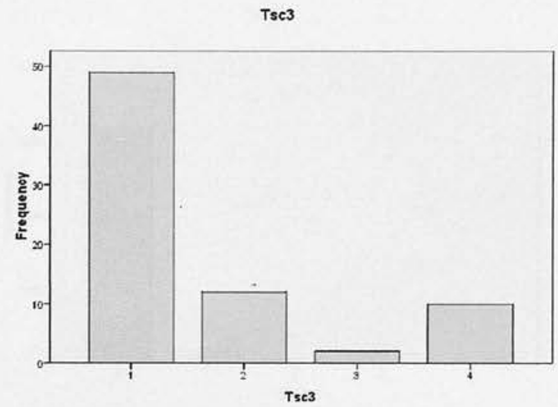


Table 4.1h: Frequency of *Green Space One*

Zon4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4	3679	81.5	100.0	100.0
Missing	System	837	18.5		
Total		4516	100.0		

Act4

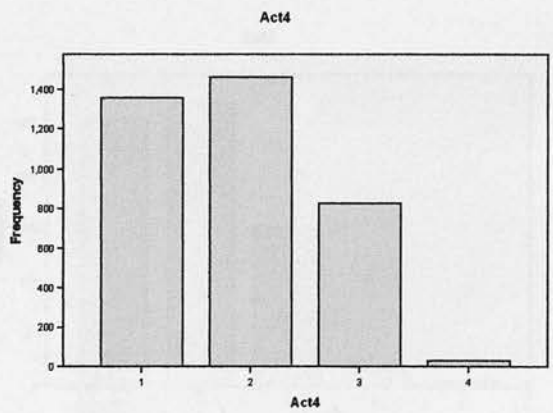
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1358	30.1	36.9	36.9
	2	1463	32.4	39.8	76.7
	3	828	18.3	22.5	99.2
	4	30	.7	.8	100.0
	Total	3679	81.5	100.0	
Missing	System	837	18.5		
Total		4516	100.0		

Aff4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	137	3.0	90.7	90.7
	2	14	.3	9.3	100.0
	Total	151	3.3	100.0	
Missing	System	4365	96.7		
Total		4516	100.0		

Tsp4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3295	73.0	89.6	89.6
	2	198	4.4	5.4	95.0
	3	46	1.0	1.3	96.2
	4	138	3.1	3.8	100.0
	Total	3677	81.4	100.0	
Missing	System	839	18.6		
Total		4516	100.0		



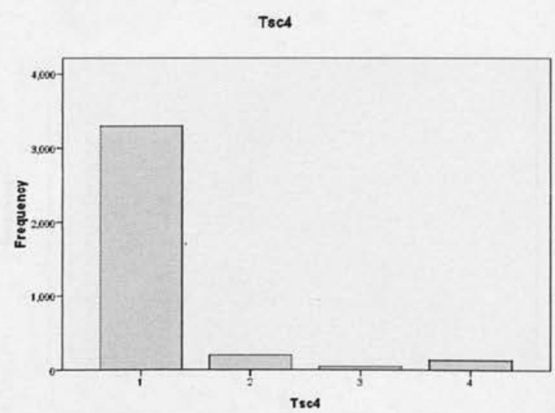


Table 4.1i: Frequency of *Green Space Two.*

Zon5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5	3519	77.9	100.0	100.0
Missing	System	997	22.1		
Total		4516	100.0		

Act5

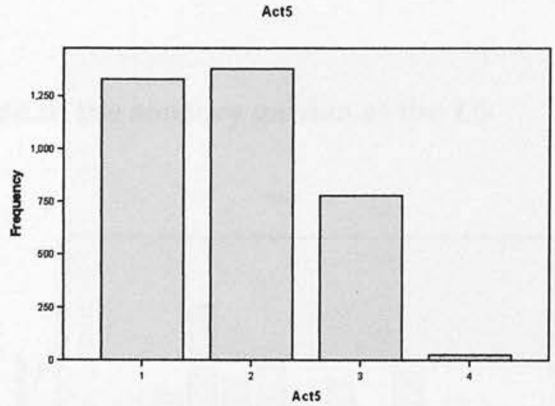
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1328	29.4	37.9	37.9
	2	1376	30.5	39.2	77.1
	3	778	17.2	22.2	99.3
	4	24	.5	.7	100.0
	Total	3506	77.6	100.0	
Missing	System	1010	22.4		
Total		4516	100.0		

Aff5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	78	1.7	63.9	63.9
	2	44	1.0	36.1	100.0
	Total	122	2.7	100.0	
Missing	System	4394	97.3		
Total		4516	100.0		

Tsp5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3171	70.2	90.2	90.2
	2	165	3.7	4.7	94.9
	3	47	1.0	1.3	96.2
	4	132	2.9	3.8	99.9
	5	2	.0	.1	100.0
	Total	3517	77.9	100.0	
Missing	System	999	22.1		
Total		4516	100.0		



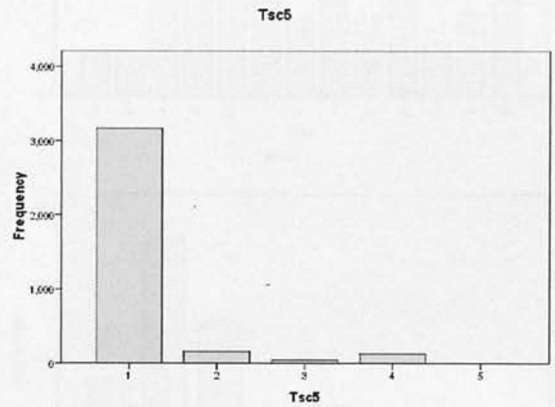


Table 4.1j: Frequency of *Asteroids Arts Garden*.

Zon6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6	3457	76.6	100.0	100.0
Missing	System	1059	23.4		
Total		4516	100.0		

Act6

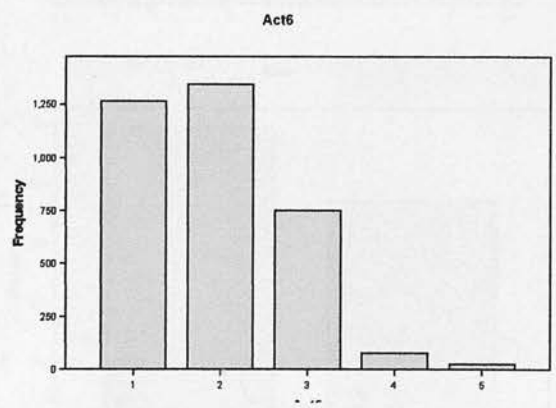
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1264	28.0	36.6	36.6
	2	1342	29.7	38.8	75.4
	3	750	16.6	21.7	97.1
	4	76	1.7	2.2	99.3
	5	25	.6	.7	100.0
	Total	3457	76.6	100.0	
Missing	System	1059	23.4		
Total		4516	100.0		

Aff6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	98	2.2	45.0	45.0
	2	120	2.7	55.0	100.0
	Total	218	4.8	100.0	
Missing	System	4298	95.2		
Total		4516	100.0		

Tsp6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3060	67.8	88.5	88.5
	2	162	3.6	4.7	93.2
	3	55	1.2	1.6	94.8
	4	179	4.0	5.2	100.0
	Total	3456	76.5	100.0	
Missing	System	1060	23.5		
Total		4516	100.0		



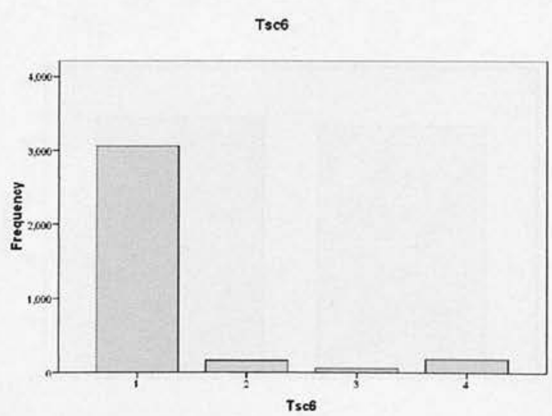


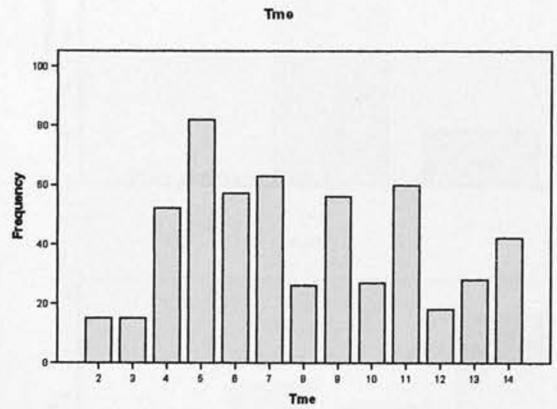
Table 4.1k: Frequency of *Water Central Area*.

D.3 The frequencies of patterns of use in the sensory garden at the LS

Tme

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	15	2.8	2.8	2.8
	3	15	2.8	2.8	5.5
	4	52	9.6	9.6	15.2
	5	82	15.2	15.2	30.3
	6	57	10.5	10.5	40.9
	7	63	11.6	11.6	52.5
	8	26	4.8	4.8	57.3
	9	56	10.4	10.4	67.7
	10	27	5.0	5.0	72.6
	11	60	11.1	11.1	83.7
	12	18	3.3	3.3	87.1
	13	28	5.2	5.2	92.2
	14	42	7.8	7.8	100.0
	Total	541	100.0	100.0	

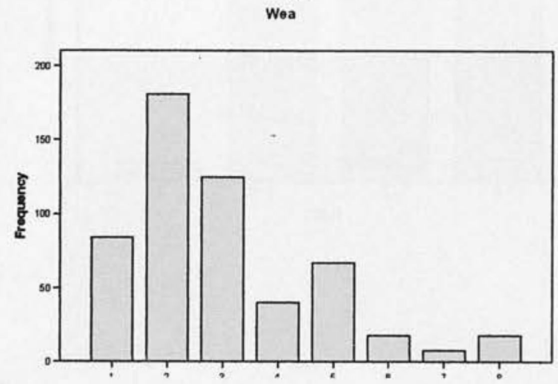
Table 4.2a: Frequency of time.



Wea

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	84	15.5	15.5	15.5
	2	181	33.5	33.5	49.0
	3	125	23.1	23.1	72.1
	4	40	7.4	7.4	79.5
	5	67	12.4	12.4	91.9
	6	18	3.3	3.3	95.2
	7	8	1.5	1.5	96.7
	8	18	3.3	3.3	100.0
	Total	541	100.0	100.0	

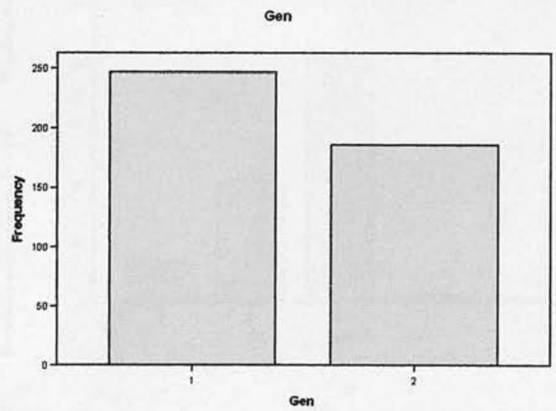
Table 4.2b: Frequency of weather.



Gen

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	247	45.7	57.0	57.0
	2	186	34.4	43.0	100.0
	Total	433	80.0	100.0	
Missing	System	108	20.0		
Total		541	100.0		

Table 4.2c: Frequency of gender.



Use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	220	40.7	50.8	50.8
	2	213	39.4	49.2	100.0
	Total	433	80.0	100.0	
Missing	System	108	20.0		
Total		541	100.0		

Table 4.2d: Frequency of user.

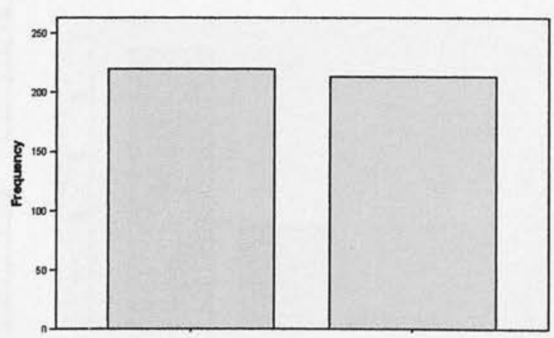
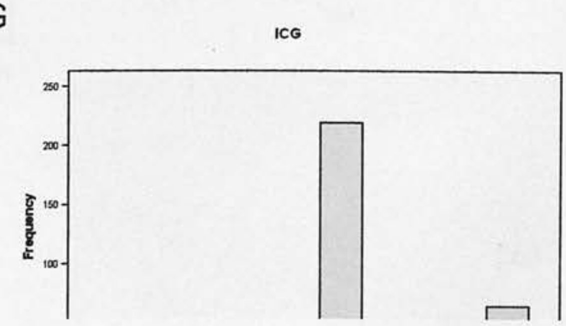


Table 4.2e: Frequency of grouping (ICG

ICG

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	16	3.0	3.7	3.7
	2	36	6.7	8.3	12.0
	3	40	7.4	9.2	21.2
	4	34	6.3	7.9	29.1
	5	219	40.5	50.6	79.7
	6	20	3.7	4.6	84.3
	7	4	.7	.9	85.2
	8	64	11.8	14.8	100.0
	Total	433	80.0	100.0	
Missing	System	[illegible]	[illegible]		



Zon1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	70	12.9	100.0	100.0
Missing	System	471	87.1		
Total		541	100.0		

Act1

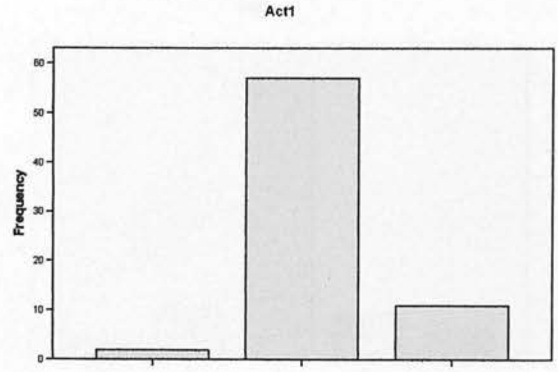
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	2	.4	2.9	2.9
	3	57	10.5	81.4	84.3
	4	11	2.0	15.7	100.0
	Total	70	12.9	100.0	
Missing	System	471	87.1		
Total		541	100.0		

Aff1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	51	9.4	100.0	100.0
Missing	System	490	90.6		
Total		541	100.0		

Tsp1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	.4	2.9	2.9
	2	21	3.9	30.0	32.9
	3	19	3.5	27.1	60.0
	4	28	5.2	40.0	100.0
	Total	70	12.9	100.0	
Missing	System	471	87.1		
Total		541	100.0		



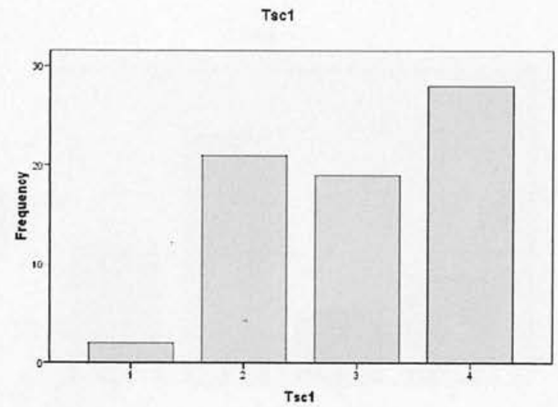


Table 4.2f: Frequency of *Rainbow Walk*.

