

An exploration into the use of smell as a support to the education of pupils with Profound and Multiple Learning Disabilities (PMLD).

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Impact Statement

The findings of this study have, to date, impacted on my professional practice in a number of ways: equipping me with an improved level of knowledge and expertise in supporting my colleagues' professional development and in devising training; offering ways forward in the assessment of smell response; impacting on the nature of teaching and learning and on the perspectives of parents and teaching professionals within the school. I strongly feel that this work could go further in raising an awareness of the importance and use of smell for pupils with PMLD within the wider professional community and extend to parents and multi-disciplinary professionals.

Professional Development and Training

My findings have supported the development of training materials for teachers and classroom staff specific to the use of smell. I have delivered several staff training sessions and led a Postgraduate Diploma module in Complex Needs (in association with the University of East London - UEL) within which I have been able to provide insights into the assessment of smell response and offer practical teaching and learning strategies in the effective use of this sense. As a result, teachers have demonstrated a heightened awareness of how smell may be impacting on their pupils' learning experiences and there has been a noted shift in attitude and practice relating to smell.

The development of the 'Smell Response Assessment Form'

Another important outcome of this study has been the development of a tool for the assessment of responses to smell (See Appendix 1). This tool, informed by my observations within the study, has been received very positively by teachers and

classroom staff within my school and used in the development of sensory profiles for pupils with PMLD (See Appendix 8). It is hoped that it will support the assessment of smell response across a wider professional community.

Curriculum content

There has also been an impact on the use of curriculum materials developed within the school since the beginning of my research period. Within the school's focus group discussions there have been a number of comments made on the effective use of smell and consequently, amendments have been made to school documentation which now reflect a broader range of learning objectives relating to smell. The impact of the changes to curriculum content have meant that teachers are now planning from documents that offer specific targets relating to the use of smell in support of learning. This is significant given that the Executive Vice-Principal commented, prior to the research period, that there were limits to which smell was referenced within the school curriculum. She had remarked, "I think what's in our curriculum hasn't given it justice."

Teaching and learning practices

The impact of training, assessment and curriculum development in relation to smell has meant that classroom practitioners are increasingly aware of the positive impact smell can have on learning. It has been evident that there is a definite shift toward integrating smell into an increasing number of the pupils' learning activities. In the past year, I have taken the lead in supporting teachers to develop sensory profiles for their pupils within which the functional use of smell for all pupils has been considered and strategies advised (See Appendix 8).

Impact on parents and other professionals

Those parents who were involved in this study demonstrated an increasing awareness of the potential value of smell in their children's learning. Some of the parents expressed a commitment to integrating a wider range of smell experiences into their child's experiences within the home. Through multi-professional discussion, there has also been an improved level of consideration given to the impact of smell in supporting eating and drinking routines and a wider range of smell experiences implemented into sensory based activities for pupils with PMLD.

Reflective statement

This statement draws upon my experiences throughout the four modules of the EdD taught course: Foundations of Professionalism (FoP); Methods of Enquiry 1 (MOE1); the Initial Specialist Course: Using psychoanalytic perspectives to make sense of education and educational research and Methods of Enquiry 2 (MOE2). Following these, is a reflective account of my journey at the Institution Focused Study (IFS) and thesis stages.

The EdD taught courses

Foundations of Professionalism (FoP) module

This first module covered a wide range of issues relating to professionalism and explored the idea of what constitutes a 'professional'. Within this, I explored the work of Lunt (2009), Whitty (2008) and Gordon (1983) who highlighted different perceptions of the teachers' role, as a provider of 'services to the public,' with 'public status' and considering the impact of national initiatives on 'professional autonomy.'

An area of interest for me was the extended role I had to perform as a teacher of pupils with multi-sensory impairments (MSI). I was required to carry out other elements of specialist healthcare provision, for example, speech and language therapy, physiotherapy, occupational therapy, personal and medical care support for this unique pupil cohort. The need for greater flexibility in curriculum planning, training to develop expertise in these other areas and embedding systems for collaborative working with the respective healthcare professionals was paramount within my profession.

These issues mirrored my reading, for example, the Laming Report (2003), Code of Practice on the Identification and Assessment of Special Needs (1994), the Education Acts (1981, 1993), Simon (1981) and The Warnock Report (1978) all recognised the importance of close working relationships between the health, social and educational services. However, my concern was that although guidance in specialist MSI teacher training encompassed the need for teachers to acquire specialist knowledge, skills and understanding in dual sensory loss (SENSE, 2009) it did not consider the need for training and expertise in aspects of healthcare provision.

Within my FoP assignment, I proposed that the teachers of MSI pupils were not 'teachers' in the traditional sense but a type of 'multi-professional' required not only to be a specialist in educational practices but also able to carry out other elements of specialist health care provision. There was the potential need to 're-professionalise' ourselves as teachers (Whitty, 2008). My studies led to the clarification of my role and responsibilities at senior management level, highlighting the need for focused healthcare training, improved multi-disciplinary working and the exploration of issues relating to accountability.

Methods of Enquiry One (MOE1)

Following the concerns with my extended role as a teacher of pupils with MSI, I endeavoured, within my MOE1 and MOE2 assignments, to explore the effectiveness of existing multi-disciplinary working within my school. I was aware that the school had access to a range of healthcare professionals, for example, a team of speech and language therapists, three nursing staff and two part-time physiotherapists. However, they were not able to meet the therapeutic needs of this pupil population by themselves. As a result, teachers, like myself, and other school staff were required to

adopt a shared role with these other professionals in attempting to provide the necessary health care provision. I hoped through my reading and research in MOE1 and empirical work carried out in MOE2 to identify the factors which both promoted and hindered effective multidisciplinary working within my school. I sought to potentially map a way forward to improving integrated professional practice for teachers, school staff and healthcare professionals alike.

Through the MOE1 module, I began to identify the relevant theoretical and methodological approaches which would help me carry out such a research study. For example, considering theoretical approaches to multidisciplinary working such as 'interdisciplinary working,' 'transdisciplinary working,' 'inter-agency working,' 'partnership working,' 'integrated working' and 'joint working' (Cheminais, 2009; Orelove et al., 2004; Watson 2002; Derrington 1996) and the merits of qualitative versus quantitative enquiry (Robson, 2002). I was conscious that there would be limits to how often, if indeed at all, I could meet to speak with healthcare professionals. It became evident that the scope of such an empirical study was constrained by the limits of time and availability of healthcare staff.

This reflected the challenges recognized as a continuing concern for effective multidisciplinary working within my reading, for example: time considerations, communication difficulties, lack of clarity about roles and responsibilities and competing priorities, to name a few (Cheminais, 2009; Siraj-Blatchford 2007; Anning 2006; Pugh and Duffy, 2006).

Comments on my final MOE1 assignment feedback showed I had addressed "both policy and academic literature well" and that "the research design was meticulous." However, I had found that I was grappling with methodological and conceptual aspects

of the course. My initial feedback highlighted the need for me to further enhance my knowledge of philosophical and methodological debates.

Initial Specialist Course: Using psychoanalytic perspectives to make sense of education and educational research

My second and chosen module deviated from my ideas in MOE1 but was an interesting journey into how psychoanalytic theory linked to my teaching experiences. In respect of my assignment, I chose to explore a particular concern of mine: the excessive display of self-stimulatory behaviours by very young pupils within my department. I aimed to gain a greater insight into the possible triggers and reasons why the pupils, at this very early stage in life, engaged in such behaviours. Through the readings of key figures within the field of psychoanalysis, namely, Sigmund Freud, Anna Freud and Melanie Klein and their psychosexual and object relations theories, I hoped to gain a greater understanding of infantile sexuality.

My studies within this module were influenced predominantly by the work of Anna Freud and her practice at the Hampstead Child Therapy Clinic. This work showed the importance of secure attachments with at least one primary caregiver for healthy social and emotional development in children. It stressed the importance for the adult to develop and maintain trusting relationships with children. This insight influenced my practice greatly and made me ever more conscious of the need to forge trusting relationships with my pupils and how my role in nurturing them (to ensure they felt safe, happy and secure in themselves within the educational environment) impacted directly on their interest in, and engagement within, their learning experiences.

My written feedback from this assignment suggested that I had addressed a range of interesting and relevant theories and suggested further exploration into more complex psychoanalytical issues relating to home/school partnership working.

Methods of Enquiry Two (MOE2)

Following my MOE1 study, I aimed to further explore the nature of existing multidisciplinary working. I was able to gather a sample of fifteen multi-disciplinary participants to carry out a qualitative study. In carrying out this research, I gained an interesting and informative insight into the working practice of a range of professionals within my school. The findings of my questionnaires and group interviews were not only valuable to me as a researcher but also as a manager within the school. The main themes that emerged and provided a focus for this study were communication, training and joint working. These core areas raised further issues for reflection such as the need for multi-disciplinary training, more effective communication systems and a greater awareness of staffing and time constraints for both educational and healthcare professional communities.

MOE 2 presented opportunities to develop a greater understanding of different research paradigms and methodologies. The inclusion of a mini weekend conference provided practical ideas in the development of my understanding of how different paradigms could be aligned to address their research questions. The focus of my reading turned to research methodology as I grappled between the use of wholly qualitative, quantitative or mixed method approaches for the future.

Feedback on my draft for MOE2 stated that “you critically interrogate the literature, including the difficulties you faced, and, indeed it must have made the research

question seem daunting.” In the final feedback the same marker commented that the work, “demonstrates a critical interrogation of the surrounding literature, and a high level of understanding of methodological issues.”

Institution Focused Study (IFS)

By the end of the MOE2 module, I felt I had explored the areas of professionalism, psychoanalytic theory and multidisciplinary working enough to satisfy my interest and offer some insights into existing practice. I decided to revert back to the thrust of my initial interest which had been developing sensory assessment material for the sensory impaired pupils in the school as I felt this was a key area for development. Prior to my enrolment on the EdD course, as Head of Department, I had been interested in developing functional sensory assessment tools for teachers of pupils with multi-sensory impairments. This included assessments on hearing and visual abilities for example.

Within my school, I found there was a good range of material available for the development of visual, hearing and physical skills but limited knowledge in respect of other senses including smell. Coupled with this was my awareness of how some of our dual sensory impaired pupils actively used their sense of smell. I wondered if, in the absence of their visual or auditory systems, they potentially relied more heavily on this other sense to gather information about the people, places and objects around them. I felt, as a class teacher and then Deputy Head of School since April 2012, that my knowledge and understanding of the role and importance of smell in supporting learning was limited.

For my IFS study, I sought to draw upon the expertise and insights of a cohort of teachers within my school to specifically explore the use of this sense. The design of the research study aimed to allow teachers to work collaboratively to identify and discuss issues within their own practice. The teachers themselves carried out individual projects where they focussed on the pupils' responses within a range of sessions and shared their findings through discussion. These results showed that pupils' responses to smells were consistent and very individualised. Improved levels of awareness and attention were noted. What was apparent, nevertheless, was that this research exercise had generated the teachers' interest in further exploring the use of this sense. For me, as the main researcher, there was a sense of needing to interrogate the pupils' responses more systematically and to include my own observations and judgements. This was a key point highlighted by my second marker on examination.

Thesis

After an eight-month interruption in my studies (Sept 2014 – April 2015), I aimed in my final thesis to continue with this area of research study and to carry out a case study exploring in greater detail the pupils' responses to smell. Rather than focusing on those pupils with multi-sensory impairments, I chose a smaller cohort within this population - pupils with profound and multiple learning disabilities (PMLD). This group of pupils in my view were especially vulnerable because they experienced the severest of impairments to cognition alongside complex physical, sensory and communicative disabilities. It seemed to me that that this cohort had the most to benefit from this kind of focussed study.

I carried out 92 observations of pupils and drew upon the perspectives of my teaching colleagues and the parents of the case study pupils whilst making my own judgements. As identified in my abstract, this study yielded evidence in support of how and in what ways smell seemed to be supporting learning for this cohort.

My thesis journey has seemed a long arduous affair with my endeavour to manage copious amounts of qualitative data and develop my academic writing style. However, since the beginning of the EdD course, my improved ability to review and analyze practice has been a contributing factor in my promotion to Deputy Head of School and in being offered the opportunity to lead Postgraduate Diploma modules to teachers of pupils with complex needs. My resulting thesis has also been a testament to my progression in terms of reflective thought and practice.

Declaration and word count

I, Jo Fitzsimons, hereby declare that, except where explicit attribution is made, the work presented in this thesis is entirely my own.

Word count: 48, 205

Signature:

Abstract

In this study, I aimed to consider how and in what ways the sense of smell could support the education of pupils with Profound and Multiple Learning Disabilities (PMLD). I had two aims: first, I wanted to explore an approach to supporting teaching and learning for the PMLD cohort. Second, since the sense of smell is an under-researched and under-valued subject, I wanted to make my own contribution to providing evidence of the potential of this sense as an important tool for learning.

At the centre of this study were seven pupils with PMLD all but one of whom I had taught before the research commenced. Although their difficulties were such that it was not possible to interview them, I was able to conduct interviews and joint observations with their parents and teaching professionals. I adopted a qualitative, interpretivist methodology, which was well suited to this close and detailed interview- and observation- focussed investigation.

The fieldwork for this study was conducted over an eight-week period, in one London special school, in the spring and summer terms of 2014. I used three main methods to generate data: firstly, sourcing of information about the pupils from educational and healthcare documents and conducting initial observations (Spring Term, 2014); secondly, interviewing 15 adult participants including five teachers, seven parents, two senior leaders and the school therapist (Summer Term, 2014); thirdly, carrying out 92 video-recorded observations of pupils' reactions to smell within sensory based activities over the eight-week fieldwork period and individually interviewing the parents, teachers and school therapist on their perceptions of the video-recordings (Summer Term, 2014).

This research provided evidence to suggest that the use of smell was performing useful functions in supporting cognitive development and in the experience of eating and drinking. What also emerged was that the use of this sense offered an additional means through which pupils with PMLD could better understand and gain information about their immediate environment.

The evidence and insights presented in this thesis have already been used to inform teaching and learning practices within my own school context and it is hoped that they can be used to better support the teaching and learning of other cohorts of pupils with PMLD.

Contents

Acknowledgements.....	2
Impact Statement.....	3
Reflective statement	6
Declaration and word count.....	14
Abstract.....	15
Chapter One – Introduction	22
1.1. Rationale.....	22
1.2. Context of the study and personal journey.....	26
1.3. Research questions	32
1.4. Definition of terms: cognition and engagement.....	33
1.5. Overview of the study.....	35
Chapter Two – Setting the Scene, Policy Background and Literature Review	36
2.1. Introduction.....	36
2.2. Who are the PMLD group	38
Definitions of PMLD	38
Use of the term PMLD.....	40
What do we mean by profound learning disability?	42
Other disabilities.....	45
Prevalence	46
2.3. Why smell is important for the education of pupils with PMLD: Introduction	46
2.4. The sense of smell and physiology of the smell organ	48
2.5. The relationship between smell and taste	53
2.6. Research on smell and SEND.....	54
2.7. Assessment tools	58
2.8. Theoretical considerations.....	66
2.9. Summary	77
Chapter Three - Methodology	78
3.1. Introduction.....	78
3.2. A philosophical perspective	78
3.3. Methodological approach.....	79
3.4. Case study strategy	81
3.5. Overview of the fieldwork process.....	87

3.6. Case selection	89
Zara	90
Andrew	91
Maria	92
Mohammed	93
Matthew	94
Saeeda.....	94
Patrick.....	95
Summary of pupils' needs	96
3.7. Methods of investigation	97
Documents	98
Interviews	99
Observations.....	102
Selection of smells.....	108
3.8. Adult participants.....	110
3.9. Analysis	111
3.10. Ethical considerations	112
Consent	113
Right to Withdraw.....	116
Best interests	116
Privacy and disclosure	118
Data Curation.....	119
3.11. My role as an insider researcher	119
Chapter 4: Findings and Analysis.....	122
4.1. Introduction.....	122
4.2. The type of reactions to smells.....	124
4.3. The presentation of smells.....	127
The containment of smells.....	128
The role of the adult.....	133
4.4. Sensory thresholds.....	142
4.5. Smell as an alternative and additional way of learning.....	148
4.6. Smell as a support for eating and drinking routines.....	155
4.7. Smell as part of a multi-sensory approach.....	160
4.8. Smell as a support for the development of recognition.....	167

Chapter Five – Conclusion	175
5.1 My research questions and key findings	175
Research question 1: How do pupils respond to smell experiences within the classroom context?	175
Research question 2: How can perceived responses to smell of pupils with PMLD be best interpreted given the nature of their communication difficulties?.....	176
Research question 3: How can the sense of smell be used to provide support for learning?	177
5.2. Limitations and strengths of the research	178
5.3. Reflections and implications for future research design.....	181
5.4. Contributions to knowledge, implications for future research and professional practice	186
5.5. Final thoughts	188
References.....	190
Appendices	206
Appendix 1: The smell response assessment form.....	206
Appendix 2: Overview of the fieldwork process	210
Appendix 3: Interview questions.....	213
Appendix 4: Piloting exercises	214
Appendix 5: The analysis of data	216
Appendix 6: Sample letter of consent.....	219
Appendix 7: Training materials developed on smell.....	220
Appendix 8: Sample sensory profile	225
Appendix 9: Sample of informal observations of pupils	227
Appendix 10: Sample of observations of pupils	228
Appendix 11: Adult participants comments after viewing the video-recordings of pupils being supported by adults.....	228
Appendix 12: Observations of Andrew at snack time.....	229
Appendix 13: Practical strategies for the presentation and use of smell for pupils with PMLD.....	231
Appendix 14: Revised curriculum objectives in relation to smell.....	232

Lists of Figures and Tables

Figure 1: The Olfactory and Limbic system.....	51
Figure 2: Smell: Nasal and retro-nasal olfaction.....	53
Figure 3: Frequency of impairments among the case study pupils.....	97
Figure 4: Maria's responses to the use of scented massage creams, scented bubbles and cooking ingredients.....	131
Figure 5: Andrew's responses in relation to sensory thresholds.....	145
Figure 6: Saeeda's responses in relation to sensory thresholds.....	146
Figure 7: Pupils' responses in relation to sensory thresholds throughout the study period.....	147
Figure 8: Nature and frequency of Mohammed's responses to an adult wearing perfume.....	170
Table 1: Levels of response reflected within practitioner-based assessment tools.....	63
Table 2: Overview of the fieldwork process.....	87
Table 3: Summary of pupils' needs.....	96
Table 4: Summary of methods.....	98
Table 5: Weekly schedule for video-recording observations of pupils' responses to smell.....	107
Table 6: Video-recorded observations in total, mean, median and mode.....	107
Table 7: Smells experienced by the pupils throughout the fieldwork period.....	109
Table 8: Research questions and themes.....	122
Table 9: Pupils' responses to smell experiences throughout the fieldwork period.....	125
Table 10: How scented items were contained within the fieldwork period.....	128
Table 11: Zara's responses to the smell of peppermint on cotton wool.....	130
Table 12: Zara's responses to the smell of spices in different packets.....	130
Table 13: Adult participants' comments at interview about how the pupils accessed smells.....	134
Table 14: Strategies used by supporting adults to present smells to pupils.....	136
Table 15: Observations of the pupils' responses to different types of adult intervention.....	137
Table 16: Aligning the work of Longhorn (1988) and Pagliano (2012) with strategies used within this study.....	140

Table 17: Comments made by the adult participants from observing video-recordings of Andrew at snack time.....	156
Table 18: The range and frequency of Andrew’s responses to smell noted by the adult participants.....	157
Table 19: Frequency of Zara’s responses to different smells.....	161
Table 20: Frequency of Saeeda’s responses to different smells.....	162
Table 21: Frequency of Maria’s responses to different smells.....	163
Table 22: Parents’ comments suggesting the pupils’ abilities to recognise certain smells.....	168
Table 23: Pupils’ responses that suggested the ability to recognise a smell.....	169
Table 24: Comments made by the adult participants from observing video-recordings of Mohammed.....	170

Chapter One – Introduction

1.1. Rationale

The cohort of pupils for whom this research is based, namely those with ‘profound and multiple learning disabilities’ (PMLD) have historically been labelled as “uneducable” (Cartwright and Wind-Cowie, 2005:1). Due to their complex needs and multiple impairments they experience great difficulty in accessing the world around them. They are highly dependent on adults and require the use of specialist and individualistic approaches to learning.

This research explores an area of learning that is under-researched and under-theorised and one which may prove of particular value for this pupil cohort. It will explore how the sense of smell may serve as an effective means through which learning for this pupil group can take place. As a classroom practitioner and researcher, I have experienced at first-hand how responsive these pupils can be to smell and consequently, I wish to explore further how and in what ways the use of this sense may facilitate learning.

The history of approaches to the education of pupils with PMLD (and sensory impairments) and legislation in support of this pupil group has evolved significantly over the past 50 years. Prior to 1971, pupils with PMLD were the responsibility of the Department of Health and primarily received basic care provision. There were no statutory benchmarks for assessing pupil performance and no recognised curriculum framework for learning. This cohort was effectively ‘unseen’ within the educational system. A national shift toward inclusive educational entitlement led to a series of governmental publications which radically changed the situation for all pupils with

special educational needs (Dorchester Curriculum Group, 2002; Brown, 2001; Ware, 1994). The 1988 Education Act brought the introduction of the National Curriculum and pupils with special educational needs, including those with Profound and Multiple Learning Disabilities, received an entitlement to what was called a 'broad and balanced curriculum' (Daniels and Ware, 1990:3). However, the National Curriculum content did not meet the needs and lower attainment levels of pupils with PMLD. As a result, schools began to devise their own curricular materials to underpin National documentation. Sensory based approaches to learning were developed and recognised as an effective means through which this pupil group could better access their environment, the resources and people within it.

However, educational material on the use of the senses tended to emphasise the use of the visual, tactile or auditory systems (Fowler, 2007; Mednick, 2007; Davis, 2001; Longhorn, 1988). The use of smell seemed to feature as an 'add on' or a subsidiary medium through which learning took place. Very few texts made specific references to pedagogy associated with the use of smell. The refinement of systems for presenting smells, their use within a range of situations and the assessment of how smell may perform a very personal and individual function for the pupil had not been extensively addressed. There also existed a very limited range of assessment material to support the identification of the individual's functional use of smell.

So, why had the sense of smell been neglected? The fields of philosophy and psychoanalysis, show a history that deemed the sense of smell as inferior to the more intellectual and noble senses of sight and hearing and averse to the better intentions of scientific knowledge and understanding (Rouby et al., 2002; Mathrani,

2000). I would suggest that this inferior status might arguably have led to its neglect as a research topic.

There are also several barriers that inhibit the sense of smell as a tool for learning. Perhaps most important is that smell is commonly not deemed to be of value to the education of pupils beyond those working at the very early stages of development, and even when the use of smell is encouraged, it plays a subsidiary role to other senses such as vision, hearing and touch. This can be evidenced in the limits to research and pedagogy on the use of smell with pupils with PMLD.

As babies develop, it is argued that the more complex senses of vision and hearing take over and have a greater impact on the behaviour, physical, social and emotional development of the child (Van Etten, Arkwell and Van Etten, 1980). Therefore, it is assumed that smell does not continue to have an important role to play in development and learning. In the case of the child with sensory impairments, such as pupils with PMLD, who often cannot avail themselves of their senses of vision or hearing, there may be a continued reliance on other sensory systems such as smell to recognise and respond to the people, objects and places around them.

There is also not a well-developed smell-specific language. As Grace (2018:59) suggests, “olfactory illiteracy” exists; there is not a well-established bank of smell-specific language that can be used to categorise smells. When we describe our environment, it is more commonly in terms of what we can see, and also of what we can hear and touch. When we describe what we can ‘smell,’ however, there are difficulties in expressing the nature of our experiences, “we lack the rigor of language required for more precise description and are forced to fall back on metaphors”

(Rouby et al., 2002:4). Grace (2018:59) makes the point that there is indeed, “no set frame of reference for us all to use.”