Zon2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	350	64.7	100.0	100.0
Missing	System	191	35.3		
Total		541	100.0		

Act2

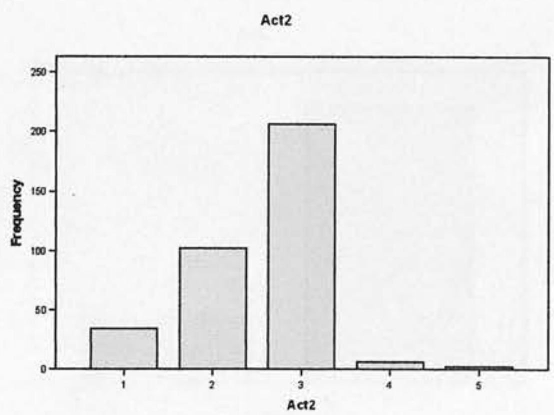
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	34	6.3	9.7	9.7
	2	102	18.9	29.1	38.9
	3	206	38.1	58.9	97.7
	4	6	1.1	1.7	99.4
	5	2	.4	.6	100.0
	Total	350	64.7	100.0	
Missing	System	191	35.3		
Total		541	100.0		

Aff2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	13	2.4	18.6	18.6
	2	57	10.5	81.4	100.0
	Total	70	12.9	100.0	
Missing	System	471	87.1		
Total		541	100.0		

Tsp2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	240	44.4	68.6	68.6
	2	91	16.8	26.0	94.6
	3	14	2.6	4.0	98.6
	4	5	.9	1.4	100.0
	Total	350	64.7	100.0	
Missing	System	191	35.3		
Total		541	100.0		



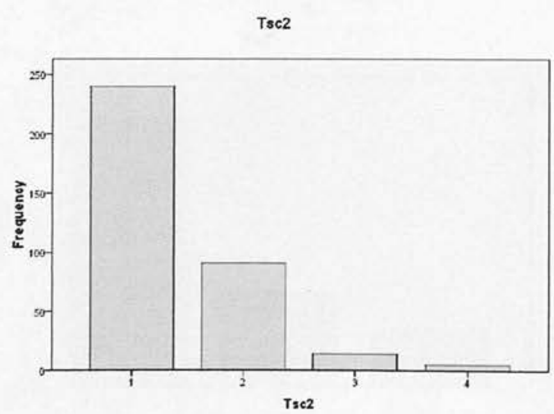


Table 4.2g: Frequency of *Water Garden*.

Zon3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	189	34.9	100.0	100.0
Missing	System	352	65.1		
Total		541	100.0		

Act3

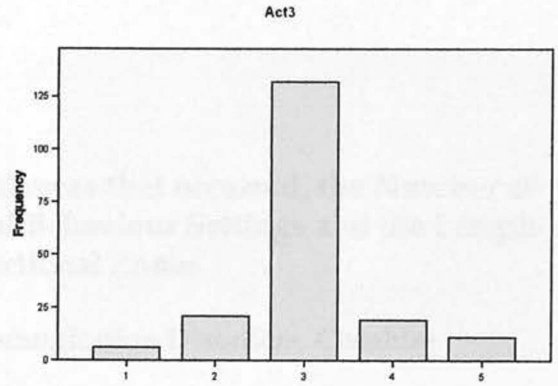
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	6	1.1	3.2	3.2
	2	21	3.9	11.1	14.3
	3	132	24.4	69.8	84.1
	4	19	3.5	10.1	94.2
	5	11	2.0	5.8	100.0
	Total	189	34.9	100.0	
Missing	System	352	65.1		
Total		541	100.0		

Aff3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	17	3.1	15.9	15.9
	2	90	16.6	84.1	100.0
	Total	107	19.8	100.0	
Missing	System	434	80.2		
Total		541	100.0		

Tsp3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	46	8.5	24.3	24.3
	2	83	15.3	43.9	68.3
	3	24	4.4	12.7	81.0
	4	36	6.7	19.0	100.0
	Total	189	34.9	100.0	
Missing	System	352	65.1		
Total		541	100.0		



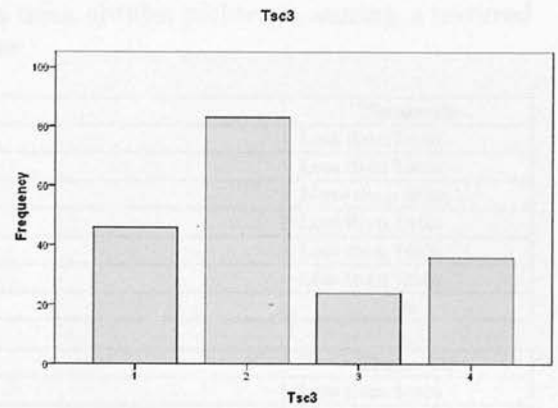


Table 4.2h: Frequency of *Green Space*.

Zon4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4	114	21.1	100.0	100.0
Missing	System	427	78.9		
Total		541	100.0		

Act4

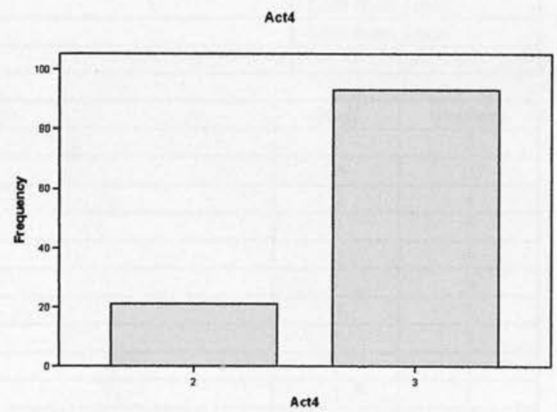
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	21	3.9	18.4	18.4
	3	93	17.2	81.6	100.0
	Total	114	21.1	100.0	
Missing	System	427	78.9		
Total		541	100.0		

Aff4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	114	21.1	100.0	100.0
Missing	System	427	78.9		
Total		541	100.0		

Tsp4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	72	13.3	63.2	63.2
	3	26	4.8	22.8	86.0
	4	16	3.0	14.0	100.0
	Total	114	21.1	100.0	
Missing	System	427	78.9		
Total		541	100.0		



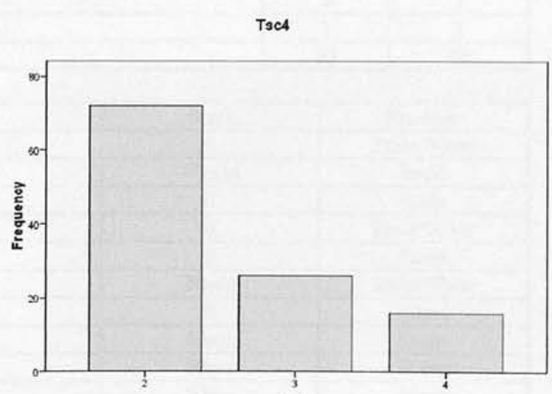


Table 4.2i: Frequency of *Woodland Garden*

APPENDIX E

List of the Unique and Multiple Affordances that occurred, the Number of Users who engaged with the Individual Behaviour Settings and the Length of their Engagement in each of the Functional Zones

E.1 The Royal School of Deaf and Communication Disorders, Cheshire

Zone A (*Parents' Waiting Area*)
Individual behaviour settings: two lawn patches, trees, shrubs, pathways, seating, a textured wall and a signage. The area covers 660 sq. metres.

Number of Unique Affordances (positive)	Timescale
Running hands against the textured wall	Less than 1min
Running on the pathway	Less than 1min
Sitting on the pathway	More than 5min
Skipping on the grass	Less than 1min
Touching the textured wall	Less than 1min
Walking on the grass	Less than 1min
TOTAL	6

Number of Multiple Affordances (2 or more affordances)	Timescale
Brushing leg against, plucking and smelling scented flower	Less than 1min
Feeling and touching the textured wall	Less than 1min
Plucking, rubbing and smelling scented flowers	Less than 1min
Plucking and smelling scented flowers	Less than 1min
Plucking, smelling and throwing scented flowers	Less than 1min
Pointing and talking about the plane	Less than 1min
Running and singing on the pathway	Less than 1min
TOTAL	7

Number of Users	Staff	Student
Running hands against the textured wall	0	5
Running on the pathway	26	10
Sitting on the pathway	0	1
Skipping on the grass	0	5
Touching the textured wall	0	6
Walking on the grass	1	5
Brushing leg against, plucking and smelling scented flower	0	1
Feeling and touching the textured wall	1	2
Plucking, rubbing and smelling scented flowers	1	1
Plucking and smelling scented flowers	1	1
Plucking, smelling and throwing scented flowers	1	1
Pointing and talking about the plane	1	1
Running and singing on the pathway	1	1
TOTAL	33	40

Length of Engagement	Staff	Student
Running hands against the textured wall	0	2min 30sec
Running on the pathway	13min	5min
Sitting on the pathway	0	6min
Skipping on the grass	0	2min 30sec
Touching the textured wall	0	3min
Walking on the grass	30sec	2min 30sec
Brushing leg against, plucking and smelling scented flower	0	30sec
Feeling and touching the textured wall	30sec	1min
Plucking, rubbing and smelling scented flowers	30sec	30sec
Plucking and smelling scented flowers	30sec	30sec
Plucking, smelling and throwing scented flowers	30sec	30sec
Pointing and talking about the plane	30sec	30sec

Running and singing on the pathway	30sec	30sec
TOTAL	**16min 30sec**	**25min 30sec**

Table 5.1a: The number of unique and multiple affordances, the number of users and the length of engagement at the *Parents' Waiting Area* of the RSDCD.

Zone B (*Exploraway*)

Individual behaviour settings: three lawn patches, gravel on the path surface, lighting bollards and pathways. The area covers 511 sq. metres.

Number of Unique Affordances (positive)	**Timescale**
Crossing over the grass	Less than 1min
Crushing the gravel with foot	Less than 1min
Feeling the grass	1 - 2min
Running on the pathway	Less than 1min
Squatting on the grass	1 - 2min
Touching the lighting bollard	Less than 1min
Walking fast on the pathway	Less than 1min
TOTAL	**7**

Number of Multiple Affordances (2 or more affordances)	**Timescale**
Sitting on pathway, looking and communicating with builders	More than 5min
TOTAL	**1**

Number of Users	**Staff**	**Student**
Crossing over the grass	3	3
Crushing the gravel with foot	5	2
Feeling the grass	3	3
Running on the pathway	9	0
Squatting on the grass	3	3
Touching the lighting bollard	3	3
Walking fast on the pathway	3	3
Sitting on pathway, looking and communicating with builders	1	1
TOTAL	**30**	**18**

Length of Engagement	**Staff**	**Student**
Crossing over the grass	1min 30sec	1min 30sec
Crushing the gravel with foot	2min 30sec	1min
Feeling the grass	4min 30sec	4min 30sec
Running on the pathway	4min	0
Squatting on the grass	4min 30min	4min 30sec
Touching the lighting bollard	1min 30sec	1min 30sec
Walking fast on the pathway	1 min 30sec	1min 30sec
Sitting on pathway, looking and communicating with builders	6min	6min
TOTAL	**26min 30sec**	**20min 30sec**

Table 5.1b: The number of unique and multiple affordances, the number of users and the length of engagement at the *Exploraway* of the RSDCD.

Zone C (*Green Space One*)

Individual behaviour settings: lawn patch, scented plants, lighting bollards, seating, a *vaporized trail* with gravel and limestone blocks on the surface, a willow tunnel with bark chip on the path surface and artwork display. The area covers 316 sq. metres.

Number of Unique Affordances (positive and negative)	**Timescale**
Brushing body against shrubs	Less than 1min
Brushing hand against shrubs	Less than 1min
Brushing hands against scented flowers	Less than 1min
Brushing legs against scented flowers	Less than 1min
Hiding in the willow tunnel	Less than 1min 1 -2 min
Holding the lighting bollard with both hands	Less than 1min
Shaking the lighting bollard	Less than 1min

Sitting at the seating	Less than 1min
Smelling scented flowers	Less than 1min
Standing on the grass	More than 5min
Stepping on the *vaporized trail*	Less than 1min
Touching the lighting bollard	Less than 1min
Fear of getting in the willow tunnel	More than 5min
TOTAL	13

Number of Multiple Affordances (2 or more affordances)	Timescale
Brushing arms and hands against scented flowers	Less than 1min
Brushing hands and smelling scented flowers	Less than 1min
Hiding and spreading both arms feeling the willow	Less than 1min
Hiding, taking photo, cheering and playing with artworks in the willow tunnel	More than 5min
Plucking, smelling and giving away scented flowers to another person	Less than 1min
Plucking, rubbing, smelling and throwing scented flowers	Less than 1min
Plucking and smelling scented flowers	Less than 1min
Plucking, sniffing and throwing leaves	Less than 1min
Plucking leaves and sniffing scented flowers	Less than 1min
Smelling scented flowers and talked about it (inc. sign language)	Less than 1min
Stepping on the *vaporized trail*, sniffing and rubbing scented flower	Less than 1min
Stepping on the *vaporized trail*, walking on the grass, brushing legs against, plucking, tasting and eating herbs	Less than 1min

Number of Users	Staff	Student
Brushing body against shrubs	1	1
Brushing hand against shrubs	0	1
Brushing hands against scented flowers	0	1
Brushing legs against scented flowers	1	1
Hiding in the willow tunnel	2	1
Holding the lighting bollard with both hands	0	1
Shaking the lighting bollard	0	1
Sitting at the picnic seat	1	1
Smelling scented flowers	3	1
Standing on the grass	1	0
Stepping on the vaporized trail	1	8
Touching the lighting bollard	0	1
Fear of getting in the willow tunnel	0	1
Brushing arms and hands against scented flowers	1	1
Brushing hands and smelling scented flowers	1	1
Hiding and spreading both arms feeling the willow	0	1
Hiding, taking photo, cheering and playing with artworks in the willow tunnel	2	2
Plucking, rubbing, smelling and throwing scented flowers	2	0
Plucking, smelling and giving away scented flowers to another person	1	1
Plucking and smelling scented flowers	5	9
Plucking, sniffing and throwing leaves	1	1
Plucking leaves and sniffing scented flowers	0	1
Smelling scented flowers and talked about it (inc. sign language)	2	0
Stepping on the *vaporized trail*, sniffing and rubbing scented flowers	0	1
Stepping on the *vaporized trail*, walking on the grass, brushing legs against, plucking, tasting and eating herbs	0	1
TOTAL	25	38
TOTAL	12	

Length of Engagement	Staff	Student
Brushing body against shrubs	30sec	30sec
Brushing hand against shrubs	0	30sec
Brushing hands against scented flowers	0	30sec
Brushing legs against scented flowers	30sec	30sec
Hiding in the willow tunnel	3min	1min 30sec
Holding the lighting bollard with both hands	0	30sec
Shaking the lighting bollard	0	30sec
Sitting at the picnic seat	30sec	30sec
Smelling scented flowers	1min 30sec	30sec

Standing on the grass	6min	0
Stepping on the vaporized trail	30sec	4min
Touching the lighting bollard	0	30sec
Fear of getting in the willow tunnel	0	6min
Brushing arms and hands against scented flowers	30sec	30sec
Brushing hands and smelling scented flowers	30sec	30sec
Hiding and spreading both arms, feeling the willow	0	30sec
Hiding, taking photo, cheering and playing with artworks in the willow tunnel	12min	12min
Plucking, rubbing, smelling and throwing scented flowers	1min	0
Plucking, smelling and giving away scented flowers to another person	30sec	30sec
Plucking and smelling scented flowers	2min 30sec	2min 30sec
Plucking, sniffing and throwing leaves	30sec	30sec
Plucking leaves and sniffing scented flowers	0	30sec
Smelling scented flowers and talked about it (inc. sign language)	1min	0
Stepping on the *vaporized trail*, sniffing and rubbing scented flowers	0	30sec
Stepping on the *vaporized trail*, walking on the grass, brushing legs against, plucking, tasting and eating herbs	0	30sec
TOTAL	31min	36min 30sec

Table 5.1c: The number of unique and multiple affordances, the number of users and the length of engagement at the *Green Space One* of the RSDCD.

Zone D (*Green Space Two*)

Individual behaviour settings: six lawn patches, trees, hedges, lighting bollards, pathways and a rubber walk. The area covers 370 sq. metres.

Number of Unique Affordances (positive)	Timescale
Brushing legs against scented flowers	Less than 1min
Crossing over the grass	Less than 1min
Feeling the lighting bollard	Less than 1min
Holding the lighting bollard	Less than 1min
Hoping on the rubbery pathway	Less than 1min
Jumping on the pathway	Less than 1min
Jumping over the hedges	Less than 1min
Running on the pathway	Less than 1min
Running on the rubber pathway	Less than 1min
Splashing puddle	Less than 1min
Standing on the grass	2 - 5min
Staring at the lighting bollard	Less than 1min
Touching the lighting bollard	Less than 1min
TOTAL	13

Number of Multiple Affordances (2 or more affordances)	Timescale
Crossing over the grass and running on the pathway	Less than 1min
Crossing over the grass and skipping on the pathway	Less than 1min
Feeling and touching the tree branch	Less than 1min
Running and jumping on the pathway	Less than 1min
Running and singing at the pathway	Less than 1min
Running on the pathway and touching the lighting bollard	Less than 1min
Stopping and listening to the blowing wind on the pathway	Less than 1min
Walking and singing on the pathway	Less than 1min
TOTAL	8

Number of Users	Staff	Student
Brushing legs against scented flowers	0	1
Crossing over the grass	22	33
Feeling the lighting bollard	0	1
Holding on the lighting bollard	0	1
Hoping on the rubbery pathway	2	2
Jumping on the pathway	3	3
Jumping over the hedges	0	1
Running on the pathway	13	13
Running on the rubbery pathway	12	12

Splashing puddle	1	1
Standing on the grass	2	0
Starring at the lighting bollard	0	2
Touching the lighting bollard	2	7
Crossing over the grass and running on the pathway	2	1
Crossing over the grass and skipping on the pathway	1	1
Feeling and touching the tree branch	1	1
Running and jumping on the pathway	1	1
Running and singing at the pathway	1	1
Running on the pathway and touching the lighting bollard	1	1
Stopping and listening to the blowing wind on the pathway	1	1
Walking and singing on the pathway	1	1
TOTAL	**66**	**85**

Length of Engagement	**Staff**	**Student**
Brushing legs against scented flowers	0	30sec
Crossing over the grass	12min 30sec	16min 30sec
Feeling the lighting bollard	0	30sec
Holding on the lighting bollard	0	30sec
Hoping on the rubbery pathway	1min	1min
Jumping on the pathway	1min 30sec	1min 30sec
Jumping over the hedges	0	30sec
Running on the pathway	6min 30sec	6min 30sec
Running on the rubbery pathway	6min	6min
Splashing puddle	30sec	30sec
Standing on the grass	7min	0
Staring at the lighting bollard	0	1min
Touching the lighting bollard	1min	4min
Crossing over the grass and running on the pathway	1min	30sec
Crossing over the grass and skipping on the pathway	30sec	30sec
Feeling and touching the tree branch	30sec	30sec
Running and jumping on the pathway	30sec	30sec
Running and singing at the pathway	30sec	30sec
Running on the pathway and touching the lighting bollard	30sec	30sec
Stopping and listening to the blowing wind on the pathway	30sec	30sec
Walking and singing on the pathway	30sec	30sec
TOTAL	**40min 30sec**	**43min**

Table 5.1d: The number of unique and multiple affordances, the number of users and the length of engagement at the *Green Space Two* of the RSDCD.

Zone E (*Asteroids Arts Garden*)

Individual behaviour settings: shrubs, pathways, lighting bollards, balancing beams, boardwalks, gravel, musical instruments, rock sculpture and wood edge. The area covers 231 sq. metres.

Number of Unique Affordances (positive)	**Timescale**
Brushing shrubs with hand	Less than 1min
Crushing the gravel with feet	Less than 1min
Kicking the gravel	Less than 1min
Playing the musical instruments	Less than 1min
Running on the boardwalk	Less than 1min
Running on the gravel	Less than 1min
Sitting on the wood edge	1-2min
Skipping on the boardwalk	Less than 1min
Stepping on the rock sculpture	Less than 1min
Stepping on the wood edge	Less than 1min
Stamping on the boardwalk	Less than 1min
Walking on the gravel	Less than 1min
TOTAL	12

Number of Multiple Affordances (2 or more affordances)	**Timescale**
Jumping and climbing the rock sculpture	Less than 1min

Lifting, playing and hitting the musical instruments	1 - 2min
Playing and hitting the musical instruments	Less than 1min 1 - 2min 2 - 5min
Running on and kicking the gravel	Less than 1min
Running and singing on the boardwalk	Less than 1min
Running on the gravel and pathway; climbing on, stepping on and jumping from the rock sculpture	Less than 1min
Sitting and taking photos at the rock sculpture	2 - 5min
Stamping and running on the boardwalk	Less than 1min
Stepping on and climbing on the rock sculpture	Less than 1min
Stepping and walking on the wood edge	Less than 1min
Walking and crushing the gravel with feet	Less than 1min
Walking and balancing on the balancing beam	1 - 2min
Walking on the gravel; walking and balancing on the wood edge	Less than 1min
TOTAL	**13**

Number of Users	Staff	Student
Brushing shrubs with hand	1	1
Crushing the gravel with feet	2	2
Kicking the gravel	1	1
Playing the musical instruments	2	0
Running on the boardwalk	22	14
Running on the gravel	1	12
Sitting on the wood edge	1	1
Skipping on the boardwalk	1	1
Stepping on the rock sculpture	1	1
Stepping on the wood edge	1	3
Stamping on the boardwalk	2	5
Walking on the gravel	1	1
Jumping and climbing the rock sculpture	0	1
Lifting, playing and hitting the musical instruments	5	2
Playing and hitting the musical instruments	9	8
Running on and kicking the gravel	1	1
Running and singing on the boardwalk	1	1
Running on the gravel and pathway; climbing on, stepping on and jumping from the rock sculpture	0	1
Sitting and taking photos at the rock sculpture	2	0
Stamping and running on the boardwalk	2	1
Stepping on and climbing on the rock sculpture	1	2
Stepping and walking on the wood edge	1	1
Walking and crushing the gravel with feet	1	1
Walking and balancing on the balancing beam	0	1
Walking on the gravel; walking and balancing on the wood edge	0	1
TOTAL	**59**	**63**

Length of Engagement	Staff	Student
Brushing shrubs with hand	30sec	30sec
Crushing the gravel with feet	1min	1min
Kicking the gravel	30sec	30sec
Playing the musical instruments	1min	0
Running on the boardwalk	11min	7min
Running on the gravel	30sec	6min
Sitting on the wood edge	1min 30sec	1min 30sec
Skipping on the boardwalk	30sec	30sec
Stepping on the rock sculpture	30sec	30sec
Stepping on the wood edge	30sec	1min 30sec
Stamping on the boardwalk	1min	2min 30sec
Walking on the gravel	30sec	30sec
Jumping and climbing the rock sculpture	0	30sec
Lifting, playing and hitting the musical instruments	7min 30sec	3min
Playing and hitting the musical instruments	16min 30sec	5min 30sec
Running on and kicking the gravel	30sec	30sec
Running and singing on the boardwalk	30sec	30sec

Running on the gravel and pathway; climbing on, stepping on and jumping from the rock sculpture	0	30sec
Sitting and taking photos at the rock sculpture	7min	0
Stamping and running on the boardwalk	1min	30sec
Stepping on and climbing on the rock sculpture	30sec	1min
Stepping and walking on the wood edge	30sec	30sec
Walking and crushing the gravel with feet	30sec	30sec
Walking and balancing on the balancing beam	0	1min 30sec
Walking on the gravel; walking and balancing on the wood edge	0	30sec
TOTAL	53min 30sec	37min

Table 5.1e: The number of unique and multiple affordances, the number of users and the length of engagement at the *Asteroids Arts Garden* of the RSDCD.

Zone F (*Water Central Area*)

Individual behaviour settings: pathways, a pergola, climbers, raised beds, herbs, scented plants, seating and a water feature. The area covers 230 sq. metres.

Number of Unique Affordances (positive and negative)	Timescale
Brushing arms against scented flowers	Less than 1min
Brushing legs against scented flowers	Less than 1min
Feeling the column of pergola	Less than 1min
Feeling moss at the raised beds	1 - 2min
Greeting people playing with water at the pathway	Less than 1min
Jumping on the pathway	Less than 1min
Leaning against the raised bed	Less than 1min
Listening to birds and chimes at the pathway	More than 5min
Looking at the plane and crane at the pathway	Less than 1min
Laying down on the seating	1 - 2min
Pointing at the plane	Less than 1min
Repairing the water feature	2 - 5min
Running on the pathway	Less than 1min
Running hands over scented plants at the raised beds	Less than 1min
Singing at the pathway	Less than 1min
Sitting on the raised beds	1 - 2min
Skipping on the pathway	Less than 1min
Sniffing scented flowers at the pergola	Less than 1min
Talking about scented flowers at the pergola (inc. sign language)	Less than 1min
Talking about the sound of birds (inc. sign language)	Less than 1min
Talking about the water feature (inc. sign language)	Less than 1min
Touching climbers with head and body at the pergola	Less than 1min
Waving to the plane	Less than 1min
Disgusting at the slug (inc. sign language)	Less than 1min
Fear of getting wet	Less than 1min
Fear of getting stung by the bees	Less than 1min
Affords of getting agitated by the microclimate	Less than 1min
TOTAL	27

Number of Multiple Affordances (2 or more affordances)	Timescale
Brushing hand against herbs and smelling hand at the raised bed	Less than 1min
Brushing hand against herbs, plucking, rubbing and smelling at the raised beds	More than 5min
Brushing hand against scented flowers and smelling hand	Less than 1min
Feeling leaves and took photo with scented flower at the pergola	1 - 2min
Feeling the rain with hands, stepping and playing with puddle	Less than 1min/ 2-5min
Feeling the moss, brushing hand against scented flowers and smelling hand at the raised bed.	Less than 1min
Feeling, plucking and smelling scented flower at the pergola	1 - 2min
Feeling, plucking and smelling herb at raised planters	Less than 1min
Feeling and rubbing herbs at the raised beds	Less than 1min
Hearing, stepping over shrub, splashing, tasting and drinking the water	1 -2min
Holding scented flower in palm and smelling it at the pergola	Less than 1min
Lifting and carrying seating from Parent's Waiting Area to Water Central Area	Less than 1min

Picking up a slug, putting it on his palm and putting it back on the pathway	Less than 1min
Plucking, picking, cutting, smelling, holding, giving and talking about herbs at the raised bed	Less than 1min
Plucking, rubbing and smelling herbs at the raised beds	Less than 1min
Plucking, rubbing, smelling, tasting and eating herbs at the raised beds	2 - 5min
Plucking and smelling herbs at the raised beds	Less than 1min
Plucking and smelling scented flowers	Less than 1min
Plucking, smelling and throwing scented flowers; rubbing, smelling, plucking and collecting herbs at the raised beds	Less than 1min/ More than 5min
Plucking, smelling and throwing scented flowers; stepping over shrub, feeling and touching the water; squatting near the water feature	Less than 1min
Plucking and sniffing herbs at the raised beds	Less than 1min
Plucking and sniffing scented flowers at the pergola	Less than 1min
Plucking, sniffing, tasting and spitting herbs at the raised beds	Less than 1min
Plucking, sniffing herbs and keeping it into the pocket at the raised beds	1 -2min
Plucking, sniffing and throwing herbs at the raised beds	Less than 1min
Pointing and sniffing scented flower at the pergola and talking about it (inc. sign language)	2 - 5min
Pointing at the water feature, stepping over the shrubs, feeling the water, sprinkling, laughing and taking photo	1 - 2min
Pointing and talking about the construction noise on the pathway	Less than 1min
Pointing and talking about the plane (inc. sign language)	Less than 1min
Pointing and talking about the water feature (inc. sign language)	1 -2min
Pointing, searching, rubbing, plucking, smelling, tasting, holding, collecting, giving away and talking about the herbs; pointing and talking about scented flowers at the pergola; leaned against and sitting on the raised bed and talking	More than 5min
Rubbing and smelling herbs at the raised beds	Less than 1min
Rubbing, plucking, smelling herbs at the raised beds and talking about it (inc. sign language)	Less than 1min
Rubbing, plucking, smelling, tasting herb and talking about it (inc. sign language)	1 -2min
Running hand against herbs, rubbing and smelling at the raised beds	Less than 1min
Sitting, laying and running on the pathway	Less than 1min
Sitting on the pathway, stepping over shrub, feeling the water, playing, sprinkling, tasting and drinking	More than 5min
Staring and taking photo of the water feature	1 -2min
Stepping over shrub, scooping, splashing, playing and pouring the water	More than 5min
Stepping over shrub, hand dipping, tasting and drinking the water	2 - 5min
Stepping over shrub, hand dipping into the water and communicating (inc. sign language)	Less than 1min
Sniffing and talking in sign language about the scented flower at the pergola	Less than 1min
Squatting on the pathway, touching climbers at the pergola and sitting on the raised bed	Less than 1min
Squatting on the pathway; stepping over the shrub and washing hands at the water feature; plucking, rubbing, sniffing and collecting herbs and scented flowers at the raised beds	More than 5min/ 1-2min/ more than 5min
Stepping over shrub, feeling the water and surface of 'pineapple', splashing and sprinkling	More than 5min
Stopping and listening to the plane on the pathway	Less than 1min
Talking about the water feature, plucking, smelling and throwing herbs at the raised beds	Less than 1min
Touching and talking about climbers at the pergola	Less than 1min
Touching bollard and column of the pergola	Less than 1min
Touching scented flowers at the pergola and feeling moss at the raised beds	Less than 1min
Touching climbers at the pergola and brushing legs against the shrubs	Less than 1min
Walking and singing on the pathway	1 - 2min
TOTAL	52

Number of Users	Staff	Student
Brushing arms against scented flowers	6	6
Brushing legs against scented flowers	0	1
Feeling the column of pergola	2	2
Feeling moss at the raised beds	3	10
Greeting people playing with water at the pathway	1	0
Jumping on the pathway	1	2
Leaning against the raised bed	0	1
Listening to birds and chimes at the pathway	1	1

Looking at the plane and crane at the pathway	1	1
Laying down on the seating	0	2
Pointing at the plane	0	1
Repairing the water feature	1	0
Running on the pathway	8	5
Running hands over scented plants at the raised beds	1	2
Singing at the pathway	1	1
Sitting on the raised beds	2	1
Skipping on the pathway	1	1
Sniffing scented flowers at the pergola	4	1
Talking about scented flowers at the pergola (inc. sign language)	2	2
Talking about the sound of birds (inc. sign language)	1	2
Talking about the water feature (inc. sign language)	1	2
Touching climbers at the pergola	4	2
Waving to the plane	0	1
Disgusting at the slug (inc. sign language)	2	0
Fear of getting wet	1	0
Fear of getting stung by the bees	3	3
Affords of getting agitated by the microclimate	0	1
Brushing hand against herbs and smelling hand at the raised bed	2	0
Brushing hand against herbs, plucking, rubbing and smelling at the raised beds	2	1
Brushing hand against scented flowers and smelling hand	1	0
Feeling leaves and took photo with scented flower at the pergola	1	1
Feeling the rain with hands, stepping and playing with puddle	0	2
Feeling the moss, brushing hand against scented flowers and smelling hand at the raised bed.	0	2
Feeling, plucking and smelling scented flower at the pergola	1	1
Feeling, plucking and smelling herb at raised planters	1	0
Feeling and rubbing herbs at the raised beds	1	1
Hearing, stepping over shrub, splashing, tasting and drinking the water	0	1
Holding scented flower in palm and smelling it at the pergola	3	0
Lifting and carrying seating from Parent's Waiting Area to Water Central Area	1	0
Picking up a slug, putting it on his palm and putting it back on the pathway	0	1
Plucking, picking, cutting, smelling, holding, giving and talking about herbs at the raised bed	1	0
Plucking, rubbing and smelling herbs at the raised beds	1	1
Plucking, rubbing, smelling, tasting and eating herbs at the raised beds	2	1
Plucking and smelling herbs at the raised beds	1	1
Plucking and smelling scented flowers	2	2
Plucking, smelling and throwing scented flowers; rubbing, smelling, plucking and collecting herbs at the raised beds	1	0
Plucking, smelling and throwing scented flowers; stepping over shrub, feeling and touching the water; squatting near the water feature	0	1
Plucking and sniffing herbs at the raised beds	4	2
Plucking and sniffing scented flowers at the pergola	4	2
Plucking, sniffing, tasting and spitting herbs at the raised beds	3	3
Plucking, sniffing herbs and keeping it into the pocket at the raised beds	1	1
Plucking, sniffing and throwing herbs at the raised beds	5	2
Pointing and sniffing scented flower at the pergola and talking about it (inc. sign language)	2	2
Pointing at the water feature, stepping over the shrubs, feeling the water, sprinkling, laughing and taking photo	2	1
Pointing and talking about the construction noise on the pathway	1	0
Pointing and talking about the plane (inc. sign language)	1	1
Pointing and talking about the water feature (inc. sign language)	1	0
Pointing, searching, rubbing, plucking, smelling, tasting, holding, collecting, giving away and talking about the herbs; pointing and talking about scented flowers at the pergola; leaned against and sitting on the raised bed and talking	2	2
Rubbing and smelling herbs at the raised beds	1	1
Rubbing, plucking, smelling herbs at the raised beds and talking about it (inc. sign language)	1	1
Rubbing, plucking, smelling, tasting herb and talking about it (inc. sign language)	3	2
Running hand against herbs, rubbing and smelling at the raised beds	0	1
Sitting, laying and running on the pathway	0	1

Sitting on the pathway, stepping over shrub, feeling the water, playing, sprinkling, tasting and drinking	0	1
Staring and taking photo of the water feature	0	1
Stepping over shrub, scooping, splashing, playing and pouring the water	2	2
Stepping over shrub, hand dipping, tasting and drinking the water	0	1
Stepping over shrub, hand dipping into the water and communicating (inc. sign language)	1	1
Sniffing and talking in sign language about the scented flower at the pergola	1	1
Squatting on the pathway, touching climbers at the pergola and sitting on the raised bed	0	1
Squatting on the pathway; stepping over the shrub and washing hands at the water feature; plucking, rubbing, sniffing and collecting herbs and scented flowers at the raised beds	1	0
Stepping over shrub, feeling the water and surface of 'pineapple', splashing and sprinkling	2	1
Stopping and listening to the plane on the pathway	0	2
Talking about the water feature, plucking, smelling and throwing herbs at the raised beds	2	0
Touching and talking about climbers at the pergola	3	1
Touching bollard and column of the pergola	0	1
Touching scented flowers at the pergola and feeling moss at the raised beds	0	1
Touching climbers at the pergola and brushing legs against the shrubs	1	1
Walking and singing on the pathway	1	1
TOTAL	113	105