There may also exist cultural and societal barriers to the pupils’ use of smells within the wider environment. For example, when we greet someone we are able to establish at a glance who that person is and respond in a socially acceptable manner, for example, through a verbal greeting, hand shake or a smile. The pupil with PMLD may not so readily be able to recognise another person, and may benefit from the use of a smell cue in order to recognise and begin to respond. I have experienced numerous occasions when pupils have actively tried to smell me – this has more often happened when I am less familiar to the pupil. The act of a child smelling an adult at close proximity may, however, be a quite daunting experience for an unprepared adult, even though it could be the most effective way for that particular child to determine whether they recognise the adult or not. Bruce (2004) points out that measured against their potential value as learning experiences the specific acts exercised by children may often be discouraged if cultural boundaries are threatened or jeopardized.

When something is important for any human anywhere in the world...critical periods are found in relation to that part of developing learning. This is not the case when cultural influences are stronger in their impact on development.

(Bruce, 2004:10)

Clearly, if the act of smelling plays an important role in the pupils’ understanding of and ability to engage within their immediate environment these are reasons to explore the potential of using smell as a resource in the context of special schools, and to explore the social norms and rules of etiquette that regulate interaction in these environments.

It may be the case that for pupils with PMLD, who are limited in their abilities to access the world around them, a more effective use of this sense within the educational context could elicit positive responses from pupils and serve to improve their situation and their ability to make progress.

1.2. Context of the study and personal journey

Beechleaf is a special needs school based in North East London. It is part of an academy that encompasses two special schools and a professional development centre. The academy has a total enrolment of 353 pupils of which approximately 25% of pupils have profound and multiple learning disabilities. These pupils are taught predominantly within Beechleaf School. The majority of pupils reside within the school's own local authority but pupils come from a total of 13 different boroughs representing a diverse range of ethnic backgrounds. The school's most recent census report (2019) indicates that 39% of the pupils within the academy are eligible for free school meals and 83% of pupils are from minority ethnic groups which is well above the national average. National statistics from the same year (DfE, 2020) suggest 34.6% of pupils with special educational needs are eligible for free school meals and 28% are from ethnic minority groups.¹

The academy has National Teaching School accreditation and provides education, training and information for an expansive range of schools within the East of England and North East London. Within the Professional Development Centre foundation degrees with Greenwich and Kingston University, school direct and PGCE

¹ 2014 data was not available at the time of writing.

apprenticeship courses with the University of East London are housed. Reflective practice is both encouraged and supported through ongoing training and regular sharing of best practice sessions. Professionals working in multi-disciplinary teams such as physiotherapists, speech and language and music therapists also work alongside teachers and class staff in facilitating specialist healthcare provision.

Beechleaf school caters for pupils with profound and multiple learning disabilities (PMLD) and severe learning disabilities (SLD)², aged from three to nineteen years. It is located in the academy's main site alongside a primary and secondary school for pupils with autism. Pupils from all of the schools share a range of non-classroom-based facilities located across the academy's main site including a hydrotherapy pool, numerous sensory rooms, music and drama studios, a large sports hall, kitchen areas, a sensory garden, immersive room and soft and adventure play areas. These facilities help to provide the necessary space for pupils to avail themselves of learning opportunities outside the classroom environment. The hydrotherapy pool, sensory rooms and sensory garden are of particular importance to pupils with PMLD. It is in these areas that pupils, as individuals or in smaller groups, engage in physical and sensory based sessions, for example, swimming, sensory stories, relaxation and massage and gardening.

The sensory garden naturally lends itself to the experience of smell, which is of particular interest to this study. This area is a small half paved rectangular space, located to one side of Beechleaf school. It has a perimeter of colourful plants, flowers and some herbs, a water feature, wind chimes and includes a small seated area which

² Pupils with SLD are those who have significant cognitive impairments. They may also have difficulties in mobility, communication and perception and the acquisition of self-help skills. Some pupils will use sign and symbols but most will be able to hold simple conversations (Male, 2015: 10).

altogether offers visitors a wide range of sensory experiences. It is mostly used by staff and pupils as a place to relax and engage with the different varieties of herbal and scented flowering plants. Other shared areas can also be seen to have implications for the sense of smell. For example, the hydrotherapy pool is known to have a distinctive odour given off by the chlorine used to maintain the cleanliness of the pool. Similarly, many of the pupils' timetables include a 'sensory walk' which involves a tour of the academy's site and visits to facilities of particular sensory appeal such as the sensory garden and hydrotherapy pool. Apart from these areas a feature of a sensory walk, relative to smell, may include passing outside the kitchen area at approximately 11.45 a.m. when you can smell the school dinners just before they are served.

However, despite the range of meaningful smell related experiences to be found across the academy's main site, smell is not always recognised as a key aspect of the multi-sensory learning experiences of pupils. For example, teachers of pupils with PMLD usually begin an activity with a visual or tactile cue, such as an armband shown to the pupil before swimming or a brightly coloured watering can to signify going to the sensory garden. It is not necessarily the case that a smell is used as a cue to visiting these areas.

The classes themselves, within Beechleaf school, are open spaces with access to neighbouring classrooms through partitioning doors. Each room has its own interactive plasma screen, overhead tracking hoist to support pupils with manual handling needs, a wheelchair accessible bathroom, and bespoke classroom furniture. Displays include the pupils' targets, evidence of topic and curriculum-based learning and a celebration of the pupils' achievements. A number of the classrooms have sensory corners

wherein pupils can access a range of multi-sensory equipment, for example, switch activated lights, musical or vibratory toys. Hanging rails with sensory toys and musical instruments are also stationed in different areas of the classroom.

As it is the case that a number of the pupils and staff are sensitive to smells, any smell related resources that do exist tend to be contained and housed in the cupboard areas of classrooms. It is important to note that there are particular activities that naturally lend themselves to the experience of smell. For example, cookery may include strong smelling ingredients, massage and relaxation sessions may be facilitated with the use of scented massage creams. However, from my experience, smells are not necessarily used in every session and have not, in the past, been perceived by teachers to be a key channel through which learning takes place.

PMLD class sizes range between six to seven pupils with one teacher and up to three members of support staff. Class groupings are determined by a range of factors including the pupils' age, ability, medical, behavioural and basic care needs. For example, it is commonly the case that pupils with similar abilities and medical needs are grouped together. Staff: pupil ratios depend on the level of pupil support required. If there is a class group of pupils with a range of complex medical needs, there tends to be a greater number of staff. For example, one teacher and three members of staff to six pupils. If the pupils' needs are less severe there tends to be typically one teacher and two members of staff to seven pupils.

The class team play an integral role in not only supporting the pupils' education but also in providing for their health and personal care needs. This means that the whole team are often actively involved in carrying out elements of physiotherapy, providing

nutrition and managing personal care on a daily basis. These activities are integrated throughout the day according to the needs of individual pupils.

The school has a bespoke non-subject based curriculum for pupils with PMLD with an emphasis on the development of early communication and exploratory skills. The curriculum material is organised into small graded steps which helps to provide for the small measures of progress made by pupils. There are five main curriculum areas that all primary and secondary pupils follow: communication and interaction; exploring and ordering the world; social and emotional, physical and creative development. Pupils at Post-16 level follow personalised pathways with a greater emphasis on purposeful engagement and independence skills. Planning for learning is based on curriculum and personal targets set by the class teacher alongside the class staff and parents at the pupils' annual reviews. Various teaching strategies are used in support of these targets including: intensive interaction and the use of multi-sensory approaches – This I will discuss in Chapter Two. It is recognised that pupils with PMLD form a distinctive cohort for whom a personalised approach to learning is required.

The school day starts at 9.15 a.m. and ends at 3.30 p.m. There are usually four main learning activities within the pupils' daily timetable delivered at approximately 10 a.m., 11 a.m., 2 p.m. and 3 p.m. These sessions last for about 30-45 minutes depending on the pupils' abilities to engage. The first activity is normally a communication focused morning circle routine within which pupils are encouraged to greet their peers and members of staff. Within these sessions, there are often choosing exercises where pupils pick a preferred sensory experience to share with their peers, for example, playing the chimes or blowing bubbles. Other core and foundation subjects tend to be spread out throughout the day and include sensory stories, cookery, ICT, music, art or messy play, swimming, massage and relaxation, gardening or wheelchair dancing.

Lunchtimes are between 12 noon and 1 p.m. Pupils normally eat their lunch in their classrooms. However, those who normally receive nutrition via their gastronomy tubes are grouped together and engage in social or sensory based activities with a member of staff. At 3 p.m. pupils commonly have an end of day circle session. Communication is again the focus wherein the pupils' work is shared and celebrated following this there is usually a 'goodbye' song. To signify the end of day classes often include the use of a candle which is lit and then blown out by pupils before they leave for home.

At the time of this study, as the Deputy Head of School (DHOS), I became ever conscious that teachers were involved in a lot of sensory based teaching and learning. However, an area of concern was the lack of detailed information about the pupils' sensory abilities, especially in their use of smell. The pupils' special educational needs statements and healthcare reports often gave quite vague descriptions. For example, reports would often state that a pupil had a severe visual impairment but no further detail would be provided. This left teachers in a difficult position as it was unclear how much a pupil may be able to see, hear, touch or smell. I was also aware that professional practice was not underpinned by a systematic interrogation of functional capacity. It was the case that a small number of teachers did avail themselves of some sensory assessment material they had sourced in the schools' library but this mainly comprised visual assessments. As a DHOS, I wanted to help create a bank of assessment material that could be used routinely by teachers to ascertain the pupils' abilities to see, hear, touch, smell and even taste.

What became evident from my literature search, was that there was a good range of material available on the functional assessment and use of visual, hearing and physical skills (Pagliano, 2012; Fowler, 2007; Aitken and Bultjens, 1992) but limited knowledge in respect of other senses including smell. I realised that my knowledge

and understanding of the role and importance of smell was very limited and that this was something I needed to explore.

Basing my study within Beechleaf was an ideal choice. I already had an in-depth knowledge of the existing practice within the school, good working relationships with the teachers, class staff, families and carers and access to a range of educational and healthcare professionals who could provide greater insight into the pupils' situations.

1.3. Research questions

The aim of this study was to explore the role of the sense of smell in enriching the learning experiences of pupils with PMLD. It required an exploration into how pupils responded to smell experiences. Also, the consideration of how, or if, any existing teaching and learning theories or approaches offered insights into the impact of smell on learning. These concerns were reflected in crafting my overarching and subsidiary research questions:

Can the sense of smell be used to support the education of pupils with profound and multiple learning disabilities (PMLD), and in what ways?

1. How do pupils respond to smell experiences within the classroom context?
2. How can perceived responses to smell of pupils with PMLD be best interpreted given the nature of their communication difficulties?
3. How can the sense of smell be used to provide support for learning?

1.4. Definition of terms: Cognition and engagement

In Chapter Two, I provide a detailed exploration of key terms used within this thesis; here I focus on the usage of cognition and engagement. In terms of *cognition*, quite broad definitions are found such as that of Gray and MacBlain (2015:214) who refer to the “internal processes of the mind.” More recently, within SEND governmental publications, such as The Standards and Testing Agency (STA) (2018: 5), cognition is suggested to be, “the thinking skills and thought processes that a child/young person has acquired through their prior experience.” I have found references within the fields of neuroscience (Doty, 2006; Rouby et al., 2002), neuropsychology (Neil Martin, 2013) and cognitive and developmental psychology (Gray and MacBlain, 2015; Sutherland, 1992), which put emphasis on the processes which influence cognitive development – those involving attention, perception, language, thinking, problem solving and memory.

For the purposes of this study, however, I would like to draw special attention to the characterisation of cognition proposed by Lacey and Ouvry (1998:102). Their book, *“People with Profound and Multiple Learning Disabilities: A Collaborative Approach to Meeting Complex Needs”* includes a definition of cognition which is well suited to my educational context. The authors suggest that cognition deals with, “the ways in which we gain information about the world around us, the conversion of this information into knowledge and its use in directing and informing our behaviour.” When I refer to cognition - and also, ‘cognitive development,’ ‘cognitive function’ and ‘cognitive impairment,’ - I will be referring to how well pupils are able to use information within their environment to support their understanding of and ability to engage within that environment.