Length of Engagement	Staff	Student
Brushing arms against scented flowers	3min	3min
Brushing legs against scented flowers	0	30sec
Feeling the column of pergola	1min	1min
Feeling moss at the raised beds	4min 30sec	15min
Greeting people playing with water at the pathway	30sec	0
Jumping on the pathway	30sec	1min
Leaning against the raised bed	0	30sec
Listening to birds and chimes at the pathway	6min	6min
Looking at the plane and crane at the pathway	30sec	30sec
Laying down on the seating	0	3min
Pointing at the plane	0	30sec
Repairing the water feature	3min 30sec	0
Running on the pathway	4min	2min 30sec
Running hands over scented plants at the raised beds	30sec	1min
Singing at the pathway	30sec	30sec
Sitting on the raised beds	3min	1min 30sec
Skipping on the pathway	30sec	30sec
Sniffing scented flowers at the pergola	2min	30sec
Talking about scented flowers at the pergola (inc. sign language)	1min	1min
Talking about the sound of birds (inc. sign language)	30sec	1min
Talking about the water feature (inc. sign language)	30sec	1min
Touching climbers at the pergola	2min	1min
Waving to the plane	0	30sec
Disgusting at the slug (inc. sign language)	1min	0
Fear of getting wet	30sec	0
Fear of getting stung by the bees	2min 30sec	2min 30sec
Affords of getting agitated by the microclimate	0	30sec
Brushing hand against herbs and smelling hand at the raised bed	1min	0
Brushing hand against herbs, plucking, rubbing and smelling at the raised beds	12min	6min
Brushing hand against scented flowers and smelling hand	30sec	0
Feeling leaves and took photo with scented flower at the pergola	1min 30sec	1min 30sec
Feeling the rain with hands, stepping and playing with puddle	0	4min
Feeling the moss, brushing hand against scented flowers and smelling hand at the raised bed.	0	1min
Feeling, plucking and smelling scented flower at the pergola	1min 30sec	1min 30sec
Feeling, plucking and smelling herb at raised planters	30 sec	0
Feeling and rubbing herbs at the raised beds	30sec	30sec

Hearing, stepping over shrub, splashing, tasting and drinking the water	0	1min 30sec
Holding scented flower in palm and smelling it at the pergola	1min 30sec	0
Lifting and carrying seating from Parent's Waiting Area to Water Central Area	30sec	0
Picking up a slug, putting it on his palm and putting it back on the pathway	0	30sec
Plucking, picking, cutting, smelling, holding, giving and talking about herbs at the raised bed	30sec	0
Plucking, rubbing and smelling herbs at the raised beds	30sec	30sec
Plucking, rubbing, smelling, tasting and eating herbs at the raised beds	7min	3min 30sec
Plucking and smelling herbs at the raised beds	30sec	30sec
Plucking and smelling scented flowers	1min	1min
Plucking, smelling and throwing scented flowers; rubbing, smelling, plucking and collecting herbs at the raised beds	6min 30sec	0
Plucking, smelling and throwing scented flowers; stepping over shrub, feeling and touching the water; squatting near the water feature	0	30sec
Plucking and sniffing herbs at the raised beds	2min	1min
Plucking and sniffing scented flowers at the pergola	2min	1min
Plucking, sniffing, tasting and spitting herbs at the raised beds	1min 30sec	1min 30sec
Plucking, sniffing herbs and keeping it into the pocket at the raised beds	1min 30sec	1min 30sec
Plucking, sniffing and throwing herbs at the raised beds	2min 30sec	1min
Pointing and sniffing scented flower at the pergola and talking about it (inc. sign language)	7min	7min
Pointing at the water feature, stepping over the shrubs, feeling the water, sprinkling, laughing and taking photo	3min	1min 30sec
Pointing and talking about the construction noise on the pathway	30sec	0
Pointing and talking about the plane (inc. sign language)	30sec	30sec
Pointing and talking about the water feature (inc. sign language)	1min 30sec	0
Pointing, searching, rubbing, plucking, smelling, tasting, holding, collecting, giving away and talking about the herbs; pointing and talking about scented flowers at the pergola; leaned against and sitting on the raised bed and talking	12min	12min
Rubbing and smelling herbs at the raised beds	30sec	30sec
Rubbing, plucking, smelling herbs at the raised beds and talking about it (inc. sign language)	30sec	30sec
Rubbing, plucking, smelling, tasting herb and talking about it (inc. sign language)	4min 30sec	3min
Running hand against herbs, rubbing and smelling at the raised beds	0	30sec
Sitting, laying and running on the pathway	0	30sec
Sitting on the pathway, stepping over shrub, feeling the water, playing, sprinkling, tasting and drinking	0	6min
Staring and taking photo of the water feature	0	1min 30sec
Stepping over shrub, scooping, splashing, playing and pouring the water	12min	12min
Stepping over shrub, hand dipping, tasting and drinking the water	0	3min 30sec
Stepping over shrub, hand dipping into the water and communicating (inc. sign language)	30sec	30sec
Sniffing and talking in sign language about the scented flower at the pergola	30sec	30sec
Squatting on the pathway, touching climbers at the pergola and sitting on the raised bed	0	30sec
Squatting on the pathway; stepping over the shrub and washing hands at the water feature; plucking, rubbing, sniffing and collecting herbs and scented flowers at the raised beds	13min 30sec	0
Stepping over shrub, feeling the water and surface of 'pineapple', splashing and sprinkling	12min	6min
Stopping and listening to the plane on the pathway	0	1min
Talking about the water feature, plucking, smelling and throwing herbs at the raised beds	1min	0
Touching and talking about climbers at the pergola	1min 30sec	30sec
Touching bollard and column of the pergola	0	30sec
Touching scented flowers at the pergola and feeling moss at the raised beds	0	30sec
Touching climbers at the pergola and brushing legs against the shrubs	30sec	30sec
Walking and singing on the pathway	1min 30sec	1min 30sec
TOTAL	156min	105min

Table 5.1f: The number of unique and multiple affordances, the number of users and the length of engagement at the *Water Central Area* of the RSDCD.

E.2 The Lyndale School, Wirral

Zone A (*Rainbow Walk*)

Individual behaviour settings: lawn, boardwalks, pathways and trees. This area covers 767 sq. metres.

Number of Multiple Affordances (2 or more affordances)	Timescale
Digging ground with spade and bury dead bird	2-5min
Stamping and jumping on the boardwalk	Less than 1min
Feeling and touching (bark rubbing)	2 -5min
Jumping and walking around the conifer at the boardwalk	Less than 1min
Playing and throwing ball and plucking wild flowers on the grass	1 - 2min
Running and jumping on the pathway	Less than 1min
Singing, stamping, skipping, jumping, cheering and clapping at the boardwalk	More than 5min
Walking in circle around the conifer on the boardwalk, plucking and holding wild flowers to bring back to class while chatting	1 - 2min
TOTAL	8

Number of Users	Staff	Student
Digging ground with spade and bury dead bird	1	0
Stamping and jumping on the boardwalk	1	0
Feeling and touching (bark rubbing)	5	5
Jumping and walking around the conifer at the boardwalk	0	2
Playing and throwing ball and plucking wild flowers on the grass	0	1
Running and jumping on the pathway	7	7
Singing, stamping, skipping, jumping, cheering and clapping at the boardwalk	6	6
Walking in circle around the conifer on the boardwalk, plucking and holding wild flowers to bring back to class while chatting	5	5
TOTAL	25	26

Length of Engagement	Staff	Student
Digging ground with spade and bury dead bird	3min 30sec	0
Stamping and jumping on the boardwalk	30sec	0
Feeling and touching (bark rubbing)	17min 30sec	17min 30sec
Jumping and walking around the conifer the boardwalk	0	1min
Playing and throwing ball and plucking wild flowers on the grass	0	1min 30sec
Running and jumping on the pathway	3min 30sec	3min 30sec
Singing, stamping, skipping, jumping, cheering and clapping at the boardwalk	36min	36min
Walking in circle around the conifer on the boardwalk, plucking and holding wild flowers to bring back to class while chatting	7min 30sec	7min 30sec
TOTAL	68min 30sec	67min

Table 5.2a: The number of unique and multiple affordances, the number of users and the length of engagement at the *Rainbow Walk* of the LS.

Zone B (*Water Garden*)

Individual behaviour settings: boardwalks, steps, an interactive fountain, talking tubes, a pond, marginal plants and slate stone channels. This area covers 223 sq. metres.

Number of Unique Affordances (positive and negative)	Timescale
Crossing the water channel	Less than 1min
Sitting at the edge of boardwalk	Less than 1min
Throwing stones at the water channel and pond	Less than 1min
Watching tadpoles in the pond	Less than 1min
Fear of slippery on the boardwalk near the pond	Less than 1min
TOTAL	5

Number of Multiple Affordance (2 or more affordances)	Timescale
Feeling slate and talking about it (including sign language)	1-2min
Hearing and talking through the talking tube	1- 2min
Listening and talking about the thunder	Less than 1min
Plucking, holding and keeping wild flowers on the grass	Less than 1min
Pointing and talking about the dead bird	1 - 2min
Throwing stones and looking over the pond at the pond	Less than 1min
Watching tadpoles and talking about it (including sign language)	1 - 2min
TOTAL	7

Number of Users	Staff	Student
Crossing the water channel	0	2
Sitting at the edge of boardwalk	1	1
Throwing stones at the water channel	0	2
Watching tadpoles in the pond	0	3
Fear of slippery on the boardwalk near the pond	2	2
Feeling slate and talking about it (including sign language)	2	2
Hearing and talking through the talking tube	3	13
Listening and talking about the thunder	2	2
Plucking, holding and keeping wild flowers on the grass	1	2
Pointing and talking about the dead bird at the pond	8	8
Throwing stones and looking over the pond	0	3
Watching tadpoles and talking about it (including sign language)	3	8
TOTAL	22	48

Length of Engagement	Staff	Student
Crossing the water channel	0	1min
Sitting at the edge of boardwalk	30sec	30sec
Throwing stones at the water channel	0	1min
Watching tadpoles in the pond	0	1min 30sec
Fear of slippery on the boardwalk near the pond	1min	1min
Feeling slate and talking about it (including sign language)	3min	3min
Hearing and talking through the talking tube	4min 30sec	19min 30sec
Listening and talking about the thunder	1min	1min
Plucking, holding and keeping wild flowers on the grass	30sec	1min
Pointing and talking about the dead bird at the pond	12min	12min
Throwing stones and looking over the pond	0	1min 30sec
Watching tadpoles and talking about it (including sign language)	10min 30sec	28min
TOTAL	33min	71min

Table 5.2b: The number of unique and multiple affordances, the number of users and the length of engagement at the *Water Garden* of the LS.

Zone C (*Green Space*)

Individual behaviour settings: a covered tunnel, seating, a sloping lawn, musical pipes, pathways, raised beds, herbs, scented plants and a textured wall. The area covers 337 sq.m.

Number of Unique Affordances (positive and negative)	Timescale
Brushing legs against scented flowers	Less than 1min
Singing on the pathway	Less than 1min
Sitting on the grass	More than 5min
Watching the plane	Less than 1min
Fear of getting stung (pointing at the bees)	Less than 1min
TOTAL	5

Number of Multiple Affordances (2 or more affordances)	Timescale
Feeling, plucking, rubbing and sniffing scented plants	Less than 1min
Crawling, sitting, throwing and scooping stones at the pathway	More than 5min
Looking at the bees and talking about them (inc. sign language)	1- 2min
Passing through and taking photo at the covered tunnel	1- 2 min
Plucking and holding wild flowers on the grass	Less than 1min
Plucking and sniffing herbs at raised beds	1-2 min
Plucking, sniffing and talking about scented plants	1-2 min

Plucking, rubbing and sniffing herbs at raised beds	1- 2min
Plucking, sniffing and throwing herbs at the raised beds	Less than 1min
Pointing and talking about the covered tunnel	Less than 1min
Running, crawling and sitting on the pathway	More than 5min
Running hands through scented plants, plucking and sniffing	Less than 1min
Running hands through scented plants, rubbing, smelling and taking photos	1-2 min
Running hands, rubbing and sniffing herbs at the raised beds and scented plants	Less than 1min
Running, crawling and sitting on the pathway; Digging, scooping with spoon and throwing stones	More than 5min
Running and sitting on the pathway; Digging, scooping stones with spoon and throwing stones	1- 2min
Running hands through herbs, smelling hands, rubbing and sniffing herbs at the raised beds	Less than 1min
Running and sitting on the pathway; Feeling stones with hands on the pathway; Pouring, sprinkling and scooping water with hand	More than 5min
Stepping, walking, jumping, sitting, knocking (making sounds) at the artwork display	2- 5min
Stepping, sitting and knocking (making sound) at the artwork display	2- 5min
Sitting on pathway, scooping and throwing stone with spoon at the pathway	2- 5min
Swinging, hitting, hearing, playing, counting the musical pipes and reading the musical notes	Less than 1min/ 1 - 2min/ 2- 5min
Juggling, throwing, smashing water balloons at the textured wall and taking photos	More than 5min
Watching and communicating with cat	2- 5min
TOTAL	**24**

Number of Users	**Staff**	**Student**
Brushing legs against scented flowers	4	4
Singing on the pathway	1	1
Sitting on the grass	2	2
Watching the plane	0	1
Fear of getting stung (pointing at the bees)	1	1
Feeling, plucking, rubbing and sniffing scented plants	2	2
Looking at the bees and talking about them (inc. sign language)	1	1
Crawling, sitting, throwing and scooping stones at the pathway	0	1
Passing through and taking photo at the covered tunnel	3	3
Plucking and holding wild flowers on the grass	0	2
Plucking and sniffing herbs at raised beds	2	0
Plucking, sniffing and talking about scented plants	4	4
Plucking, rubbing and sniffing herbs at raised beds	2	0
Plucking, sniffing and throwing herbs at raised beds	2	2
Pointing and talking about the covered tunnel	1	1
Running, crawling and sitting on the pathway	0	1
Running hands through scented plants, plucking and sniffing	2	2
Running hands through scented plants, rubbing, smelling and taking photos	1	1
Running hands, rubbing and sniffing herbs at the raised beds and scented plants	4	4
Running, crawling and sitting on the pathway; Digging, scooping with spoon and throwing stones	0	1
Running and sitting on the pathway; Digging, scooping stones with spoon and throwing stones	0	1
Running hands through herbs, smelling hands, rubbing and sniffing herbs at the raised beds	4	4
Running and sitting on the pathway; Feeling and throwing stones on the pathway; Pouring, sprinkling and scooping water with hand	0	1
Stepping, walking, jumping, sitting, knocking (making sounds) at the artwork display	0	1
Stepping, sitting and knocking (making sound) at the artwork display	0	1
Sitting on pathway, scooping and throwing stones with spoon at the pathway	0	1
Swinging, hitting, hearing, playing, counting the musical pipes and reading the musical notes	3/3/3	3/3/3
Juggling, throwing, smashing water balloons at the textured wall and taking photos	4	4
Watching and communicating with cat	1	1
TOTAL	**50**	**57**

Length of Engagement	Staff	Student
Brushing legs against scented flowers	2 min	2min
Singing on the pathway	30sec	30sec
Sitting on the grass	12min	12min
Watching the plane	0	30sec
Fear of getting stung (pointing at the bees)	30sec	30sec
Feeling, plucking, rubbing and sniffing scented plants	1min	1min
Looking at the bees and talking about them (inc. sign language)	1min 30sec	1min 30sec
Crawling, sitting, throwing and scooping stones at the pathway	0	1min 30sec
Passing through and taking photo at the covered tunnel	4min 30sec	4min 30sec
Plucking and holding wild flowers on the grass	0	1min
Plucking and sniffing herbs at raised beds	3min	0
Plucking, sniffing and talking about scented plants	6min	6min
Plucking, rubbing and sniffing herbs at raised beds	3min	0
Plucking, sniffing and throwing herbs at raised beds	1min	1min
Pointing and talking about the covered tunnel	30sec	30sec
Running, crawling and sitting on the pathway	0	6min
Running hands through scented plants, plucking and sniffing	1min	1min
Running hands through scented plants, rubbing, smelling and taking photos	1min 30sec	1min 30sec
Running hands, rubbing and sniffing herbs at the raised beds and scented plants	2min	1min 30sec
Running, crawling and sitting on the pathway; Digging, scooping with spoon, throwing stones	0	6min
Running and sitting on the pathway; Digging, scooping stones with spoon and throwing stones on the pathway	0	1min 30sec
Running hands through herbs, smelling hands, rubbing and sniffing herbs at the raised beds	2min	2min
Running and sitting on the pathway; Feeling and digging stones with hands on the pathway; Pouring, sprinkling and scooping water with hand	0	6min
Stepping, walking, jumping, sitting, knocking (making sounds) at the artwork display	0	3min 30sec
Stepping, sitting and knocking (making sound) at the artwork display	0	3min 30sec
Sitting on pathway, scooping and throwing stones with spoon on the pathway	0	3min 30sec
Swinging, hitting, hearing, playing, counting the musical pipes and reading the musical notes	1min 30sec/ 4min 30sec/ 10min 30sec	1min 30sec/ 4min 30sec/ 10min 30sec
Juggling, throwing, smashing water balloons at the textured wall and taking photos	24min	24min
Watching and communicating with cat	3min 30sec	3min 30sec
TOTAL	**86min**	**112min 30sec**

Table 5.2c: The number of unique and multiple affordances, the number of users and the length of engagement at the *Green Space* of the LS.