Of note are a number of other terms that have been used within this study in relation to the idea of cognition, including ‘intellectual development’ or ‘measures of attainment.’ These are terms that are used interchangeably within SEND literature (DfE, 2014; Tasse, 2013; Holland, 2011) but infer the same meaning. Assessment procedures for measuring progress within this area now put greater emphasis on ‘areas of engagement,’ as I will discuss below.

The term *engagement*, has in recent years come to the fore in discussions about how we should assess the progress of pupils with Complex Learning Difficulties and Disabilities (CLDD) including pupils with PMLD (DfE, 2012; Carpenter et al., 2011). ‘*The Engagement Model*’ (STA, 2020) is now part of current practice in schools supporting the formative and summative assessment of pupils not engaged in subject specific learning. This model, identified by Rochford Review (2016), built on the work of Professor Barry Carpenter and his team in the DfE-funded CLDD project (2011) and his development of the ‘*Engagement Profile and Scale*’ (DfE, 2012). Carpenter et al., (2015:21) argue that the term engagement has historically been defined “rather vaguely” and “received many interpretations, and (that) numerous definitions exist.” In his book, ‘*Engaging Learners with Complex Learning Difficulties and Disabilities*’ he refers in particular to a definition by the National Research Council (2001:160) within which engagement is defined as “sustained attention to an activity or person” and argues that this limits the idea of engagement to only a measure of ‘time’ (2015:21). He describes engagement as the “journey that connects a child to their environment (including people, ideas, materials and concepts) to enable learning and achievement” (Carpenter et al., 2015:22) and has proposed the use of a range of terms as meaningful indicators: exploration, initiation, persistence, anticipation.

Within this study, the use of the term 'engagement' or 'engage' provides a way of framing descriptions about the degree of intensity within which the pupils interact with the objects, people and activities within their environment - so a pupil may be 'more engaged' or 'less engaged' in an activity, interaction or a sensory object. I do not follow Carpenter's model to the letter, but I recognise that 'engagement' is an important conceptual lens through which the pupils' responses can be perceived.

1.5. Overview of the study

The thesis has been organised into five chapters: Chapter One, as detailed above, includes my rationale, context and research questions; Chapter Two provides a review of literature which explores the nature of, and terminology associated with, the PMLD cohort, the importance of smell for the education of these pupils, the relationship between smell and taste, the physiology of the smell organ, tools for assessment and the history of approaches to teaching and learning; Chapter Three explores my chosen methodology and includes details of my chosen case selection, methods of investigation and ethical considerations; Chapter Four presents, interprets and discusses the findings of my research and Chapter Five forms my conclusion, providing a summary of findings, a discussion of the strengths and limitations of the methodology and methods chosen and, aims to map ways forward for future professional practice.

Chapter Two – Setting the Scene, Policy Background and Literature Review

2.1. Introduction

There exists a broad range of literature discussing the impact of smell on human life and development: for example, Neil Martin (2013), Pagliano (2012), DeVere and Calvert (2011), Doty (2006), Zoladz and Raudenbush (2005) and Sullivan (2000). However, these perspectives mainly reside in disciplines beyond the literature on special education, including human physiology, cognitive science, neurology and developmental psychology. I contend that the role of smell, as a means of supporting the learning of pupils with PMLD, is under-researched, under-developed and under-valued within special education. This is evident in the limitations of practitioner research and pedagogical guidance on the use of this sense. One of the complicating factors is that there is no definitive or universally agreed theory incorporating the facets of smell and as a result no foundation on which the practitioner can base their understanding of the role and importance of this sense.

The intention of this study is to carry out a more systematic interrogation of pupil response, to identify the essential components of the sense of smell and to harness these into a pedagogical framework that will enhance the educational multi-sensory experiences of pupils with PMLD. To this end, I will first critically review the literature which provides the theoretical underpinning for the pedagogical practice I discuss in later chapters.

My principal concerns are that:

- There is insufficient theory that exists on the use of smell, for practitioners to draw on;
- There is a lack of insight into the nature of pupil response and pedagogical advice into the application of smell in learning situations;
- There exists a lack of assessment tools designed to specifically measure the pupils' responses to smell

Within this literature review, I will consider each of the above points in detail through the examination of relevant literature and by drawing on my practitioner experience. I will discuss the nature and composition of, and terminology associated with, the PMLD cohort since diverse variations are used to describe this pupil group. I aim to explain why this study is significant for the education of pupils with PMLD, illustrate the limits to pedagogical material available and how insights from these wider disciplines may help to better inform teaching and learning practice in relation to smell.

Whilst the literature on smell as this applies to pupils with PMLD is not extensive, there are some authors whose work I have found especially influential and these will feature prominently in this review. These include Pagliano (2012, 2001), Longhorn (2007, 2001, 1993, 1988), Murdoch (2014), Grace (2020, 2018) all of whom focus exclusively on the olfactory sense and children and young people with PMLD. However, it is important to emphasise that several of these authors, including Longhorn and Pagliano, did not undertake any systematic empirical enquiry as part of their research, and this is a highly consequential limitation. It means, at the very least, that all their views must be regarded as tentative, speculative and provisional, and awaiting

(further) empirical investigation. At the same time, the authors have extensive professional experience, and offer notable insights into the teaching and learning of pupils with PMLD through their practitioner materials and publications; their work offers a rich store of material for anyone conducting research on the sense of smell, and it is widely considered as illuminating and valuable by practitioners working within the field.

2.2. Who are the PMLD group

Definitions of PMLD

How we define people with Profound and Multiple Learning Disabilities (PMLD) is vital in order to help us identify the exact nature and needs of this population (Bellamy et al., 2010; Mansell, 2010). Nevertheless, there are a large number of very different definitions in circulation, (Simmons and Watson, 2014) many of which include numerous and complex characteristics within their specification including sensory and physical impairments (Hogg, 2004; Lacey and Ouvry, 1998), autism, mental illness and challenging or self-injurious behaviour (Lacey and Ouvry, 1998), epilepsy, dysphagia and respiratory problems (Hogg, 2004). Individuals with PMLD may have any combination of these impairments (Male, 2015) and it is widely accepted that people with PMLD are “not a homogenous group” (Schools Curriculum and Assessment Authority (SCAA) 1996a:8).

However, pupils with PMLD are also known to have the severest of cognitive impairments being set apart from other groups due to their profound learning disabilities. Their abilities are compared to those of neonates who function at the very early stages of development. They have historically been assessed under

standardised intelligence quotient (IQ) measures and identified as having an IQ of under 20 (PMLD Network, 2016; DfE, 2014; Simmons, 2011). Pupils with PMLD experience great difficulty with communication, often being pre-verbal, and they are arguably the most vulnerable group of pupils within the education system - being primarily fully dependent on others to provide for their health and social care needs and requiring the use of personalised and specialist approaches to learning (Pmldlink, 2017; Male, 2015).

Within the most recent UK statutory guidance, the revised 'Special Educational Needs and Disability Code of Practice (SEND): 0 to 25 years' (DfE, 2014) pupils are now categorised according to four 'broad areas of need': communication and interaction, cognition and learning, social, emotional and mental health difficulties and sensory and/or physical needs. The term PMLD can now be found within the 'Cognition and Learning' section and describes, "where children are likely to have severe and complex learning disabilities as well as a physical disability or sensory impairment" (DfE, 2014: 98). This definition does not necessarily encapsulate the situation for pupils with PMLD within which a wide variety of other complex and multiple disabilities, as previously outlined, may exist. However, there is widespread agreement that the category 'PMLD' includes the existence of a profound learning disability, as a primary impairment, alongside other multiple needs (Ware, 2004, 1996; World Health Organisation (WHO), 1992; APA, 2013, 2000, 1980).

Alongside views that tend to emphasise impairments and the medical features of PMLD, we should acknowledge the recent thoughts of Grace (2020:21) who proposes that we should be defining this group of pupils in a more positive way, "by ability not deficit." She suggests that we consider the term *Sensory Beings* to describe pupils

with PMLD and defines them as “people whose primary experience of the world, and meaning within it, is sensory.” Grace does not claim that her term *Sensory Beings* necessarily encapsulates the situation of the individual. However, for her, it has addressed the need to move away from persecutive language and replace it with something different. It resonates most closely with what she perceives as the primary route through which this group of pupils connect with and understand the world around them – the sensory world.

In this study I will be calling the pupils by name. A pseudonym for each: Mohammed, Maria, Patrick, Saeeda, Zara, Andrew and Matthew. I will make use of the expression ‘pupils with PMLD’ in accordance with current nomenclature, but in a sense that acknowledges Grace’s views, and without intending to imply that these pupils are defined by their disabilities.

Use of the term PMLD

Together with discrepancies in the definition of PMLD, we find the use of a variety of expressions relating to the PMLD cohort. Within UK based educational practitioner material, terminology such as ‘Profound and Multiple Learning Difficulties’ and ‘Profound and Multiple Learning Disabilities’ are used interchangeably. Texts that specifically refer to the idea of a ‘Profound and Multiple Learning Difficulty,’ include Lacey et al., (2015), Cartwright and Wind-Cowie (2005) and Ware (1996). However, Ware (2004) and Lacey and Ouvry (1998) also refer to ‘Profound and Multiple Learning Disabilities.’ Although, there is no explanation within these texts for their differing usage, the terms ‘disability’ and ‘difficulty,’ beyond this are explained in different ways.

In the UK, 'disability' is known to be used in cases when a person has, "an impairment that started before adulthood, and known to have a lasting effect on development" (Department of Health, 2001). This also includes those persons who have acquired an impairment within their adult life which is recognised as having a substantial and long-term adverse effect (Equality Act, 2010). A person with a 'difficulty' is known to imply "those who do not have a significant general impairment of intelligence" (Holland, 2011:3). Given this, the term 'disability' rather than 'difficulty' will be used in this study with regard to those pupils with PMLD owing to their profound cognitive impairments.

Of note is that learning disabilities are also referred to as 'intellectual disabilities' in many parts of the world including the US, Australia and in parts of Europe. Intellectual disabilities have been identified in the revised fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association (APA), 2013) and the American Association on Intellectual and Developmental Disabilities (AAIDD) (Tasse, 2013) as a developmental condition that is characterized by significant deficits in both intellectual functioning and adaptive behaviour, including conceptual, social and practical skills – discussed further in *2.7. Assessment tools*.

Another consideration is that the term 'PMLD' is not often used within the UK healthcare system. Rather, individuals are categorised according to a medical diagnosis: microcephaly, epilepsy and cerebral palsy are conditions that often feature in the pupils' paediatric reports. This range of terminology and the associated conditions do not necessarily give an indication of the pupils' level of cognitive functioning which is necessary for the classroom practitioner to plan for effective curriculum provision. This leaves the practitioner having to infer meaning from medical

reports and to carry out their own assessments in order to ascertain levels of cognitive ability and plan for suitable approaches to teaching and learning.

What do we mean by profound learning disability?

Clinical definitions such as those found in the World Health Organisation's ICD 10 (2007) and Diagnostic and Statistical Manual of Mental Disorders (DSM) III and IV (2000, 1980) have traditionally defined pupils with PMLD solely in terms of their 'intellectual disabilities' or 'learning difficulties.' Pupils with PMLD, known to have 'profound learning difficulties,' have traditionally been described having an intelligence quotient or IQ below 20 (mental age below 3 years), the lowest measure on the IQ scale and a marked contrast to the perceived 85-114 average IQ scores of their mainstream counterparts. Individuals with IQ measures of lower than 20 have been identified as, "Heavily dependent on others. Can learn no or only the very simplest tasks" (paulcoojmans, n.d.).

It has been suggested that there have been issues in determining exact scores for individuals under an IQ of 40 (Vorhaus, 2016; APA, 2013). Carnaby (2004:4) has highlighted the problematic nature of achieving accurate and reliable IQ results for this pupil population asserting that such test scores are only "notional" representations of cognitive ability. Indeed, there has been much debate about the emphasis which is put on the diagnosis and classification of individuals according to IQ scoring alone (APA, 2013, 2000; WHO, 2007, 1992; Ware, 2004, 1996).