Zone D (*Woodland Garden*)

Individual behaviour setting: an artwork display, boardwalks, rope railing, pathways, a lawn patch, trees and a variety of sound stimulation. The area covers 556 sq. metres.

Number of Multiple Affordances (2 or more affordances)	Timescale
Climbing and crawling on the sloping grass with hands on the log	Less than 1 min
Running and jumping on boardwalk	Less than 1min
Running on the boardwalk and throwing the broken branch	Less than 1min
Climbing and coasting down on the sloping grass	Less than 1min
Climbing, coasting down and crawling on the sloping grass	Less than 1min
Climbing, coasting down the sloping grass and plucking wild flowers	Less than 1min
Climbing, feeling and shaking the artwork display	Less than 1min
Grabbing, shaking the tree branch and feeling the rain water	Less than 1min
Plucking and blowing the wild flowers on the grass	Less than 1min
Pulling the tree branch, plucking and feeling the leaf	Less than 1min

Running and coasting down the sloping grass	Less than 1min
Running and stamping on the boardwalk	Less than 1min
Running on the boardwalk and feeling the railing rope	Less than 1min
Stepping, climbing, pulling, feeling, sitting and feeling water between gaps at the artwork display	Less than 1min
Touching, pressing and listening to the sound stimulation	Less than 1min/ 1 - 2min
Touching, pressing, listening to the sound stimulation, laughing and feeling the railing rope	2 - 5min
Touching, pressing, listening to the sound stimulation, clapping hands and taking photo	2 - 5min
TOTAL	17

Number of Users	Staff	Student
Climbing and crawling on the sloping grass with hands on the log	0	1
Running and jumping on boardwalk	2	3
Running on the boardwalk and throwing the broken branch	2	3
Climbing and coasting down on the sloping grass	5	5
Climbing, coasting down and crawling on the sloping grass	0	2
Climbing, coasting down the sloping grass and plucking wild flowers	0	1
Climbing, feeling and shaking the artwork display	0	1
Grabbing and shaking the tree branch and feeling the rain water	1	0
Plucking and blowing the wild flowers on the grass	1	1
Pulling the tree branch, plucking and feeling the leaf	1	0
Running and coasting down the sloping grass	0	1
Running and stamping on the boardwalk	1	4
Running on the boardwalk and feeling the railing rope	1	2
Stepping, climbing, pulling, feeling, sitting and feeling water between gaps at the artwork display	0	1
Touching, pressing and listening to the sound stimulation	4/19	5/17
Touching, pressing, listening to the sound stimulation, laughing and feeling the railing rope	6	6
Touching, pressing, listening to the sound stimulation, clapping hands and taking photo	9	9
TOTAL	52	62

Length of Engagement	Staff	Student
Climbing and crawling on the sloping grass with hands on the log	0	30sec
Running and jumping on boardwalk	1min	1min 30sec
Running on the boardwalk and throwing the broken branch	1min	1min 30sec
Climbing and coasting down on the sloping grass	2min 30sec	2min 30sec
Climbing, coasting down and crawling on the sloping grass	0	1min
Climbing, coasting down the sloping grass and plucking wild flowers	0	30sec
Climbing, feeling and shaking the artwork display	0	30sec
Grabbing, shaking the tree branch and feeling the rain water	30sec	0
Plucking and blowing the wild flowers on the grass	30sec	30sec
Pulling the tree branch, plucking and feeling the leaf	30sec	0
Running and coasting down the sloping grass	0	30sec
Running and stamping on the boardwalk	30sec	2min
Running on the boardwalk and feeling the railing rope	30sec	1min
Stepping, climbing, pulling, feeling, sitting and feeling water between gaps at the artwork display	0	30sec
Touching, pressing and listening to the sound stimulation	2min/ 28min 30sec	2min 30sec/ 25min 30sec
Touching, pressing, listening to the sound stimulation, laughing and feeling the railing rope	17min 30sec	21min
Touching, pressing, listening to the sound stimulation, clapping hands and taking photo	21min	31min 30sec
TOTAL	74min	93min

Table 5.2d: The number of unique and multiple affordances, the number of users and the length of engagement at the *Woodland Garden* of the LS.

APPENDIX F

The Observation Notes on the Activities and Potential Affordances in each of the Functional Zones

F.1 Royal School of Deaf and Communication Disorder, Cheshire

Date of observation: 3rd-4th, 7th-11th May and 23rd-27th, 30th-31st July (14 days)
Time of observation: 8.30am - 3.00pm

Zone A: *Parents' Waiting Area*

1. Although the school day starts at 9.00am, the observation took place 30 minutes earlier because users were observed using the sensory garden.
2. On the first day of the observation, a seat was missing near the water feature. A male teacher lifted and carried a seat from a location at the *Parents' Waiting Area* and placed it close to the water feature (see the anecdotal evidence in p.127, para.1).
3. Almost each day of the observation period, a female student in her wheelchair (X3*) and a female teaching assistant (X2*) would stroll in the sensory garden from 12.00pm to 12.30pm. Sometimes she could be there until 1.00pm. It did not matter if it was a rainy or windy day, she would be in the sensory garden! When strolling, with her, the teaching assistant was not allowed to bring the student's wheelchair to a stop (she always had to be on the move) or else she would be cross (see the anecdotal evidence in p.116).
4. On a sunny day, a visually impaired male student (Y1*) preferred to sit on the pathway rather than on a seat, while his female teacher (X1*) preferred to sit on a seat (see the anecdotal evidence in p.128, para.1 and p.157, para.2).
5. A visually impaired male student liked to feel the textured wall while passing through the sensory garden with his teacher.

* This coding can be referred to in the SPSS software data p.257.

Zone B: *Exploraway*

1. The *Exploraway* is underused due to the surface material (gravel). According to the landscape architect, the *Exploraway* should be bumpier to offer challenges in mobility (see Image 7.1, p.193).
2. A female teacher tried to attract the attention of a male student with learning difficulties attention to the water feature but the student went towards the refurbishment noise. The student sat on the pathway near the construction fence and looked at the builders. Sometimes both parties communicated with one another (see p.128, para.2 and Image 4.2).
3. **Potential affordance**: Students on a specially adapted bicycle wanted to cycle on the *Exploraway* but they did not manage to because of the surface material.

Zone C: *Green Space One*

1. One of the school buildings was under refurbishment in May. The work was completed in July.
2. Most of the activities and affordances were present along the most used pathway. The lighting bollards had not worked since day one of the opening of the sensory garden. Instead, they had been used for touching while passing through the sensory garden. Some lighting bollards had been broken into pieces while some were not attached to the stand; the *vaporized trail* (see Image 7.2, p.193) is not being used as had been intended because of the surface material. Instead, it is used for stepping on while passing through the sensory garden (see Image 5.6, p.154).

3. Although the willow tunnel is located towards the end of the sensory garden, some students like to use this feature to hide in and to spread their arms while feeling the willow.
4. **Potential affordances:** A partially-sighted male student and a male student in a wheelchair were frightened of going into the willow tunnel because of the changes in the material. Two teachers had to cheer them on and convince them to walk through the willow tunnel (see Image 5.5, p.153 and the anecdotal evidence, p.154).

Zone D: *Green Space Two*

1. A hearing impaired male student jumped over small hedges to play with the musical instrument at the *Asteroid Arts Garden* (see the anecdotal evidence, p.152, para.1 and Image 5.4).
2. A female therapist and a female student with a speech difficulty jumped onto the images at the rubber walkway, which affords jumping and communication (see the anecdotal evidence, p.149, para.1 and Image 5.1).
3. A male student played with the water puddle on the pathway. He splashed the water with his feet and he was very excited when some water sprinkled onto his hands (see the anecdotal evidence in p.170).
4. A small maintenance truck was parked on the rubberised walkway for more than five minutes, therefore, users had to walk on the lawn patch to pass by.

Zone E: *Asteroid Arts Garden* (see pp.152-154):

1. A number of teachers and students who were not in wheelchairs enjoyed stamping on the boardwalk to make a noise. Teachers drew the students' attention to the vibration and sound of the boardwalk.
2. A female teacher would lift up and put one of the musical instruments on a male student's lap who was in a wheelchair and in turn, he would hit it.
3. A male student with a hearing-impairment liked to climb and jump from the rock sculpture.
4. Only one male student with hearing-impaired liked to balance and walk on the wood edge while passing through the sensory garden.
5. Two males sat on the rock sculpture and took photographs beside the feature.
6. **Potential affordances:** Students in wheelchairs wanted to play with all of the musical instruments but did not manage to because of the surface material.

Zone F: *Water Central Area*

1. Water feature not working due to a pump failure (not until the 6th day of observation in May).
2. Students on specially adapted bicycles liked to feel the moss on the raised beds (see Image 5.2, p.150).
3. A female teaching assistant had a fear of getting wet at the water feature (see the anecdotal evidence in p.150, para.2).
4. A male student with multiple disabilities became agitated because it was too sunny (see the anecdotal evidence in p.151, para.1).
5. A male student with a hearing-impairment picked up a slug and put it on his palm. His female teacher talked about it in sign language, saying she disliked it because it is slimy. The student laughed and put the slug back on the pathway (see the anecdotal evidence in p.150, para.1).
6. A male student with special needs sat with his teacher on a seating. After a while, the student lay down on the seating with his head on his teacher's lap. They were communicating (including sign language) and sat there between 1-2 minutes.
7. **Potential affordances:**

- Students in wheelchairs wanted to feel the water but did not manage to do so because of the shrubs around the feature (see Image 5.3, p.151). They also wanted to feel the plants in the raised beds but did not manage this because of the height of the wall.
- When the water feature was not working, a female teacher (X1*) expressed her feelings that this was a pity because her visually-impaired male student (Y1*) loves to hear the sound of the water (see p.151, para.2).

F.2 Lyndale School, Wirral.
Date of observation: 21st-25th, 28th-29th May and 11th-13th, 16th-19th July (14 days) Time of observation: 9.00am – 3.30pm

Zone A: *Rainbow Walk*

1. The school is a non-residential special school. The time of the observation started at 9.00am since the sensory garden had not been used 30 minutes earlier, like the RSDCD. The school starts at 9.00am and finishes at 3.30pm.
2. Private outdoor play space is used by students and teachers between 12.30pm to 2.00pm everyday because the school loses 50% of the staff of each classroom during playtime. Some go for a break while others supervise play with the students. So to give students the maximum freedom to run and play, each class has its own private outdoor play area (see Image 4.5, p.136).
3. The volunteer gardener comes in every Tuesday and Wednesday from 9.30am to 12pm.
4. A group of female staff with students in wheelchairs stamp their feet on the boardwalk while singing during their school lessons (see Plan 3.2a, p.110 and Image 5.19, p.164).
5. A group of female staff and students did tree-rubbing and felt the texture of the leaves (see the anecdotal evidence, p.164 and Image 5.19).
6. A bird was found dead beside the water feature and it concerned four female staff. Later, a female staff brought a spade and dug a hole to bury the dead bird.

Zone B: *Water Garden*

1. The water feature only worked on the first day of observation in May and was not working during the whole period of observation in July due to a pump failure.
2. A partially-hearing male student asked the researcher while strolling in the sensory garden, *'It's a nice garden, isn't it?'* (see the anecdotal evidence in p.131).
3. Staff were concerned about the surface of the boardwalk because it is slippery and hazardous for students. Two staff and two students had a fear of using the slippery boardwalk near the pond. So they used the steps instead (see Image 5.16, p.162).
4. A few female staff were surprised to see tadpoles in the pond. Students enjoy watching them (see Image 5.15, p.162).
5. A female staff picked up a piece of slate and gave it to a partially-sighted male student to feel the texture (see Image 5.15).
6. Birds like taking a dip in the water channels and chipping on the tree branch (see Image 5.17, p.163).
7. **Potential affordances** (see p.163, para.1):
   - Students in wheelchairs wanted to continue their exploration on the boardwalk but did not manage to because the path came to the end. One of the students who was mobile just sat at the end of the boardwalk (see Image 5.18, p.163).
   - Teachers expressed their frustration at not having the interactive fountain working because some of their students loved watching and talking about this design feature.

Zone C: *Green Space*

1. The covered tunnel with climbers was constructed by a group of students with the help of a specialist and their teacher. The installation took place a few weeks before the observation period in July 2007. Once completed, users were keen to take photographs of this feature (see Image 5.11, p.160).
2. Physically-able students liked climbing up and coasting down the sloping lawn (sometimes using the log as a means to climb up) (see Image 5.12, p.160).
3. Staff and students like to brush their legs and hands against the lavender (see Image 5.13, p.161).
4. Staff and students threw water balloons at the textured wall, which affords communication (see Image 5.12).
5. One female staff sang on the pathway to attract one male student with learning disabilities to come into the class and join his mates.
6. Two staff and two students sat on the lawn and had a picnic (see Image 4.6, p.143).
7. Students were observed engaging with the water trapped between logs at the artwork display (see Images 4.8, p.143 and 5.10, p.160). The artwork display later had been relocated to the *Woodland Garden* by the time of the observation period in July.
8. **Potential affordances**:
   - Students in wheelchairs could not reach to touch and smell the herbs in the raised beds and asked for staff assistance (including sign language) (see Image 5.14, p.161).
   - Students in wheelchairs also could not continue their exploration on the boardwalk because the path was discontinued (see Image 5.18, p.163).

Zone D: *Woodland Garden*

1. Partially-sighted students liked to touch, feel and hold the rope railing while walking on the boardwalk (see Image 5.9, p.159).
2. The sound stimulation was making a 'bonking' noise by itself. A learning difficulty boy heard it and ran towards the sound (see the anecdotal evidence in p.131).
3. A male student with partially hearing-impaired climbed and coasted down the sloping lawn. Then he plugged the wild flowers and gave them to his teacher.
4. A female staff shook a tree branch and the rainwater dropped on top of the student's head. The student looked up, laughed and felt the rainwater running on his face (see the anecdotal evidence in p.180).
5. **Potential affordances**: A few sound stimuli that had been installed at the end of the boardwalk created a 'bottle neck' for those among students in wheelchairs. Thus some of them chose not to engage with the technical devices (see Image 5.9).

APPENDIX G

The Actualised Affordances by the Landscape Design Categories

G.1 Royal School of Deaf and Communication Disorder, Cheshire.

<u>Legend</u>

Soft L.	Soft Landscape	Hard L.	Hard Landscape
Land. F.	Landscape Furniture	NoU	Number of Users
TTS/TTSPU	Total Time Spent/Total Time Spent Per User	F	Staff
T	Students	Phy.Soc.	Physical and Social skills
Act.	Activities		

Zone/ Themes/ Total area covered	Affords	The Landscape Design Categories, the Number of Users and the Total Time Spent/User (min.sec)														
	SENSES	**Soft L.**	**NoU**		**TTS/TTSPU**		**Hard L.**	**NoU**		**TTS/TTSPU**		**Land. F.**	**NoU**		**TTS/TTSPU**	
	Touch		F	T	F	T		F	T	F	T		F	T	F	T
Zone A/ *Parents' Waiting Area/* 660 sq. metres	Brushing legs	•	0	1	0	.30										
	Feeling						•	1	2	.30	1.0					
	Plucking	••••	3	4	1.30	2.0										
	Running hands						•	0	5	0	2.30					
	Rubbing	•	1	1	.30	.30										
	Sitting						•	0	1	0	6.0	••••• ••••• ••••• ••	17	0	25.30	0
	Throwing	•	1	1	.30	.30										
	Touching						••	1	8	.30	4.0					
	Smell															
	Smelling	••••	3	4	1.30	2.0										
	Sight															
	Pointing						•	1	1	.30	.30					
	Sound	0														

	Taste	0														
	PHYSICAL and SOCIAL SKILLS	Soft L.	NoU		TTS/TTSPU		Hard L.	NoU		TTS/TTSPU		Land. F.	NoU		TTS/TTSPU	
	Mobility															
	Running						••	27	11	13.30	5.30					
	Skipping	•	0	5	0	2.30										
	Walking	•	1	5	.30	2.30										
	Speech															
	Singing						•	1	1	.30	.30					
	Talking about it (including sign language)						•	1	1	.30	.30					
TOTAL	**3 senses (10 act)/ 2 phy.soc. (5 act)**	**13**	**9**	**21**	**4.30 /.30**	**10.30 /.30**	**10**	**32**	**30**	**16.0 /.30**	**20.30 /.30**	**17**	**17**	**0**	**25.30 /1.49**	**0**

Table 6.1a: Matrix of the actualised affordances in relation to the landscape design categories, the number of users and the total time spent, utilising their senses, physical and social skills, recorded at the *Parents' Waiting Area* of the RSDCD.