Consequently, in recent years, there has been a shift toward the use of 'support-based' definitions (Farrell, 2012). Changes in the criteria from the DSM-IV (APA, 2000) to the DSM-V (APA, 2013) have encouraged more comprehensive patient assessment

(APA, 2013). The DSM-V emphasizes the need to use both clinical assessment and standardized testing of intelligence when diagnosing intellectual disability, with the severity of impairment based on adaptive functioning (how well the individual meets standards of personal independence and social responsibility) rather than IQ test scores alone. The assessment of intelligence is now measured across three domains (conceptual, social, and practical) to ensure that clinicians base their diagnosis on other aspects of the individual's adaptive functioning (APA, 2013). Similarly, the American Association on Intellectual and Developmental Disabilities (AAIDD) now identifies with the assessment of skills in 'adaptive behaviour' and classifies disability according to the intensity of support required by the individual rather than the extent of their functional limitations (Tasse, 2013). The positive and more humane elements of the support-based definition provide a model that characterises a person, not primarily by their impairment – or what they cannot do - but by what they can do. The involvement of parents, teachers and healthcare professionals means that the opinions of those individuals known to the child are included. This is an essential component in recognising the pupils' actual abilities.

In reality, a specific diagnosis of PMLD or a profound learning disability may not appear on a clinician's report which poses a problem for teachers of pupils with PMLD. My experience suggests it is more likely that the classroom teacher may receive documentation to suggest a severe developmental delay or cognitive impairment. However, within the educational context the difference between an individual having a 'severe' or 'profound' learning disability has a great bearing on the nature of teaching and learning approaches used. Consequently, it is necessary for the classroom teacher to carry out their own assessments of cognitive functioning. For pupils with

PMLD, who often have life limiting conditions, judging how we should record attainment or progress has been a contentious issue (Chapman, 2016).

It has been suggested that “schools, and indeed teachers, need a wide-ranging battery of assessment tools” to best inform their judgements on pupil response (Fergusson and Byers, 2015:251). Assessment tools such as, the Communication Matrix (Rowland, 2013); Quest for Learning (CCEA, 2011); Routes for Learning (Welsh assembly Government (2006) and the Affective Communication Assessment (ACA) (Coupe-O’Kane and Goldbart, 1998) have all helped to inform decisions about communicative and cognitive functioning. These tools have been used in conjunction with the evolving nature of statutory performance descriptors or P Scales (DfE, 2014), originally developed in 1998 to support National Curriculum documentation, further revised and updated in 2001, 2009 and 2011 (Fergusson and Byers, 2015.)

Curriculum material, assessment policy and procedures developed within Beechleaf school sit within the framework of the National Curriculum and include a comprehensive range of objectives have been developed that allow for the very small steps of progress that pupils can make. There is a focus on the breadth of curriculum experience received by pupils in order to allow for the consolidation of skills (School, 2016).

More recently, insights from the Rochford Review (2016) and the work of Barry Carpenter and his colleagues, as previously mentioned, has come to the fore providing another interesting lens through which progress for pupils with PMLD can be viewed resulting in ‘The Engagement Model’ (STA, 2020). However, this tool aims to cater for a much broader cohort of pupils than those pupils with PMLD, namely those with Complex Learning Difficulties and Disabilities (CLDD). The assessment of progress

for pupils with PMLD still requires the careful consideration of their profound cognitive needs and other multiple disabilities which sets them apart from other cohorts of pupils with SEND.

Other disabilities

The characteristics and composition of other complex and multiple disabilities within the PMLD population are, as mentioned, varied and complex. Although it has been highlighted that no information is collected nationally to determine the composition of these other multiple disabilities (Emerson, 2009), a small number of regional studies exist. Figures from the Lambeth PMLD project (2010) reported that of the 81 (8%) people identified as having PMLD, within the learning disability register, 55 (68%) had a physical disability, 48 (59%) presented challenging behaviours, 46 (57%) had epilepsy, 43 (53%) (Mencap, 2010:10). Gittins and Rose (2007) carried out an audit of 61 adults with profound and multiple learning disabilities within a West Midlands Community Health Trust. Similarly, the most commonly reported disabilities were physical impairments 57 (93%); epilepsy 39 (64%) and visual impairments 20 (33%). Hearing impairments were only reported for five people with case notes frequently reflecting no information on hearing function. This particular audit highlighted a lack of recorded information about the adults' sensory impairments and the need for "priority for health action plans, particularly vision and hearing screening" (2007:1). Information about an individual's sensory abilities however, is crucial in attempting to devise meaningful approaches for intervention. The extent to which an individual can see, hear, reach out and touch, smell or taste will have a great bearing on what they perceive and detailed information about the nature of their disabilities is imperative.

Prevalence

The latest statistics publication – (DfE, 2020) *Special Educational Needs in England* - that provides data on the number of pupils with SEND, indicates that the number of pupils with PMLD - with an Education and Health Care Plan (EHCP) - constitutes 0.4% of the SEND population. It has been estimated that there will be a sustained and accelerated growth in the number of people with PMLD in England between 2009 – 2026 (Mansell, 2010). Male (2015) indicate the number of pupils with PMLD rose an average of 29.7% between 2004 and 2009 and highlights that “factors such as increase in survival rates...are likely to lead to an increase in numbers of pupils with PMLD” (Male, 2015:12). This recognised increase in the PMLD population has been a catalyst for government initiatives such as the Department for Children, Schools and Families (DCSF) Salt Review (2010) which investigated the supply of teachers of SLD and PMLD pupils within special and mainstream schools. It found that there was limited expertise in working with the pupils with PMLD and that those practitioners who were experienced and trained in working with these pupils were ageing, indicating a greater need for opportunities to develop teaching expertise within the field. Today, there are a number of postgraduate accredited courses within the UK that include modules in supporting individuals with PMLD. These modules also cover the needs of those individuals with severe and complex learning disabilities or CLDD (PMLD network, 2016) however. It is only through studying at the University of Birmingham that a student can have a full Masters’ on PMLD.

2.3. Why smell is important for the education of pupils with PMLD: Introduction

The situation for pupils with PMLD is distinctive and complex (Hogg, 2004; Lacey and Ouvry, 1998; Ware, 1996) as mentioned earlier, together with their often physical,

sensory and other medical and behavioural needs, these are the pupils who also experience the “severest of impairments to cognition” (Simmons and Watson, 2014:3). Pupils are frequently not able to verbally communicate, to clearly express their needs, wants, wishes or preferences. Pagliano (2012:8) has written of the adverse effects of sensory deprivation and the potential for, “severe disturbances in physical development, social and emotional functioning, behaviour, communication and learning.” Pupils with PMLD, due to their multiple sensory impairments, are at high risk of experiencing such disturbances. It is, therefore, necessary to explore other ways to support the pupils’ learning. Practitioners must be creative in stimulating these pupils’ levels of awareness, engaging their attention and developing their understanding of the world around them.

Mednick makes a significant point in stating that it is often our failure to respond effectively to the needs of pupils that inhibits their potential to learn; “it is often easier to look at problems in the child rather than at our own abilities to reach the child” (2007: 1). Therefore, an exploration into the use of alternative approaches such as the use of smell is especially pertinent as it has the potential to reach this cohort of pupils who otherwise are limited in their abilities to interact with their environment.

In this study, I will argue that the sense of smell is especially valuable for pupils with PMLD who are reliant on their residual functioning senses to enable them to understand and respond to their learning environment (Bates, 2012; Moss and Blaha, 1994). There are substantial grounds for this view, as will be seen later including evidence for this claim which can be found within the limitations of practitioner research available (Murdoch et al., 2014; Longhorn, 1993).

2.4. The sense of smell and physiology of the smell organ

The sense of smell or olfactory sense serves to perform a variety of subtle, intuitive but compelling functions. It is suggested to play a pivotal role in alerting us to danger: the smell of gas, smoke or spoiled food (DeVere and Calvert, 2011), in establishing and maintaining maternal bonds (Sullivan, 2000); supporting early communication (Longhorn, 1997); in triggering particular behaviours and emotions (Murdoch et al., 2014; SOSI, 2012; Mann, 2006); as a cue to memories (Mercola, 2015; SOSI, 2012; DeVere and Calvert, 2011; Longhorn, 1993) in raising levels of awareness and attention (Jones, Ruhl, Warm and Dember, 1999; Baron and Kalsher, 1998; Dember, Warm and Parasuraman, 1996, 1991) and improving virtual recognition memory, working memory, and visual-motor response speed (Zoladz and Raudenbush, 2005).³

Even from the very earliest stages of development, the sense of smell is deemed to play an important role in the overall health and wellbeing of the child. Without the use of fully developed visual and auditory systems, it is suggested that it is the foetus's sense of smell that secures its transition into the outside world. During pregnancy, the foetus can sense strong smells through the amniotic fluid which allow them to taste and smell everything their mother eats. The foetus acquires a unique 'olfactory signature' for their mother which performs the function of attracting the baby to the mother's milk and promoting recognition and attachment to the mother after birth (Sullivan, 2000). The sense of smell is not only necessary for the newborn's survival but alongside its other senses it arguably provides a channel through which the baby can begin to interpret communications and respond to its mother (Longhorn, 1997).

³ The references used within this paragraph reflect, to some extent, insights from research studies but are mainly based on the respective authors' acquired knowledge and understanding of the value and use of smell in human development and learning.

If the case of Helen Keller is considered (1880-1968), world renowned as the first deafblind person to earn a Bachelor of Arts degree, it is documented that she depended on her sense of smell to an “unusual degree” (Macy, 1970:190). The story of her life illustrates how her sense of smell was instrumental in evoking particular memories of the people and places she knew and how it helped her to establish an image of her reality and surroundings. Her sense of smell was deemed to have “exerted a great influence on her mental and moral development” (Macy, 1970:242).

Smells have been suggested as possibly the best cues to memories (DeVere and Calvert, 2011:37). Our sense of smell has been recognised as eliciting stronger emotional responses than the senses of sight, sound and touch. The accuracy with which a specific scent is recalled is suggested as being 65% accurate after a year in contrast to our ability to recall a visual stimulus which has been recorded at just 50% after four months. Also, it has been noted that a particular odour can trigger positive or negative responses years after they are first experienced (SOSI, 2012).

The relationship between the sense of smell and its ability to elicit strong emotional responses and memories has been the basis of much discussion within the fields of neurology, philosophy and psychology. For example, it was Fliess (1858–1928), an Ear, Nose and Throat specialist and close friend of Sigmund Freud, who gave one of the first indications of a possible correlation between neurosis and olfactory function. His theory, the ‘reflex nasal neuroses,’ claimed that surgery on the nose could be an effective treatment for various neurotic disorders (Perkins, 2007). More recent literature suggests a correlation between memory and olfactory function in patients with Alzheimer’s disease, schizophrenia and Parkinson’s disease (DeVere and Calvert, 2011).

Dember, Warm and Parasuraman (1996, 1991) and Jones, Ruhl, Warm and Dember (1999) noted that the use of peppermint and cinnamon improved the motivation, task performance, and alertness in participants completing prolonged driving tasks. Zoladz and Raudenbush (2005) examined the differential effects of odorants on cognition and also showed that cinnamon and peppermint odours improved participants' scores on tasks relating to attentional processes, virtual recognition memory, working memory, and visual motor response speed. Baron and Kalsher (1998) carried out a study within which participants completed a compensatory tracking task where they used a joystick to keep a moving stimulus within two vertical lines. During some tracking conditions, a lemon scent was present. Performance was found to be significantly enhanced by the presence of this pleasant fragrance. Equally, research studies have shown that smells may have a negative impact on the individual's ability to resolve intellectual tasks. Chemical smells from air fresheners, perfume, and even some essential oils have been noted as detrimental to the learning potential of individuals (Accelerated Learning Methods, 2008). In agreement with this, Martin (1999) posited that the perception of an odour being positive or negative had a direct relation to the ability of the individuals to perform certain tasks. He found, however, that an unpleasant odour was associated with improved vocabulary and a pleasant odour was characterised with improvements in spatial tasks.