Note:
1. The number of •(s) represent the number of times (frequency) occurred for the landscape elements.
2. The total of time spent based on the total number of users engaged with the actualised affordances.

Zone/ Themed/ Total area covered	Affords	The Landscape Design Categories, the Number of Users and the Total Time Spent/User (min.sec)														
	SENSES	**Soft L.**	**NoU**		**TTS/TTSPU**		**Hard L.**	**NoU**		**TTS/TTSPU**		**Land. F.**	**NoU**		**TTS/TTSPU**	
	Touch		F	T	F	T		F	T	F	T		F	T	F	T
Zone B/ *Exploraway/* 511 sq. metres	Crushing						•	5	2	2.30	1.0					
	Feeling	•	3	3	4.30	4.30										
	Sitting						••	1	1	6.0	6.0					
	Squatting	•	3	3	4.30	4.30										
	Touching											•	3	3	1.30	1.30
	Smell	0														
	Sight															
	Looking						•	1	1	6.0	6.0					
	Sound	0														

	Taste	0														
	PHYSICAL and SOCIAL SKILLS	Soft L.	NoU		TTS/TTSPU		Hard L.	NoU		TTS/TTSPU		Land. F.	NoU		TTS/TTSPU	
	Mobility		F	T	F	T		F	T	F	T		F	T	F	T
	Crossing over	•	3	3	1.30	1.30										
	Running						•	9	0	4.0	0					
	Walking fast						•	3	3	1.30	1.30					
	Speech															
	Communicating						•	1	1	6.0	6.0					
TOTAL	**2 senses (6 act)/ 2 phy.soc. (4 act)**	**3**	**9**	**9**	**10.30 /1.14**	**10.30 /1.14**	**7**	**20**	**8**	**26.0 /1.30**	**20.30 /2.54**	**1**	**3**	**3**	**1.30 /.30**	**1.30 /.30**

Table 6.1b: Matrix of the actualised affordances in relation to the landscape design categories, the number of users and the total time spent, utilising their senses, physical and social skills, recorded at the *Exploraway* of the RSDCD.

Zone/ Themed/ Total area covered	Affords	The Landscape Design Categories, the Number of Users and the Total Time Spent/Person (min.sec)														
	SENSES	**Soft L.**	**NoU**		**TTS/TTSPU**		**Hard L.**	**NoU**		**TTS/TTSPU**		**Land. F.**	**NoU**		**TTS/TTSPU**	
Zone C/ *Green Space One/* 316 sq. metres	Touch		F	T	F	T		F	T	F	T		F	T	F	T
	Brushing body, hands, legs, arms	••••• ••	3	6	1.30	3.0										
	Giving away, throwing	•••	4	2	2.0	1.0										
	Holding											•	0	1	0	.30
	Plucking	••••• •	9	13	4.30	4.30										
	Rubbing	••	2	1	1.0	.30										
	Shaking											•	0	1	0	.30
	Sitting											••	1	1	.30	.30
	Touching											•	0	1	0	.30
	Smell															
	Smelling, sniffing	••••• ••••	15	15	7.30	5.30										
	Sight															
	Fear of getting in	•	0	1	0	6.0										
	Taking photos	•	2	2	12.0	12.0										
	Sound															

	Standing	•	1	0	6.0	0										
	Taste															
	Eating	•	0	1	0	.30										
	Tasting	•	0	1	0	.30										
	PHYSICAL and SOCIAL SKILLS	**Soft L.**	**NoU**		**TTS/TTSPU**		**Hard L.**	**NoU**		**TTS/TTSPU**		**Land. F.**	**NoU**		**TTS/TTSPU**	
	Mobility		F	T	F	T		F	T	F	T		F	T	F	T
	Hiding	•••	4	4	15.0	14.0										
	Playing						•	2	2	12.0	12.0					
	Stepping on						•	1	10	.30	5.0					
	Walking	•	0	1	0	.30										
	Speech															
	Cheering	•	2	2	12.0	12.0										
	Talking about it (including sign language)	•	2	0	1.0	0										
TOTAL	**5 senses (14act)/ 2 phy.soc. (6act)**	**39**	**44**	**49**	**62.30 /1.42**	**60.0 /1.22**	**2**	**3**	**12**	**12.30 /4.1**	**17.0 /1.42**	**5**	**1**	**4**	**.30**	**2.0**

Table 6.1c: Matrix of the actualised affordances in relation to the landscape design categories, the number of users and the total time spent, utilising their senses, physical and social skills, recorded at the *Green Space One* of the RSDCD.

Zone/ Themed/ Total area covered	Affords	The Landscape Design Categories, the Number of Users and the Total Time Spent/User (min.sec)														
	SENSES	**Soft L.**	**NoU**		**TTS/TTSPU**		**Hard L.**	**NoU**		**TTS/TTSPU**		**Land. F.**	**NoU**		**TTS/TTSPU**	
Zone D/ *Green Space Two*/ 370 sq. metres	**Touch**		F	T	F	T		F	T	F	T		F	T	F	T
	Brushing	•	0	1	0	.30										
	Feeling	•	1	1	.30	.30						•	0	1	0	.30
	Holding											•	0	1	0	.30
	Touching	•	1	1	.30	.30						••	3	8	1.30	4.30
	Smell	0														
	Sight	0														
	Staring											•	0	2	0	1.0
	Sound															
	Listening	•	1	1	.30	.30										
	Splashing	•	1	1	.30	.30										

	Standing	•	2	0	7.0	0										
	Stopping	•	1	1	.30	.30										
	Taste	0														
	PHYSICAL and SOCIAL SKILLS	Soft L.	NoU		TTS/TTSPU		Hard L.	NoU		TTS/TTSPU		Land. F.	NoU		TTS/TTSPU	
	Mobility		F	T	F	T		F	T	F	T		F	T	F	T
	Crossing over	•••	25	35	14.0	17.30										
	Jumping over, Jumping on, Hoping	•	0	1	0	.30	••	5	5	2.30	2.30					
	Running						••••• •	30	29	15.0	14.30					
	Skipping						••	2	2	1.0	1.0					
	Walking						•	1	1	.30	.30					
	Speech															
	Singing						••	2	2	1.0	1.0					
TOTAL	**2 senses (9 act)/ 2 phy.soc. (6 act)**	**11**	**32**	**42**	**23.30 /1.07**	**21.0 /.30**	**13**	**40**	**39**	**20.0 /.30**	**19.30 /.30**	**5**	**3**	**12**	**1.30 /.30**	**6.30 /.30**

Table 6.1d: Matrix of the actualised affordances in relation to the landscape design categories, the number of users and the total time spent, utilising their senses, physical and social skills, recorded at the *Green Space Two* of the RSDCD.

Zone/ Themed/ Total area covered	Affords	The Landscape Design Categories, the Number of Users and the Total Time Spent/User (min.sec)														
	SENSES	**Soft L.**	**NoU**		**TTS/TTSPU**		**Hard L.**	**NoU**		**TTS/TTSPU**		**Land. F.**	**NoU**		**TTS/TTSPU**	
Zone E/ *Asteroids Arts Garden/* 231 sq. metres	**Touch**		F	T	F	T		F	T	F	T		F	T	F	T
	Brushing hand	•	1	2	.30	.30										
	Crushing						••	3	3	1.30	1.30					
	Sitting						••••	3	1	3.30	1.30					
	Smell	0														
	Sight															
	Taking photos						•	2	0	7.0	0					
	Sound															
	Hitting						••	14	10	24.0	8.30					
	Taste	0														
	PHYSICAL and SOCIAL SKILLS	Soft L.	NoU		TTS/TTSPU		Hard L.	NoU		TTS/TTSPU		Land. F.	NoU		TTS/TTSPU	

	Mobility		F	T	F	T		F	T	F	T		F	T	F	T
	Balancing						••	0	2	0	2.0					
	Climbing						•••	1	4	.30	2.0					
	Jumping on; from						••	0	2	0	1.0					
	Kicking						••	2	2	1.0	1.0					
	Lifting						•	5	2	7.30	3.0					
	Playing						•••	16	10	25.0	8.30					
	Running						••••• •	27	30	13.30	15.0					
	Skipping						•	1	1	.30	.30					
	Stamping						••	4	6	2.0	3.0					
	Stepping						•••••	4	8	2.0	4.0					
	Walking						••••• •	3	5	1.30	3.30					
	Speech	0														
TOTAL	**3 senses (5 act)/1 phy.soc.(11act)**	**1**	**1**	**2**	**.30**	**.30**	**42**	**85**	**83**	**89.30 /1.05**	**55.0 /1.06**	**0**	**0**	**0**	**0**	**0**

Table 6.1e: Matrix of the actualised affordances in relation to the landscape design categories, the number of users and the total time spent, utilising their senses, physical and social skills, recorded at the *Asteroids Arts Garden* of the RSDCD.

Zone/ Themed/ Total area covered	Affords	The Landscape Design Categories, the Number of Users and the Total Time Spent/User (min.sec)														
	SENSES	**Soft L.**	**NoU**		**TTS/TTSPU**		**Hard L.**	**NoU**		**TTS/TTSPU**		**Land. F.**	**NoU**		**TTS/TTSPU**	
Zone F/ *Water Central Area/* 230 sq. metres	Touch		F	T	F	T		F	T	F	T		F	T	F	T
	Brushing arms; legs; hands	••••• ••	12	11	17.0	11.0										
	Collecting	•••	4	2	24.0	12.0										
	Feeling	••••• •••	7	18	8.30	24.0	••••• •	8	7	28.0	21.0					
	Getting agitated	•	0	1	0	.30										
	Hand dipping, washing hands						•••	2	2	2.0	4.0					
	Holding	•••	6	2	14.0	12.0										
	Keeping it in pocket	•	1	1	1.30	1.30										
	Laying						•	0	1	0	.30	•	0	2	0	3.0

	Leaning against						••	2	3	12.0	12.30					
	Picking up	••	1	1	.30	.30										
	Plucking, cutting	••••• ••••• ••••• ••••• ••	40	23	64.0	35.0										
	Putting it on palm; back	•	0	1	0	.30										
	Rubbing	••••• ••••• •••	16	14	50.0	28.30										
	Scooping						•	2	2	12.0	12.0					
	Sitting						••••• ••••• ••	4	6	15.0	20.30	••••• ••••• •••	11	4	16.30	6.0
	Squatting						•••	1	2	6.0	1.0					
	Sprinkling						•••	4	3	15.0	13.30					
	Throwing, giving away	••••• •	11	5	16.30	13.30										
	Touching	•••••	8	6	4.0	3.0	••	0	2	0	1.0	•	0	1	0	.30
	Smell															
	Sniffing, smelling	••••• ••••• ••••• ••••• ••••• ••	50	29	75.0	44.0										
	Smelling hands	•••	3	2	1.30	1.0										
	Sight															
	Fear of getting stung	•	3	3	2.30	2.30										
	Fear of getting wet						•	1	0	.30	0					
	Looking, staring						••	1	2	.30	2.0					
	Pointing	•••	6	6	31.0	31.0	•••••	5	3	5.30	2.30					
	Repairing						•	1	0	3.30	0					
	Taking photos	•	1	1	1.30	1.30	••	2	2	3.0	3.0					
	Waving						•	0	1	0	.30					
	Sound															
	Listening, hearing	•	1	1	6.0	6.0	•••	1	4	6.0	8.30					
	Pouring						•	2	2	12.0	12.0					

Splashing						•••	4	4	24.0	19.30					
Stopping						•	0	2	0	1.0					
Taste															
Drinking						•••	0	3	0	11.0					
Eating	•	2	1	7.0	3.30										
Spitting	•	3	3	1.30	1.30										
Tasting	••••	10	8	25.0	20.0	•••	0	3	0	11.0					
PHYSICAL and SOCIAL SKILLS	**Soft L.**	**NoU**		**TTS/TTSPU**		**Hard L.**	**NoU**		**TTS/TTSPU**		**Land. F.**	**NoU**		**TTS/TTSPU**	
Mobility		**F**	**T**	**F**	**T**		**F**	**T**	**F**	**T**		**F**	**T**	**F**	**T**
Jumping						•	1	2	.30	1.0					
Lifting, carrying						•	1	0	.30	0					
Playing	•	0	2	0	4.0	••	2	3	12.0	18.0					
Running						••	8	6	4.0	3.0					
Searching	•	2	2	12.0	12.0										
Skipping						•	1	1	.30	.30					
Stepping over; on	••••• •••••	8	11	29.0	35.30										
Walking						•	1	1	1.30	1.30					
Speech															
Disgusting (including sign language)	•	2	0	1.0	0										
Greeting, communicating (including sign language)						••	2	1	1.0	.30					
Laughing						•	2	1	3.0	1.30					
Singing						••	2	2	2.0	2.0					
Talking; talking about it (inc. sign language)	••••• •••••	18	15	40.0	37.30	••••• •	8	5	16.0	13.30					
5 senses (36 act)/ 2 phy.soc.(13act)	**137**	**215**	**169**	**433.0 /2.01**	**342.0 /2.02**	**78**	**68**	**76**	**186.0 /2.74**	**185.0 /2.43**	**15**	**11**	**7**	**16.30 /1.48**	**9.30 /1.33**

Table 6.1f: Matrix of the actualised affordances in relation to the landscape design categories, the number of users and the total time spent, utilising their senses, physical and social skills, recorded at the *Water Central Area* of the RSDCD.

G.2 Lyndale School, Wirral.

Zone/ Themed/ Total area covered	Affords	The Landscape Design Categories, the Number of Users and the Total Time Spent/User (min.sec)														
	SENSES	**Soft L.**	**NoU**		**TTS/TTSPU**		**Hard L.**	**NoU**		**TTS/TTSPU**		**Land. F.**	**NoU**		**TTS/TTSPU**	
	Touch		F	T	F	T		F	T	F	T		F	T	F	T
Zone A/ *Rainbow Walk/* 767 sq. metres	Burying	•	1	0	3.30	0										
	Digging	•	1	0	3.30	0										
	Feeling	•	5	5	17.30	17.30										
	Holding	•	5	5	7.30	7.30										
	Throwing						•	0	1	0	1.30					
	Touching	•	5	5	17.30	17.30										
	Plucking	••	5	6	7.30	9.0										
	Smell	0														
	Sight	0														
	Sound															
	Clapping						•	6	6	36.0	36.0					
	Taste	0														
	PHYSICAL and SOCIAL SKILLS	**Soft L.**	**NoU**		**TTS/TTSPU**		**Hard L.**	**NoU**		**TTS/TTSPU**		**Land. F.**	**NoU**		**TTS/TTSPU**	
	Mobility		F	T	F	T		F	T	F	T		F	T	F	T
	Jumping, jumping on						••••	14	15	40.0	40.30					
	Playing						•	0	1	0	1.30					
	Running						•	7	7	3.30	3.30					
	Skipping						•	6	6	36.0	36.0					
	Stamping						••	7	6	36.30	36.0					
	Walking						••	5	7	7.30	8.30					
	Speech															
	Cheering						•	6	6	36.0	36.0					
	Singing						•	6	6	36.0	36.0					
TOTAL	**2 senses (8 act)/ 2 phy.soc. (8 act)**	**7**	**22**	**21**	**57.0 /2.6**	**51.30 /2.44**	**15**	**57**	**61**	**231.30 /4.06**	**235.30 /4.26**	**0**	**0**	**0**	**0**	**0**

Table 6.2a: Matrix of the actualised affordances in relation to the landscape design categories, the number of users and the total time spent, utilising their senses, physical and social skills, recorded at the *Rainbow Walk* of the LS.

Zone/ Themed/ Total area covered	Affords	The Landscape Design Categories, the Number of Users and the Total Time Spent/User (min.sec)														
	SENSES	**Soft L.**	**NoU**		**TTS/TTSPU**		**Hard L.**	**NoU**		**TTS/TTSPU**		**Land. F.**	**NoU**		**TTS/TTSPU**	
Zone B/ *Water Garden/* 223 sq. metres	**Touch**		F	T	F	T		F	T	F	T		F	T	F	T
	Feeling						•	2	2	3.0	3.0					
	Holding, keeping	•	1	2	.30	1.0										
	Plucking	•	1	2	.30	1.0										
	Sitting						••	1	1	.30	.30					
	Throwing						••	0	5	0	2.30					
	Smell	0														
	Sight															
	Fear of slippery						•	2	2	1.0	1.0					
	Looking over						•	0	3	0	1.30					
	Pointing	•	8	8	12.0	12.0										
	Watching	••	3	11	10.30	29.30										
	Sound															
	Listening, hearing	•	2	2	1.0	1.0	•	3	13	4.30	19.30					
	Taste	0														
	PHYSICAL and SOCIAL SKILLS	Soft L.	NoU		TTS/TTSPU		Hard L.	NoU		TTS/TTSPU		Land. F.	NoU		TTS/TTSPU	
	Mobility		F	T	F	T		F	T	F	T		F	T	F	T
	Crossing						•	0	2	0	1.0					
	Speech															
	Talking about it (including sign language)	•••	13	18	23.30	41.0	•	2	2	3.0	3.0					
	Talking through						•	3	13	4.30	19.30					
TOTAL	**3 senses (10 act)/ 2 phy.soc. (3 act)**	**9**	**28**	**43**	**48.0 /1.71**	**85.30 /2.38**	**11**	**13**	**41**	**16.30 /1.25**	**51.30 /1.25**	**0**	**0**	**0**	**0**	**0**

Table 6.2b: Matrix of the actualised affordances in relation to the landscape design categories, the number of users and the total time spent, utilising their senses, physical and social skills, recorded at the *Water Garden* of the LS.

Zone/ Themed/ Total area covered	Affords	The Landscape Design Categories, the Number of Users and the Total Time Spent/User (min.sec)														
	SENSES	Soft L.	NoU		TTS/TTSPU		Hard L.	NoU		TTS/TTSPU		Land. F.	NoU		TTS/TTSPU	
	Touch		F	T	F	T		F	T	F	T		F	T	F	T
Zone C/	Digging						••	0	2	0	7.30					
Green Space/	Feeling	•	2	2	1.0	1.0	•	0	1	0	6.0					
337 sq.	Brushing	•	4	4	2.0	2.0										
metres	Holding	•	0	2	0	1.0										
	Juggling						•	4	4	24.0	24.0					
	Plucking	••••• ••	14	12	15.0	10.0										
	Rubbing	•••••	13	11	9.30	6.0										
	Running hands	••••	11	11	6.30	6.0										
	Scooping						•••••	0	5	0	18.30					
	Sitting	•	2	2	12.0	12.0	••••• •••••	0	10	0	43.30	•	1	0	12.0	0
	Sprinkling						•	0	1	0	6.0					
	Throwing	•	2	2	1.0	1.0	•••••	4	8	24.0	36.30					
	Smell															
	Sniffing, smelling	••••• •••	21	19	17.30	14.0										
	Smelling hands	•	4	4	2.0	2.0										
	Sight															
	Fear of getting stung	•	1	1	.30	.30										
	Looking, watching	••	2	2	5.0	5.0	•	0	1	0	.30					
	Pointing	•	1	1	.30	.30										
	Taking photos	••	4	4	6.0	6.0	•	4	4	24.0	24.0					
	Sound															
	Hearing						•	9	9	16.30	16.30					
	Hitting						•	9	9	16.30	16.30					
	Knocking						••	0	2	0	7.0					
	Pouring						•	0	1	0	6.0					
	Smashing						•	4	4	24.0	24.0					
	Taste	0														
	PHYSICAL and SOCIAL SKILLS	Soft L.	NoU		TTS/TTSPU		Hard L.	NoU		TTS/TTSPU		Land. F.	NoU		TTS/TTSPU	
	Mobility		F	T	F	T		F	T	F	T		F	T	F	T

	Crawling						•••	0	3	0	13.30					
	Jumping						•	0	1	0	3.30					
	Passing through, walking	•	3	3	4.30	4.30	•	0	1	0	3.30					
	Playing						•	9	9	16.30	16.30					
	Running						••••	0	4	0	19.30					
	Stepping						••	0	2	0	7.0					
	Swinging						•	9	9	16.30	16.30					
	Speech															
	Communicating	•	1	1	3.30	3.30										
	Counting						•	9	9	16.30	16.30					
	Reading						•	9	9	16.30	16.30					
	Singing						•	1	1	.30	.30					
	Talking about it (including sign language)	•••	6	6	8.0	8.0										
TOTAL	**4 senses (23 act)/ 2 phy.soc. (12 act)**	**41**	**91**	**87**	**94.30 /2.07**	**83.0 /1.35**	**49**	**71**	**109**	**195.30 /3.15**	**350.0 /3.21**	**1**	**1**	**0**	**12.0**	**0**

Table 8.2c: Matrix of the actualised affordances in relation to the landscape design categories, the number of users and the total time spent, utilising their senses, physical and social skills, recorded at the *Green Space* of the LS.

Zone/ Themed/ Total area covered	Affords	The Landscape Design Categories, the Number of Users and the Total Time Spent/User (min.sec)														
	SENSES	**Soft L.**	**NoU**		**TTS/TTSPU**		**Hard L.**	**NoU**		**TTS/TTSPU**		**Land. F.**	**NoU**		**TTS/TTSPU**	
	Touch		F	T	F	T		F	T	F	T		F	T	F	T
Zone D/ *Woodland Garden/* 556 sq. metres	Feeling	••	2	0	1.0	0	••••	7	10	18.0	23.0					
	Grabbing	•	1	0	.30	0										
	Throwing	•	1	0	1.0	1.30										
	Plucking	•••	2	2	1.0	1.0										
	Pressing						•••	38	37	69.0	80.30					
	Pulling	•	1	0	.30	0	•	0	1	0	.30					
	Sitting						•	0	1	0	.30					
	Touching						••••	38	37	69.0	80.30					
	Smell	0														
	Sight															

	Taking photos						•	9	9	21.0	31.30					
	Sound															
	Clapping						•	9	9	21.0	31.30					
	Listening						•••	38	37	69.0	80.30					
	Shaking	•	1	0	.30	0	•	0	1	0	.30					
	Taste	0														
	PHYSICAL and SOCIAL SKILLS	**Soft L.**	**NoU**		**TTS/TTSPU**		**Hard L.**	**NoU**		**TTS/TTSPU**		**Land. F.**	**NoU**		**TTS/TTSPU**	
	Mobility		**F**	**T**	**F**	**T**		**F**	**T**	**F**	**T**		**F**	**T**	**F**	**T**
	Climbing	••••	5	9	2.30	4.30	••	0	2	0	1.0					
	Coasting down	••••	5	8	2.30	4.30										
	Crawling	••	0	3	0	1.30										
	Jumping						•	2	3	1.0	1.30					
	Running	•	0	1	0	.30	••••	6	12	3.0	6.0					
	Stamping						•	1	4	.30	2.0					
	Stepping						•	0	1	0	.30					
	Speech															
	Laughing						•	6	6	17.30	21.0					
TOTAL	**3 senses (12 act)/ 2 phy.soc. (8 act)**	**20**	**18**	**23**	**9.30 /0.52**	**13.30 /0.58**	**29**	**154**	**170**	**289.0 /2.28**	**361.0 /2.12**	**0**	**0**	**0**	**0**	**0**

Table 6.2d: Matrix of the actualised affordances in relation to the landscape design categories, the number of users and the total time spent, with senses, physical and social skills, recorded at the *Woodland Garden* of the LS.

APPENDIX H

General design recommendations when creating a sensory garden

The data analysis results generated a question: *What is it about the environment that is engaging?* The researcher discovered **two main points**, based on the evidence recorded during the observation and data findings. These points are as follows:

- **A good network of pathways and a variety of garden features affording easy wayfinding in the sensory garden back to the school building.**

In both case studies, all users, especially students with special educational needs were able to find their way back to the school building, showing their cognitive ability in recognising all the information they needed in leaving the sensory garden. Kaplan et al. (1998:50) stated that *'The distinctiveness of such elements, where they are placed and the number of them are all key aspects of designing for way-finding'*. Therefore, it is understood that the good pathway network and circulation, access to the garden and a variety of garden features, offered easy wayfinding to the users, especially for the students to find their way through the garden and to return to their classroom. Additionally, repeat visits or recognisable features such as distinctive scented plants also supported their sense of wayfinding (see the anecdotal evidence in pp.100 and 105, para.3).

Besides linking the school building and encouraging easy wayfinding to the sensory garden, a good pathway network can also generate play activities, for example, the *Rubber Walkway* at the RDSCD and the *Rainbow Walk* at the LS. Here, the play activities afforded users the chances to socialise or even play a game. During an interview the researcher had on April 30th, 2007 with Barker, a speech therapist at the RSDCD, she said that she would like to see a **sensory trail** constructed in the garden. Two other teachers of the school also made the same suggestion. This suggests that the garden should have a main pathway, connecting the school building to the garden, and secondary pathways linking zones around the garden to the individual behaviour setting placed within accessible reach along the pathways.

- **A variety of individual behaviour settings positioned in strategic places, such as along pathways and areas with easy access, afford diverse activities for environmental and sensory learning.**

The activities users engaged in afforded them the opportunity to experience sensorial, physical and social activities. Heft and Chawla (2006) said that access and mobility are equally significant to engage with affordances. User engagement with the hard landscape behaviour settings, including artefacts and water features, offered users the highest actualised affordances in the garden. They performed activities such as balancing, crawling, climbing, jumping, kicking, running, skipping, stamping, swinging, crushing, digging, hitting, scooping, etc. The users also interacted with the soft landscape behaviour settings including animals and microclimate factors and that increased their functioning, as did the landscape furniture behaviour settings, such as the seating and lighting bollards. Users' activities and movements were evaluated by the researcher to show that the sensory garden provided more positive affordances than negative ones. In other words, the combination of the hard landscape, soft landscape and landscape furniture behaviour settings allowed the users to recognise their sensory garden as a diverse context (see p. 166, para.2 and p.189).

From these two main points, **seven design aspects** have been drawn up in relation to the development of the sensory garden: Spatial layout and location of the garden in relation to the site context; accessibility, wayfinding and circulation network; behaviour settings of hard landscape and landscape furniture; behaviour settings of soft landscape and wildlife refuge; microclimate and weather; safety; maintenance and management. These design aspects are common and practical for landscape architects to assist them in creating and maintaining a sensory garden that meets users' needs and they also indicate that care and attention must be given to each individual behaviour setting, hence they are relevant to most special schools.

i. Spatial layout and location of the garden in relation to the site context.

In terms of spatial layout, a sensory garden should be designed with a series of areas (possibly with themed zones), with an emphasis on making use of different senses. This is not to say that each individual behaviour setting of the sensory garden should appeal to just one sense, but it would be a help in the initial planning stages to concentrate on each sense separately. In addition, the *Building Bulletin 102* (2008:30) outlined, '*zoning can help children with special educational needs feel secure and make wayfinding easier*'.

In terms of the spatial location of the garden in relation to the site context, it is vital to place the sensory garden adjacent to the school building, to provide it with good access and with views from the school to the garden, to offer users the opportunity to explore it and to encourage an outdoor learning environment that has a variety of individual behaviour settings. The first case-study garden is used as a transition space between buildings (Royal School for the Deaf and Communication Disorders) and the second is attached to one building, with an open view to the residential backyard (Lyndale School). The analysis results do not suggest that one is better than the other but, whatever spatial context the sensory garden has, there are other important aspects that the landscape architect has to consider, such as *How do users access the garden from the school building? How do users journey through the spaces and back to the building?*

ii. Accessibility, wayfinding and creating a network of paths.

In order to facilitate user access into the sensory garden, it is essential to provide even-surfaced pathways that are wide enough to take a wheelchair into the garden and along to the play areas. The primary path should be a direct route from the school building into the garden and the path network should travel continuously around the garden, connecting all play areas. Steps should be avoided. If the sensory garden has different levels, a gentle gradient with non-slip surface can be used as access. Pathways can be made from a range of colours and textures that can be used effectively as markers, thus encouraging easy wayfinding. Surface materials, such as lawn and timber decking, could assist users in stimulating their senses. Although different surface materials, such as chip bark and gravel are recommended to offer variety, landscape architects should bear in mind that being wheeled over a rough and bumpy terrain may not always be a pleasant experience, particularly for someone with limited mobility. Another aspect of accessibility includes the need to make all the individual behaviour settings installed in the sensory garden accessible for all users, including wheelchair users, affording them the experience of sensorial, physical and social activities.

iii. Behaviour settings of hard landscape and landscape furniture.

Landscape architects should consider integrating four to eleven combinations of individual behaviour settings (based on the minimum and maximum number of individual behaviour settings in both case study sensory gardens), which are functional in each of the themed zones that will afford various activities. For example, shelter with seating as well as a water fountain, a fishpond and water channel enhance the garden's affordances because these features will encourage users' interest in the sensory garden. Besides offering sound stimulation, water features also provide opportunities for users to engage with aquatic habitats such as fish, dragonflies, frogs and tadpoles. When designing for any water features, landscape architects should carefully plan the safety aspect (see vi, Safety).

iv. Behaviour setting of soft landscape and a wildlife refuge.

A composition of trees, shrubs, climbers and herbs will offer attractiveness and shade as well as harbouring wildlife in the sensory garden. Other vegetation, such as fruit trees should also be planted in the garden because they have seasonal interest and some produce fruits that are edible. Besides encouraging social gathering, especially during the harvest season, fruits tress may assist users in bringing back memories of their homes which they have left. In contrast, plant massing with shelter and seats could afford seclusion for users to carry out their personal activities, thus it affords them the chance to further explore the environment. Additionally, lawn areas offer the effect of natural greenness and independent movement. It is also sensible to provide appropriate dimensions for the raised planters for users, especially those in wheelchairs, to allow them to sow seeds easily, to be 'up close and personal' with scented plants, to feel the moss growing on a wall surface while passing by and, perhaps, other gardening practices. It is recommended that raised beds should be just below average waist height and not more than 2' 6" in width (Lambe, 1995). Ultimately, landscape architects should think about 'seasonality', when soft landscapes look at their best and can be enjoyed by the users during school terms.

v. **Microclimate and weather.**

Users of the sensory garden, especially students in special schools have different reactions when engaging with the microclimate and weather. For instance, students assessed the rain as positive as it offers them the chance to splash in puddles on the pavement and to feel the rain running on their cheeks. In contrast, staff might assess it as negative because it affords them the disadvantage of getting cold and wet. By furnishing the sensory garden with a pergola and a shelter, this allows users the opportunity to experience the weather yet giving them the option either to engage with or to avoid it. In the observation at the RSDCD case-study site, a male student who was multi-disabled became agitated because it was too sunny. According to Moore (1999:372), '*children with limited mobility are especially vulnerable as they cannot get away quickly from direct sun. Plenty of shady areas need to be provided*'.

Climatic factors such as sun, wind, rain and thunder also contribute to the sensory experiences that trigger users' senses and affordances. These were recorded during the researcher's case study observation period and are further illustrated in Chapters Four and Five. For example, walking under a row of shady trees on a sunny afternoon might be evaluated as a comfortable ambience. In contrast, a stormy day with heavy rainfall might be evaluated as an undesirable situation in which to be in the natural landscape. Thus, allowing users the opportunity to engage with natural forces supports the link that has been established between personal experiences and developing environmental cognition; an individual learning process has to occur to let people understand the benefits or disadvantages of the natural features.

vi. **Safety.**

Sensory gardens are safer if they have a high number of staff offering support. This will always be an issue when sensory gardens are located in public open space where there is no supervision and people are free to use them. The sensory garden of a school, therefore, should have access merely to its students and staff, unless otherwise sanctioned by the school management, for example, on an open day. The *Building Bulletin 102* (2008:29) cited that sensory gardens should be surrounded by *'shelter belt of trees and shrub planting along the site boundaries'*. One predictable issue which often has to be resolved is the removal of branches that overhang the pathways. However, landscape architects should not take this to extremes because having something quite soft, which brushes against the skin, is sensual for users, especially multiple disabled students. *How do landscape architects manage safety while making sensory gardens exciting and rich in experiences?* Let's take a water feature, for example. Designing *wheeling streams*[61] or raised pools with shallow water could draw users closer to the water. Safety is one of the design aspects that must be taken into account in terms of how users respond to the individual behaviour settings. In this case, it would not be by eliminating the water feature but by making it accessible and user friendly.

vii. Maintenance and management.

According to Titman (1994b:42), *'children's attitudes and behaviour are influenced by the way school grounds are managed'*. Stoneham and Thoday (1994) posit that designers must consider the outdoor and indoor relationship, i.e. the quality and variety of views, as these are significant in providing interest, display and stimulation, especially through the use of detailed planting. Maintenance should be taken into consideration to avoid overgrown plants. Thus landscape architects must think about upkeep because there is no point in having carefully designed landscapes unless they can be properly maintained. These findings are also in agreement with those of Aldous and Relf (1999) that plant selection and the level of maintenance need to be well thought-out.