These findings would seem to suggest that the presence of a smell can help to improve cognitive function. However, the individual's perception of an odour being pleasant or unpleasant can have an overriding effect on their levels of performance. In the context of this study, what would seem to be important is establishing the individual's perception of what is a pleasant or unpleasant odour.

In summary, I would suggest that the literature on smell provides grounds for exploring the cognitive and affective impact on pupils with PMLD of exposing them to smells in the context of their learning.

In the following paragraphs, I will consider the physiology of the smell organ including evidence to suggest a connection between the smell organ and limbic system - the structure of the brain known to support memory, emotional processing, social functioning, behaviour and motivation (Murdoch et al., 2014; Neil Martin, 2013; SOSI, 2012; Brewer et al., 2006).

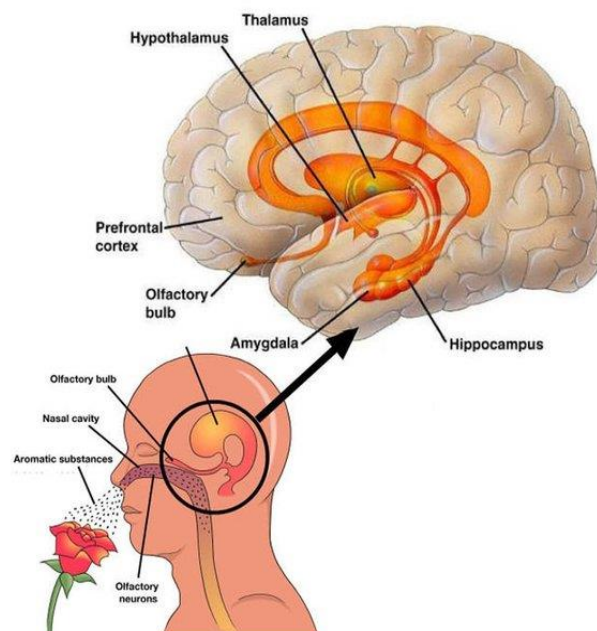


Figure 1: The Olfactory and Limbic System (Northstartherapies, 2020)

As can be seen from Figure 1, the olfactory bulb, which is the neural structure of the vertebrate forebrain involved in smell or olfaction, is closely connected to the amygdala and hippocampus. These areas of the brain are known to deal with memory and emotion and it is suggested that this is indicative of the association between our olfactory experiences and abilities to retain and retrieve pertinent information. It has

been suggested that, “Olfaction is thus the most direct interface between the brain and the outside world” (Worwood,1997:26).

The Orbitofrontal Cortex (OFC) situated within the prefrontal cortex, at the front of the brain, has been the focus of numerous research studies on smell (Li et al., 2010; Brewer et al., 2008; Suzuki, 2003; Martzke et al., 1997). Brewer et al., (2008) suggest that tests of smell identification are a well-recognised means of indirectly assessing the integrity of the Orbitofrontal Cortex (OFC). Li et al., (2010) also make an association between the OFC and smell function. Their study explored a case of complete anosmia (smell loss) in a patient with traumatic brain injury. Of particular interest to this study is the finding that despite a complete absence of conscious olfaction, the patient demonstrated odour-evoked neural activity in the left OFC. This suggests the stimulation of brain function despite a lack of any observable response to smell.

It is also significant that information from our senses of vision and hearing do not possess the same neural connection. It has been proposed that this is why the sense of smell has a better capacity for memory function:

Interestingly, visual, auditory (sound), and tactile (touch) information do not pass through these brain areas. This may be why olfaction, more than any other sense, is so successful at triggering emotions and memories.

(Lewis, 2015:1)

The literature discussed here suggests that there may be significant benefits in using smell as an additional and alternative way of supporting learning. In the case of pupils with PMLD, it would seem crucial that a closer inspection of the functional use of this sense is explored.

2.5. The relationship between smell and taste

Although this research focuses on the sense of smell it is important to highlight the close relationship between smell and taste and to explain why the sense of smell is being dealt with exclusively.

Smell and taste otherwise known as the olfactory and gustatory senses are known as the chemical senses. They interpret sensations from aromas and flavours within the chemical environment and together perform the function of heightening our perceptions of food and flavour (DeVere and Calvert, 2011). The combined functions of smell and taste play a key role in regulating our intake of food and drink and our perceptions of the world around us.

However, smell and taste are also separate organs within the body and perform unique roles in themselves. Taste (gustation) refers to the experience of food and drink as we experience it on our tongues; this we may perceive as sweet, salty, bitter, sour, and umami (savory). Smell has two distinct systems: nasal (or ortho-nasal) olfaction, when smells enter our nose, and retro-nasal olfaction when smells enter our mouths - see Figure 2.

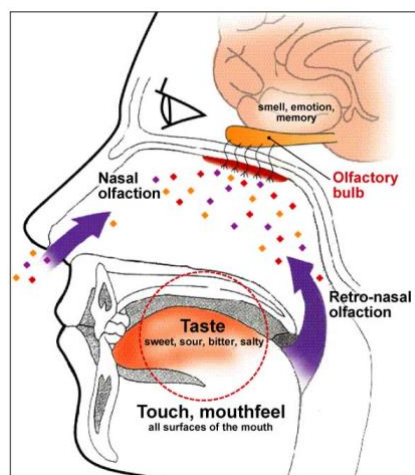


Figure 2: Smell: Nasal and Retro-nasal Olfaction (www.enologyinternational.com, 2017)

It is argued that our ability to perceive flavour happens through a combined process of smell and taste but is primarily attributed to the retronasal olfaction function. Frasnelli (2012) contends that, “we perceive the flavour of food via the sense of smell.” In support of this, Morris (1984:39) has asserted that “all flavours are really perfumes taken in through the mouth.” If we think about occasions when we have had a bad cold or blocked nose we commonly find that food has no flavour and we may lose our appetite. Similarly, a diagnosis of a smell disorder has been linked with a lack of interest in food and drink (DeVere and Calvert, 2011). Therefore, the sense of smell would seem to play a crucial and distinctive role in the experience of taste.

Of significance is that it is our sense of smell that is in constant use and is more open to detecting stimuli within the environment (Neil Martin, 2013:1). As mentioned, we are known to have four main types of taste receptors relative to sweet, sour, salt and bitter tastes. However, there are known to be 40 million olfactory receptors which allow us to distinguish up to 10,000 smells (Pagliano, 2012). These receptors carry sensory information to brain centres that also control emotions and certain types of memories (SOSI, 2012; Sullivan, 2000; Doty, 2006). This is one reason, amongst others previously discussed, why I have chosen to concentrate primarily on the sense of smell.

2.6. Research on smell and SEND

To the best of my knowledge there are not any peer reviewed empirical research studies that explore the sense of smell within the PMLD population, and I have previously acknowledged that this is a major obstacle to advancing empirical claims about the significance of smell as a resource for learning amongst this population. It is worth asking why no studies have been undertaken. One suggested limitation

derives from the known language difficulties. Murdoch et al., (2014:251) suggests that the lack of research on smell, in part, is due to the perceived “difficulties in assessing olfactory function in people without formal language.” This is echoed in the work of Brewer et al., (2008) who I will discuss later in this section.

Whilst there is no research that focuses exclusively on pupils with PMLD, there is some research on smell that includes pupils with Autism Spectrum Disorder (ASD) (Tonacci et al., 2015; Dudova and Hrdlicka, 2013; Cheung and Sui, 2009), Asperger’s Syndrome and High Functioning Autism (HFA) (Brewer et al., 2008; Suzuki, 2003), Attention Deficit Hyperactivity Disorder (ADHD) (Cheung and Sui, 2009), Visual Impairments (VI) (Feng et al., 2019) and Deafblindness (Murdoch et al., 2014).

Research has highlighted that atypical olfactory processing is present in several neurodevelopmental conditions including ASD (Tonacci et al., 2015; Dudova and Hrdlicka, 2013; Cheung and Sui, 2009; Brewer et al., 2008; Suzuki, 2003). For example, children with ASD are described as showing oral sensory processing challenges, such as smelling or licking uneatable objects, in addition to olfactory hypersensitivity (Cheung and Sui, 2009). The implication is that dysfunction to the prefrontal brain regions - including the orbitofrontal cortex (OFC) associated with odour identification – is in the pathophysiology of autism resulting in pupils with ASD being subject to olfactory abnormalities. However, studies on pupils with ASD show conflicting results – as described below.

Brewer et al., (2008) investigated olfactory identification ability in children with HFA hypothesising that they would exhibit impaired olfactory ability. The study included 15 children with HFA (aged five–nine years) and 15 age-, gender- and IQ-matched controls who were compared on their performance using the University of

Pennsylvania Smell Identification Test (UPSIT). Their hypothesis was not supported. In contrast, Suzuki (2003) found in their study of 12 adults with Asperger's disorder that deficits in odour identification were present when compared to a group of 12 matched control subjects.

On reflection, these differing results may be attributed to the varying methodologies chosen and implicating factors. For example, despite olfactory identification impairments not being found in the Brewer et al., (2008) study, some disturbance in the expected improvement in olfactory identification ability with age in HFA was noted. This could account for the results offered by Suzuki (2003) whose study suggested deficits in odour identification in adults. A possible link between olfactory identification ability and age is also reflected in the work of Cheung and Sui (2009) who compared the patterns of sensory processing among 186 children with either ASD or ADHD and 1840 children without disabilities. Children with ADHD were found to exhibit significantly more sensory processing issues as they aged.

In another study, Dudova and Hrdlicka (2013) evaluated the relationship between olfactory functions (odour-detection thresholds, odour identification, and odour preference) and autism severity and sensory-related behaviour in 35 children and adolescents with ASD. They concluded that there was no significant relationship between the severity of autistic psychopathology and olfactory functions. This is of significance to this study given that the pupil group are distinguished by their profound cognitive impairments.

Feng et al., (2019) carried out a study exploring the relationship between olfaction and geographic cognition in a group of 10 visually impaired teenagers - aiming to offer some insights into improving their freedom of movement. It was found that smell

aroused the memory of the visually impaired, inspiring their willingness to communicate. It was concluded that smells could be used to help someone re-create or describe concrete places and recognise positional information.

Murdoch et al., (2014), a research consultant group for the Seashell Trust, conducted a small-scale project examining the effects of adding food fragrances to picture symbols or objects of reference to assist three deafblind young people in choice making at mealtimes. This study concluded that the use of smell supported the students' understanding of mealtime choice making and provided some evidence of the benefits to utilizing smell to enhance the students' interest, engagement and learning by association.⁴ Murdoch et al., (2014), also illustrates how a case study strategy, chosen for this study, allowed for the consideration of the complex and diverse characteristics of the deafblind cohort, including the understanding of the individual or situation, the pre-verbal nature of the pupils and the need to interpret meaning from their responses (Murdoch et al., 2014: 264).

The research discussed here, whilst not exclusively focussed on pupils with PMLD, nevertheless has several implications for my study. Briefly, these include the suggestion that there does not seem to be a link between the severity of cognitive ability and olfactory function (Dudova and Hrdlicka, 2013); that smell has been found to arouse the memory of individuals with visually impairments, supporting their willingness to communicate and ability to identify with concrete places (Feng et al., 2019) and that a case study strategy, chosen for this study, may allow for the

⁴ This exploratory project investigating the use of fragrances to help deafblind students to make meal choices at lunchtimes. The project was a collaboration between the Seashell Trust, which provides education, care and ancillary services for young people and adults with sensory and other disabilities, and PZ Cussons, a company best known in the UK for personal healthcare products.

consideration of the complex and diverse characteristics of the PMLD cohort (Murdoch et al., 2014). I discuss these considerations further in Chapters Three and Four.

2.7. Assessment tools

Arguably, it is only when a clear picture of the individual's functional use of smell is gained that an appropriate basis for teaching and learning can be provided. This requires the practitioner to have access either to accurate data arising from clinical testing or an effective and meaningful assessment tool from which smell function can be measured. Herein lies the initial barrier for the classroom practitioner since they will often not possess the results of clinical assessment nor have access to an appropriate assessment tool for measuring the pupil's smell responses or, if they do have access, be unfamiliar with its implications (Pagliano, 2012).

In this section, I consider a range of clinical and practitioner-based tools to assess smell. It is my intention to examine these materials and to highlight potential ways forward in supporting the assessment of pupils with PMLD. Tools under examination include: *The Exteroception Template – Chemosensation* (Pagliano, 2012); *The University of Pennsylvania Smell Identification Test (UPSIT)* (Doty, 2006) and *The Learner's Sense of Smell* (Aitken and Buultjen, 1992). These assessment materials represent the most appropriate publicised documentation available to assess the smell function of pupils with special educational needs. However, as mentioned above, I will argue that despite their universal availability, these tools are often inaccessible to pupils with PMLD and offer conflicting approaches to assessment. Therefore, even when using these tools, the classroom practitioner is ill equipped to make informed judgements about the smell function of each individual pupil.

The traditional route through which a smell function is considered is as a suspected smell disorder. DeVere and Calvert (2011) and Brewer, Castle and Pantelis (2006) have identified a range of situations within which a person may be referred for clinical assessment, for example, as a result of a head injury or due to the use of certain prescribed medications such as antibiotics, anti-seizure, diuretics and antidepressants which are deemed to impact on the individual's smell function. Other causes can include thyroid and vitamin deficiency, smoking, migraine, diabetes, epilepsy, multiple sclerosis and various neurologic disorders such as schizophrenia, Alzheimer's disease and Parkinson's disease (DeVere and Calvert, 2011). There is also evidence to suggest that Down syndrome gives rise to smell dysfunction (Neil Martin, 2013; Hawkes and Doty, 2009). DeVere and Calvert (2011) classify smell disorders in the following ways:

- Dysosmia - refers to the experience of having an unusually unpleasant perception of a particular smell usually caused by abnormal function of the olfactory organ or olfactory bulb
- Congenital anosmia – is the inability to smell odours from the time of birth
- Dysgeusia – is a distortion in the sense of taste which can have an effect on the sense of smell as a secondary symptom, e.g. strange or metallic taste.

Given the above causes it is conceivable that pupils with PMLD, who often possess complex medical difficulties, may suffer from a smell disorder on a temporary if not permanent basis. It is significant that a diagnosis of epilepsy, which has been noted in over 60% of the UK PMLD population (Mencap, 2016), has been linked with smell

dysfunction (DeVere and Calvert, 2011). It is also worth pointing out that an increasing number of individuals with PMLD are being described as “technology dependent” meaning that they need oxygen, tube feeding or suctioning equipment requiring the regular use of prescribed medication (Mencap, n.d:5). Given the likelihood that a smell dysfunction may also be associated with the use of prescribed medication, this leaves pupils with PMLD particularly susceptible a smell disorder.

However, there is no research evidence to establish whether this is the case. Together with this, there are also indications that chemosensory (smell and taste) testing is simply not prioritised for this population. Pagliano (2001:45) states that “Despite chemosensation disorders being relatively common they are mostly ignored, particularly when they occur in children with PMLD” and writes of a history of “serious problems associated with children with PMLD not receiving proper assessment.”

My experience as a classroom practitioner suggests that it is uncommon to find a pupil with an up-to-date profile of sensory assessments, incorporating vision, hearing, smell and taste function. It is more often the case that the school is required to intervene in making appropriate judgements about the pupils’ sensory abilities. The reasons why this assessment information often does not exist can be attributed to the difficulties in assessing the pupils’ sensory function, with the frequent consequence that the assessment of smell function has not been prioritized.

Arguably, in respect of the PMLD population, clinical testing for smell function has not been well developed nor is it able to gauge what exactly the individual perceives. Doty (2006:236) asserts that electrophysiological tests such as a computed tomography

(CT) scan of the nasal area or a magnetic resonance imaging (MRI) of the brain and olfactory region are costly and complex and add little to clinical assessment. Consequently, he points to a range of comprehensive and commercially available psychophysical smell tests such as *the University of Pennsylvania Smell Identification Test (UPSIT) and the Brief Smell Identification test (B-SIT) (De Vere and Calvert, 2011 and Doty, 2006)*. These tests, however, are dependent on the individual being able to name or identify particular smells. Even child orientated odour identification tests such as 'The Pediatric Smell Wheel' devised to meet the needs of those at early developmental levels still requires the use of language or at least the ability to choose from a range of words and pictures (Sensonics, 2012.) These tests are inaccessible to pupils with PMLD who are predominantly pre-verbal (Hogg, 2004). It is likely that pupils with PMLD will only be able to respond to smells through changes in facial expression, eye or mouth movements or the occasional vocalisation from which the adult will have to interpret meaning.

Within the field of special education, a range of sensory based functional assessments have been developed in support of pupils with PMLD (Pagliano, 2012, 2001; Fowler, 2007; Mednick, 2007; Davis, 2001; Aitken and Buultjen, 1992; Longhorn, 1988). However, amongst these only a very small proportion aims to exclusively test smell ability, such as, the 'Learner's Sense of Smell,' (Aitken and Buultjen, 1992) and the 'Smell Units' (Longhorn, 1988). The combined assessment of taste and smell function is more prevalent and can be seen in the work of Pagliano (2012) and Fowler (2007). One of the earliest exclusive attempts at dealing with the assessment of smell within SEN practitioner material derives from the work of Longhorn (1988). She identifies levels of response within which a pupil functioning at very early developmental levels,

such as one with PMLD, can be assessed. For example, Pupil X shows an indifference to smells, responds to smells, rejects smells, discriminates between smells and shows a preference for or chooses smells. Similarly, Aitken and Buultjens (1992) also use levels of response but in terms of stages: awareness, attention, recognition and understanding. Pagliano (2012) offers a progressive range of 'skill level' which he classifies as: awareness, attending, localizing, recognition and understanding. Of note, Pagliano developed his levels of response by adapting the work of Aitken and Buultjen (1992) on functional visual assessment, so as to develop similar stages in taste and smell (2001:47). Aitken and Buultjen (1992) in turn derived their ideas about levels of response from a range of sources that included many special schools, including Beechleaf - working with Laura Pease, my school principal. Longhorn has drawn from her own extensive experience of working with pupils with PMLD.

Table 1 sets out these measures as they are described by the authors. It also includes generic descriptors found in DfE guidance to support teacher assessments of attainment for pupils with PMLD (DfE, 2014). As can be seen from Table 1, there are commonalities in the descriptors given. However, each assessment tool offers its own progressive scale through which smells can be measured and there are some differences in the terminology used. For example, Longhorn (1988) includes words such as "indifference," "rejects" and "discriminates" and Pagliano (2012) refers to the idea of "localising" smells. Arguably, these differences suggest some discrepancies in approaches chosen by the respective authors. It is significant that for some of these authors 'recognition' and 'understanding' are acknowledged as measures of attainment achievable through the use of smell.

Longhorn (1988) Planning smell units	Aitken and Buultjens (1992) The Learner's Sense of Smell	Pagliano (2012) The Exteroception Template – Chemosensation	DfE (2014) P Scale – attainment targets
Indifference to smells	-	-	P1(i) Pupils encounter
-	Awareness	Awareness	P1(ii) Pupils show an emerging awareness
Responds to smells	Attention	Attention /Localising	P2(i) Pupils begin to respond consistently
Discriminates between smells	Recognition	Recognition	-
Shows a preference for smells/rejects smells/chooses smells	Understanding	Understanding	P2(ii) Begin to be proactive in their interactions

Table 1: Levels of response reflected within practitioner-based assessment tools

The questions to be considered include: how do we measure the pupils' responses? How do we know what constitutes a level of awareness, attention, recognition or understanding of smell? How can we be sure our judgements are valid and reliable? These practitioner-based smell tests require the use of qualitative measures. There is the need to base assessments on observable changes in behaviour, e.g. if the pupil turns their head away from a smell it may be deemed to be unpleasant or if they smile when a particular smell was presented it may be perceived as pleasant. There are, however, inherent difficulties in accurately measuring such responses if tests are not carried out with the support of adults who can effectively interpret the pupils' reactions. They necessitate the use of observations made over time by familiar adults such as teachers, parents and carers who can most effectively interpret the pre-verbal and often idiosyncratic responses of pupils such as head movements, changes in facial expression or breathing. As Longhorn (1993:40) states, "much of the assessment will be subjective, as the very special child will communicate in distinctive ways, including pre-verbal communication." Pagliano (2001:35) also reinforces this point in saying:

The assessment of the child with PMLD requires that the assessor is well acquainted with the child. The more disabled the child is, the more likely it is that the assessor will need to use finely developed personal skills of observation rather than simply rely on assessment instruments.

I agree; it is necessary for the assessor to be familiar with the pupil in order to make appropriate judgments about levels of response. However, I would go further in stating that it is also necessary to incorporate the perspectives of others intimately familiar with the pupil in order to reach a consensus of opinion on smell function and perception. This would mean gaining insights from those who know and work most closely with pupils from outside of the educational context, namely their parents or carers. This would offer a more informed view of what the pupil's responses might mean and increase the likelihood that responses are interpreted correctly. Longhorn (1988:98) also refers to the role of the family in supporting assessment in stating that they can be helpful in "providing some information on the child's sense of smell." This has been indicated within this study, as shown in the comments made by parents in later sections.

The presentation of smells is an equally important aspect in the conducting of a smell assessment. The observer needs to be skilful in how they offer smell experiences to the pupils. The responses from pupils will be very individualized and the assessor will need to be tuned into what the pupil is actually perceiving. Sensory based activities can easily become overbearing when an array of stimuli is being presented in quick succession or with too much intensity. Equally, a low concentration of smell will arouse no interest in the pupil. This is a point that Pagliano (2012:20) makes in his discussion about sensory thresholds or "boundaries." He identifies three different thresholds: detection threshold, recognition threshold and differential threshold. He writes that

there is a “point that must be exceeded to produce a given effect or result or response” and that it is important that we are “focusing on a particular individual’s threshold.” It is also important to note that an individual may experience *olfactory fatigue* in that they may have adapted to, and are not responding to, a smell when it is used over a prolonged period of time (NIEHS, 2012). Within the context of this study, this is also an important consideration.

From the range of assessment tools incorporating the functional use of smell there exist a number of discrepancies in terms of the nature of advice given and the level of detail provided in presenting smells. It is only Longhorn (2007, 1993, 1988) and Pagliano (2012, 2001) who offer any suggestions as to how to offer smells to pupils. However, there are differing ideas provided by each author. Pagliano (2012) suggests the use of essential oil on cotton wool or crushing a herb in presenting smells. Longhorn (2007, 1993, 1988) goes further to advise the use of not only cotton wool but also a smell strip, vaporizer and water sprayers. She discusses how to monitor the concentration of odours by providing a recording form where the assessor is required to note the varying positions they have used in presenting smells to pupils. She encourages the use of the strongest smell at the end of a session and for odours to be offered to both nostrils. This in some ways reflects the “Methods of Limits” approach to defining and measuring sensory thresholds (Swets, 1961) - wherein the intensity of a sensory stimulus is increased and decreased. The advice given, most especially by Longhorn, highlights the precision with which it is necessary to consider the effective use of smell stimuli and consequently assessment measures used in practice. It is significant that there are variations in the support material given and that there is no clear universal guidance as to how to present smell experiences accurately. Indeed,

within educational practitioner material there is no coherent or agreed format which the assessor should follow. Herein lies the need to address such a discrepancy and to explore these aspects more precisely.

2.8. Theoretical considerations

Taking everything into consideration the question remains as to the pedagogical implications for the PMLD cohort: how do they need to be taught, what approaches should be advocated and how and in what ways could smell provide a useful tool for learning? The following section looks at the evolution of a range of approaches to teaching and learning for this cohort and considers theories that specific authors have addressed in terms of the use of smell as an aid to learning for pupils with PMLD. It explores the limits to research available on the use of smell and aims to consider what the potential next steps may be in supporting educational practice.

Supporting the learning needs of pupils with PMLD requires not only the consideration of their profound cognitive impairments but also their other multiple disabilities, such as their limited ability to communicate, their physical and sensory impairments, emotional and behavioural difficulties and complex healthcare needs. It is important for the practitioner to focus on how each of these difficulties impacts on the individuals' potential to learn so that the best teaching and learning approaches can be selected.