It would be useful for landscape architects to translate their design intentions effectively into a set of construction detailed drawings for the ground work department of the school as well as to produce a comprehensive maintenance and management schedule that would be easy to understand by the school maintenance staff or volunteers. Design consultants could also train the appointed maintenance contractors in how to maintain the sensory garden.

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[61] *Wheeling stream* was the term used by Jane Stoneham, who designed this feature in a special school for wheelchair users, to give them a feeling of wheeling in the water through shallow water that is safe to cross over.

APPENDIX I

Sensory Gardens visited during the Preliminary Site Studies

I.1 Sensory gardens designed by a landscape architect

Note: Users in each school and health-care visited have individual schedules, i.e. they do not have any specific time to be in the sensory garden.

Site study	RSDCD	RHS	RGS	WSG	SAS	LS	ASHS	CSG
Type	Residential, co-educational, non-maintained special school and college.	Residential, special independent school. Takes boarders.	Non-residential, special school.	Residential health-care centre for adults.	Non-residential, special school.	Non-residential special school.	Non- residential high school.	Public park. Walking distance from a primary school nearby.
Students (disabilities and age)	Severe and complex learning difficulties, autism, emotional and behavioural difficulties, multi-sensory impairment, medical and physical and language disorders. Aged 2-19 years.	Severe or profound and multiple learning difficulties. Aged 5-18 years.	Severe learning difficulties and autism. Aged 4-14 years.	Range of health needs, severe learning difficulties, physical disability, sensory impairment, challenging behaviour, autism and mental health needs. Aged 24 – 62 years.	Severe learning difficulties, physical and sensory disability, autism. Aged 7-11 years.	Complex needs. Profound and multiple needs, sensory impairments, medical needs and life threatening conditions (e.g. on oxygen). 2 – 11 years.	Students are able-bodied. Aged 11 – 18 years.	Open to public.
Maintenance	In-house gardener.	Relies on volunteer efforts.	Relies on volunteer efforts.	Relies on volunteer efforts.	Relies on volunteer efforts.	Relies on volunteer efforts.	In-house gardener.	Glasgow City Council.
Operating hrs	9.00am – 3.00pm	9.00am – 3.00pm	9.00am – 3.00pm	9.00am – 4.00pm	9.00am – 3.00pm	9.00am – 3.30pm	9.00am – 3.30pm	All year round.
Observation hours	9.00am – 3.00pm	9.00am – 3.00pm	9.00am – 11.00am	9.00am – 4.00pm	9.00am – 11.00am	9.00am – 3.30pm	9.00am – 3.30pm	9.00am – 3.00pm

Observation period	20th-21st July 2006	19th – 20th Oct. 2006	2nd Feb. 2007 (researcher was only allowed on the time and date given for observation due to the school policy – strict access!)	5th – 6th Feb. 2007	7th Feb. 2007 (researcher was only allowed on the time and date given for observation due to the school policy – strict access!)	15th – 16th Feb. 2007	19th Feb. 2007	22nd - 23rd Feb. 2007
Date and time of the walk-through interview with the landscape architect, teachers or therapists	20th July 2006 Gough, A. (teacher) after school hours. The landscape architect was on leave on the dates. However, she was available during the actual data collection.	19th Oct. 2006 Benjamin, H. (teacher) after school hours. The landscape architect was unavailable to contact.	2nd Feb. 2007 Bridge, A. (teacher) during school hours. 26 Sept. 2006 Petrow, R. (landscape architect) was interviewed via phone due to his busy schedule.	5th Feb. 2007 Kinnear, J. (therapist) after health-care centre hours. The landscape architect was unavailable to contact.	7th Feb. 2007 Bashir, H. (teacher) during school hours. The landscape architect was unavailable to contact.	16th Feb. 2007 Jeffries, K. (deputy head teacher) after school hours. The landscape architect was abroad during the dates. However, he was available during the actual data collection.	19th Feb. 2007 McLoughlin, B. (principle) before school hours. 30 Sept. 2006 Mathias, J. (landscape architect)	12th April 2006 King, K. (landscape architect)
Spatial location of the garden in relation to the buildings and context	Situated in the middle of the school, between two buildings. A square form: Courtyard. Flat.	Situated adjacent to the school building and car parking.	Surrounded by school buildings. A square form: Courtyard. Flat.	Situated adjacent to the occupational building.	Situated near to the school building and surrounded by fence to another play area.	Situated between the school's building and residential backyard. A linear form. Flat and undulating.	Situated near to the school building. Access to the sensory garden from the main gate (viewed from classrooms).	Situated on the highest point of Cranhill, surrounded by metal fence, overlooking residential houses and a primary school.
Properties and attributes	*Parents' Waiting Area* (lawn patches, scented	Grass, pathway, seating, pergola with climbers,	An art area, musical area with swinging chimes,	Rounded metal 'moon gate' pergola with wind	Clay blocks, coloured soft surfacing, resin-	*Rainbow Walk* (lawn, boardwalks,	*Woodland Walk* (native trees, chip bark, shrubs, a	Musical instruments, grass, shrubs,

(in this study, refers to individual behaviour setting)	plants, pathways, seating, textured wall); *Exploraway* (lawn patches, gravel, lighting bollards, pathways; *Green Area One* (lawn patch, scented plants, lighting bollards, seating, artwork display, *vaporised trail*: gravel and limestone blocks, willow tunnel: bark chip); *Green Area Two* (lawn patches, trees, hedges, lighting bollards, pathways, rubber walk); *Asteroid Arts Garden* (shrubs, pathways, lighting bollards, balancing beam, boardwalks, gravel, musical instruments, rock sculpture, wood edge); *Water Central Area*	raised beds with herbs and scented plants.	gong and slap tubes, water feature, sail pit, swirl, art board, drip drop, bridge, spinning wheel, and xylophone bars.	chimes hang, water feature, driftwood sculpture, seating, lighting, semi-mature trees, raised plant beds, green house and storage.	bound blue glass, tarmac, canvas shade structure, art area, musical instrument, rounded metal 'moon gate' pergola, wood sculpture, seating, accessible work table, planting and lawn.	pathways, trees); *Water Garden* (boardwalks, interactive fountain with talking tubes, pond with marginal planting, slate stone channels); *Green Area* (covered tunnel, seating, sloping lawn, musical pipes, pathway, raised beds, herbs, scented plants, textured wall); *Woodland Garden* (artwork display, boardwalks, rope railing, pathways, lawn patch, trees, a variety of sound stimuli).	range of spring – autumn bulbs), *Sensory Garden* (gravel, concrete footprints, pebble pool, seating, bamboo), *Seaside Garden* (silver sphere water feature with sand, pebbles, grasses and shells), *Growing Area* (pumpkins, annual flowers, vegetables, herbs, greenhouse), *Wildflower Meadow* (meadow with bulbs), *Grass Maze* (a maze created by mowing concentric circles through longer grass).	gravel pathways, talking telescope, seating and boulders.

	(pathways, shrubs, pergola, climbers, raised beds, herbs, scented plants, moss, seating, water feature).							
Issues	The water feature is inaccessible. Students can only experience the sense of touch with the help of support teachers. Students react positively to the scented plants but when they are in the sensory garden, they are not aware of the smell around them. Support teachers will have to direct them. Some individual behaviour settings and areas are not accessible for wheelchair users, such as the musical instruments at the *Asteroid Arts*	The size of the sensory garden is too small and has limited area for large group of students. The sensory garden had been designed for only passive activities. Lack of water feature.	Limited area: No plant area offered. High maintenance of water feature.	Water feature not working most of the time. Maintenance.	Lack of herbs and scented plants to promote sensory learning. Lack of water feature.	Lack of maintenance. Interactive water feature with talking tubes, which activate the height of the fountain, is popular among the children. However, this technology does not work most of the time. Ramp for access from the school building. However, the ramp is slippery when damp. This could cause hazardous among users. Some pathways have dead-ends. Wheelchair users	Water feature is accessible for users but not working most of the time (technical fault). Teachers requested a shelter for rainy day and easy access from the classrooms.	This sensory garden was not use during the observation period. The sensory garden is not use by the primary school nearby because the school has its own ground (tarmac and grass). The school was also under-staff to monitor students to the sensory garden. The landscape architect of the city council only emailed the researcher photographs and location of the

	Garden. Lighting bollards are not working since day one.					find it difficult to move around.		sensory garden. He was unable to participate during the data collection.
Benefits	The water feature generates communication skills among students and teachers. Certain plants, such as lavender sparks memories. Good path design for wayfinding.	Working areas for horticulture are wheelchair accessible. The idea of having a sensory garden came from a sensory studio (indoor) as part of the school curriculum.	Uses include musical therapy, outdoor classrooms, art classes and informal play. A variety of hard landscape features offered.	Improvement in health (healing) and outdoor enjoyment. Tree preservation.	Safety aspect has been considered when designing for this sensory garden. For example, curvy wall and wide pathways.	Children are more confident being in an outdoor environment. Interactive behaviour setting type (technology) help children to engage with it due to their low ability.	Children can theme the areas at different times of year: Spring (new growth), Summer (add collection of shells), Autumn (Halloween, dressing up the area, growing pumpkins), Winter (Christmas, decoration, holly, tree lights)	From the researcher's personal observation, the sensory garden has a nice view overlooking Cranhill.
What the users need in their sensory garden	An accessible water feature for active activities. The sensory garden should have an extensive use of scented plants to offer good impact for the students. It would be helpful and educational for staff if plants are	A larger sensory garden to accommodate water features for active activities.	More plant areas for growing herbs and scented plants so students and teachers can interact more.	To upkeep the sensory garden.	It would be nice to have more lawn for children to lie down under the sun and water feature for active activities. Users of the sensory garden need more herbs and scented plants in the raised beds.	Consistent maintenance in the sensory garden. More seating. Water feature needs to be working during school terms.	Shelter and upkeep the water feature.	Unknown.

	labelled properly. Lighting bollards should be light up so residents could use the sensory garden during night.							
Image of the sensory garden								
Possibility of case study	Good! Because it is completed and operational, offers a variety of individual behaviour settings, easy access for information and adequate size for study. The landscape architect was available during the actual data collection.	The sensory garden is not in an adequate size for study and not many individual behaviour settings offered. The landscape architect was unavailable during the actual data collection.	Restricted access to public, even though the researcher had sent a consent letter for study. Lack of plant selection. The landscape architect was scheduled to travel abroad during the actual data collection.	The sensory garden was under used due to lack of maintenance. The landscape architect was scheduled to travel abroad during the actual data collection.	Restricted access to public, even though the researcher had sent a consent letter for study. The landscape architect was scheduled to travel abroad during the actual data collection.	Good! Because it is completed and operational, offers a variety of individual behaviour settings, easy access for information and adequate size for study. The landscape architect was available during the actual data collection.	The researcher is looking into the design and use of sensory garden that cater for special needs. The All Saints High School, however, caters for able-bodied students. Furthermore, the landscape architect was scheduled to undergo an operation during the actual data collection.	Because the sensory garden was under use and the landscape architect was unavailable during the actual data collection.

Table 1.1: Summary of sensory gardens designed by a landscape architect, recorded based on personal observations and interviews during the preliminary site studies.

I.2 Sensory gardens from the client's effort

Note: Students in each school have individual schedules and users in each centre have non-structured activities, i.e. they do not have any specific time to be in the sensory garden.

Site study	SYAC	SCS	KS	CRS	RBS	INSC
Type	Non-structured activities - Indoor and outdoor play activity for children with special needs.	Non- residential, special school.	Non-residential, special school.	Residential special school.	Residential, special school. Takes boarders.	Non-residential centre for educational workshops and horticultural therapy.
Students (disabilities and age)	Children and young adults with additional needs.	Severe or profound and multiple learning difficulties. Aged 5-18 years.	Blind or severely visually impaired with a wide range of additional learning difficulties and/ or multiple disabilities. Aged 2 – 18 yrs.	Combination of hearing and visual impairments.	Visually impairment. Aged 3 – 19 years.	Primary school children and adult groups with a range of disabilities. Aged 5 – 80 years.
Maintenance	Relies on volunteer efforts.	Relies on volunteer efforts.	Relies on volunteer efforts.	Self maintained (low maintenance)	Maintained by the pupils with help from staff.	In-house gardener.
Operating hrs	10.00am – 3.30pm	9.00am – 3.00pm	9.00am – 3.00pm	9.00am – 3.00pm	9.00am – 3.00pm	9.00am – 5.00pm
Observation hours	10.00am – 3.30pm	9.00am – 3.00pm	9.00am – 10.30am	9.00am – 3.00pm	9.00am – 3.00am	9.00am – 5.00pm
Observation period	4th -6th July 2006	28th – 29th Aug. 2006	11th Sept. 2006 (researcher was only at the sensory garden for a while because it was run down)	12th Sept. 2006	11th Aug. 2006	8th – 9th Feb. 2007
Date and time of the walk-through interview with teachers	4th July 2006 Busby, J. (director) after centre hours.	28th Aug. 2006 Alsleigh, E. (teacher) after school hours.	11th Sept. 2006 The researcher did not note the name of the teacher interviewed.	12th Sept. 2006 The researcher did not note the name of the teacher interviewed.	11th Aug. 2006 Bleck, G. (teacher) after school hours.	8th Feb. 2007 McLellan, S. (therapist) before centre hours.

or therapists						
Spatial location of the garden in relation to the buildings and context	Situated at the corner of the whole play area.	Situated besides the school building. Access to the sensory garden from the main gate.	Surrounded by school buildings. Access to the sensory garden from the main gate.	Situated besides the school building. Access to the sensory garden from the main gate.	A walled garden in a small manageable, secluded area within the school grounds.	Situated near to the centre.
Properties and attributes (in this study, refers to individual behaviour setting)	Archway, herbs and scented plants in raised beds, shady trees, concrete slab steps and seating.	Scented plants, herbs, vegetables, fruit trees, art work, seating, water feature, sundial, grass, musical instruments, steps, logs, chip bark and work tables.	Tactile surface, water feature, musical pipes, rope railing, shrubs and seating.	Boulders, pergola, herbs and scented plants in raised beds, shady trees, lawn, steps, chip barks, rope hand rails, carved seating, musical pipes, art work, concrete slab and gravel.	Herbs and scented plants in raised beds, fruit trees, shrubs, lawn, seating, bird feeding house and storage for gardening use.	Sundial, wind chimes, aromatic herbs, grass, textural and edible plants,
Issues	The sensory garden (small part of the whole playground) needs enhancement. Hence, not many users use this garden. Plants require maintenance and play equipment need to be durable. Main activity: biking. Too many 'special bikes', thus obstructing pathways.	The size of the sensory garden is too small and has limited area for large group of students. The sensory garden had been designed for only passive activities. Lack of water feature.	Kelvin School merged with Carnbooth Residential School and relocated to a new site, named Hazelwood School.	Carnbooth Residential School merged with Kelvin School and relocated to a new site, named Hazelwood School.	Lack of maintenance since the former teacher left. Lack of water feature. Accessibility aspect! And wayfinding, especially for the visually impaired.	Inaccessible moving around the sensory garden. Plant hazardous, such as ivy, weeds with needles and broken branches.
Benefits	The sensory garden is used as a quiet place for	Working areas for horticulture are	Planning in relocating good condition	Planning in relocating good condition	The sensory garden is used was a school	Users being in the sensory garden are able

	passive activities, such as reading and resting. Children like to use plants and shady trees as a hiding place.	wheelchair accessible. The idea of having a sensory garden came from a sensory studio (indoor) as part of the school curriculum.	essential features to the new site.	essential features to the new site.	project.	to stop for a while from their daily activities – resting and listening to the nature. Users particularly like to sit on the bench at the sundial because it provides a sense of security and privacy.
What the users need in their sensory garden	Funding to maintain the sensory garden for maximum use.	A larger sensory garden to accommodate water features for active activities.	Good maintenance.	Accessible pathways.	Wind chimes, water features and sensory sculptures.	Consistent maintenance in the sensory garden. More seating and hazardous plants need to be avoided.
Image of the sensory garden						
Possibility of case study	The sensory garden is not in an adequate size for study and not many essential features offered.	Possibly for a pilot study. The sensory garden was easily accessible, was an appropriate size and was well used, even though it was not designed by a landscape architect.	The researcher did not manage to visit the new school because it was under construction during the progress of this research.	The researcher did not manage to visit the new school because it was under construction during the progress of this research.	The sensory garden under use since the former teacher left, is not in an adequate size for study and not many essential features offered.	The sensory garden is not in an adequate size for study and not many essential features offered.

Table 1.2: Summary of sensory gardens from the client's effort, recorded based on personal observations and interviews during the preliminary site studies.