Teaching approaches have historically not been equipped to provide for the personalised and specialist intervention required to meet and challenge the learning needs of pupils with PMLD. Behaviourist techniques such as operant conditioning have traditionally been integrated into special school settings and used in therapeutic practice. According to operant conditioning, a method of learning attributed to Skinner,

behaviour is suggested to be conditionable through a process of reinforcement. Rewards or positive reinforcers therefore lead to good behaviour and punishment or negative reinforcers eliminate unacceptable behaviour (Gray and MacBlain, 2015). However, this method of learning has arguably been limited in what it can offer pupils with PMLD (Simmons and Watson, 2014). The learning capacity of this cohort has not necessarily matched the higher levels of cognitive function required for them to appropriately and consistently respond within many of these earlier contexts.

Simmons and Watson, (2014) point to some successful claims in using behavioural approaches to improve adaptive functioning, maladaptive behaviours and alternative and augmentative forms of communication (AAC)⁵ such as micro-switch pressing but conclude that the results of early research carried out in the use of behaviourist approaches with PMLD individuals were not reliable. Investigations into operant conditioning to improve postural control and develop adaptive skills were inconclusive. Brown, McLinden and Porter (cited in Lacey and Ouvry, 1998:37) note that “operant methods such as rewarding the learner may be inappropriate given the learner’s profound learning difficulty, and in many cases, additional motor difficulties.” As Simmons and Watson (2014:29) further articulate, “There is one group of people with developmental disabilities for whom the impact is less clear; specifically, the utility of behaviourist intervention for people with PMLD.”

In current special education practice, when there is a recognised need to address the pupils’ individual differences, frameworks for learning have resulted in the use of more

⁵ A communication method used to support language understanding when the learner is nonverbal (Brown, 2015).

personalised and multi-method approaches rather than single strategy solutions (Davis and Florian, 2004; Paul, 1997; Nelson and Cammarata, 1996). Approaches such as Intensive Interaction, the use of Multi-Sensory Environments (MSE), Multi-Sensory Story Telling (MSST) have formed the basis for much professional practice in mainstream and special schools. In support of this, target setting has shifted from the use of objective based SMART targets (Specific, Measurable, Achievable, Realistic and Timed) to a more 'process-centred' approach including the use of SCRUFFY targets (Student led, Creative, Relevant, Unspecified, Fun for Youngsters) (Hewett et al., 2015; Lacey, 2010).

Teaching approaches, for pupils with severe to profound learning disabilities, such as intensive interaction, have tended to favour the social constructivist or developmental-interactionist approach (Davis and Florian, 2004). These frameworks take the view that learning is a personalised process in which the development of knowledge is based upon the individual's own experiences and the quality of interaction with others through active or participatory learning methods. Approaches such as Intensive Interaction have provided a useful tool within which the fundamentals of communication can be gradually built upon in the context of free flowing 1:1 interactive session (Nind and Hewett, 2001, 1994). Intensive Interaction has been widely used amongst professionals and has formed the basis of much professional practice within special school settings today. Developed in the 1980's, by Hewett and Nind, the approach built on the psychological model of 'augmented mothering' – replicating caregiver-infant interaction techniques. The approach involved an adult working one to one with a child, allowing the child to take the lead in a joint activity or interaction, acknowledging and mimicking their behaviours and promoting a sense of mutual

enjoyment, shared attention and meaningful exchanges in communication and interaction. The idea was to support pupils who had severe difficulties “to develop the very beginnings of sociability and communication” (Nind, 1996:48). Nind’s (1996) first study on Intensive Interaction, which included six adults with severe and complex learning difficulties, suggested that the approach helped to reduce levels of ritualistic or self-stimulatory behaviours; improved pre-communication and informal communication abilities and the ability to maintain and initiate social contact.

These positive findings were later mirrored in a number of other studies: Elgie and Maguire (2001), Kellett (2000), Lovell, Jones, and Ephraim (1998). However, the use of intensive interaction has been highlighted as needing further systematic research (Firth, 2006) due to the use of small scale or single case studies without experimental controls and the limited time scale of some of the research studies.

Another key influence to literature developed within the PMLD field has been Jean Piaget and in particular his sensory-motor stage of development. This has provided some explanations for the nature of behaviour in very early stages of development typical of pupils with PMLD (Lacey et al., 2015; Pagliano, 2012; Lacey and Ouvry, 1998). His position, which stated that thought came before language, has provided some of the first tools within which the pre-verbal child’s development could be examined (Gray and MacBlain, 2015; Pound, 2008). Consequently, the curriculum models that emerged from the 1980s and educational material in support of this, were based on this developmental approach.

However, it has been suggested that many of the behaviours displayed by the pupil with special educational needs are not necessarily very different from that of usual

activity in the very early stages of development (Herbert, 2003). Therefore, it is assumed that following through the typical stages of child development and supporting pupils accordingly, serves to appropriately meet the needs of pupils. This idea is flawed. For pupils with PMLD it is necessary to address their profound learning disabilities and multiplicity of other complex needs in an informed way and being able to adapt frameworks for learning to appropriately meet and challenge their learning abilities. In other words, working with pupils who may be physically, visually or hearing impaired will require a different approach from those who do not possess a sensory impairment.

In recent years, learning for pupils with PMLD has, in conjunction with interactive models, recognised the use of a multi-sensory approaches. The idea of a multi-sensory approach is a method of teaching that aims to integrate a range of senses into the pupils' learning experiences (QIA, 2008). It is recognised that utilising more than one sense at a time is a more effective means of supporting learning than using one sense alone (Coffield, 2004). For pupils with PMLD, who experience a range of sensory impairments, it is especially important to consider the use of any residual sensory functioning to ensure they gain as much information about their environment as they can. The work of Grace (2020), Lacey et al., (2015), Pagliano (2012, 2001), Fowler (2007), Longhorn (2007, 2001, 1988), Farrell (2006), McLinden and McCall (2002), Davis (2001), Aitken and Buultjens (1992) and Hulsegge and Ad Verheul (1987) have been instrumental in providing practitioner material within this field. Literature they have produced offers guidance into the use of approaches such as multi-sensory environments (MSE) (Grace, 2020; Pagliano, 2001; Hulsegge and Ad Verheul, 1987) and multi-sensory stories (MSST) (Grace, 2020; Ten Brug et al., 2015, 2013).

Arguably, Hulsegge and Ad Verheul (1988, 1987) were pioneers in the field of multi-sensory learning with their 'Snoezelen' concept, later followed by the idea of 'Multi-Sensory Environments (MSE).' Ironically, when translated from its Dutch origin the word Snoezelen means "sniffing and dozing" (Hulsegge and Ad Verheul, 1987) and has been described as, "the active curiosity of sniffing set against the relaxed state of dozing" (Grace, 2020:26). However, the active use of smell by individuals with PMLD (those described as being severely retarded) within Hulsegge and Verheul's book is arguably dismissed and references to the use and application of smell are limited. Within Hulsegge and Ad Verheul's original book *Snoezelen: Another World (1987)* there is reference to the use of smell trays or cushions and how odours may be used in combination with hot or cold currents of air. However, it does not appear that the premise behind such suggestions is based on any form of theory or acquired knowledge of the functional use of smell for pupils with PMLD or how it may inform, or impact, on learning. The authors even question whether a pupil with severe or profound learning disabilities would be able to actively use their sense of smell. They also admit the difficulties that had been faced in identifying appropriate ways of presenting smells or devising a programme for smell experiences:

The question remains open whether severely retarded people smell actively. In other words, do they really sniff up smells when their nasal organ is stimulated? Probably not. The question of what smells in combination should be offered remains a difficult one. We tried several combinations without finding a system.

Hulsegge and Ad Verheul (1987:95)

The original aim of Snoezelen was to recreate "authentic experiences" that were sensory based, relaxing and nature inspired (Hulsegge and Verheul, 1987:31). It involved the design and use of an indoor environment and was intended to give

individuals, such as those with PMLD, access to and control of a range of multi-sensory resources including specialized high and low-tech equipment. For example, the use of switch activated light and sound effects (Fowler, 2007). The Snoezelen concept was a catalyst for the provision of multi-sensory environments for individuals not only with severe to profound difficulties, but also individuals with autism and other behavioural disorders within schools, nurseries and hospitals (Pagliano, 2012; Fowler, 2008). Although, its original aim was to provide a leisurely activity its use has built momentum and been used within the context of special education. For example, in stimulating the senses, promoting communication, behavioural responses and improving interpersonal relationships between adults and pupils. However, as Pagliano (2001:3) argues, the Snoezelen concept has been concerned primarily with “visual and aural ambience” and the effective integration of smell, as part of a multi-sensory experience, does not appear to have been systematically addressed.

There are also concerns about the over reliance on technology as a tool for learning within multi-sensory environments. Grace (2020:46) writes of the “false belief that the equipment and effects offered by multi-sensory rooms should be valued over simple interactions between persons.” She provides evidence, from her own research, of how training has focussed on the use of equipment rather than on how the adults themselves can help to facilitate an effective multi-sensory learning experience for pupils. Given the small scale of her study - with only 25 people being formally interviewed – she acknowledges the limits to her evidence base (Grace, 2020:110). From my experience within Beechleaf school, I can attest to there being a greater emphasis on providing training on the use of equipment rather than developing the underpinning knowledge and skills of staff to use multi-sensory environments effectively. Arguably, as Hulsegge and Ad Verheul themselves “did not systematically

evaluate the responses of the children and adults using the Hartenberg snoezelen suite” (Mount and Cavet, 1995:53) there is little in the way of robust research evidence to orientate the educational practitioner. Mount and Cavet (1995:52) highlight a “paucity of relevant, rigorous research and the lack of focus on educational benefits” of multi-sensory environments. It has been noted that methodological issues, for example, “weak control conditions, limited number of sessions and use of qualitative/descriptive data have considerably reduced the overall strength/impact and generality of findings” (Lancioni et al., 2009:182). Nevertheless, and acknowledging these limitations, there are promising provisional findings from research: the uninterrupted nature of the rooms, ability to focus pupils’ attention and have a blacked-out space (Grace, 2020); an increase in the number of meaningful responses (Lancioni et al., 2009); and improvements in engagement, concentration and reduced behaviour (Hogg et al., 2001).

Following on from Hulsegge and Ad Verheul’s initial practitioner-based insights, we find Flo Longhorn’s work to have been a major influence on sensory based pedagogy. She has produced a number of works throughout the past 30 years in support of multi-sensory learning and provided one of the only instruction manuals with specific references and guidance into the use and application of smell. In her book *A Sensory Curriculum for Very Special People (1988)* she provides the basis of a curriculum for each sense including guidance on assessment, target setting and practical teaching strategies. She incorporates the idea of a smell bank to complement her smell curriculum identifying the need for a specific area in the classroom where a range of smells linked to environment, a person or an experience can be stored. She suggests methods for presenting smells, for example, on smelling strips or cotton wool and how the senses of smell and taste combine to play a fundamental role in the development

of eating and drinking skills. A key feature of her approach is the idea of integrating smell experiences into every aspect of the learning process. An example of this is her suggestion that pupils should engage with the smell of soap before washing hands and the smell of clay when in the art room. The idea is that the integration of smell into every aspect of learning supports the multi-sensory experiences of pupils. This work remains the most comprehensive contribution to the use of smell for pupils with SEN.

Another key approach in working with pupils with PMLD has been the idea of Multi-Sensory Story Telling (MSST) better known as Sensory stories (Grace, 2020). MSST is a story telling method developed for people with profound and multiples disabilities (Ten Brug et al., 2015; Lambe and Hogg, 2011;). Its purpose is to adapt fictional and non-fictional stories to include "music, textures, smells, tastes and visual images" (Grove et al., 2015: 307) with an emphasis on the value of sensory experience and the context storytelling provides for social interaction for pupils with PMLD (Young et al., 2011). MSST allows for personalization, the use of a sensory medium tailored to the pupil's sensory capabilities and the repetition of phrases or text to reinforce learning (Ten Brug et al., 2013). Research into the use of MSST has suggested increased levels of alertness and attention (Ten Brug et al., 2015) and engagement in pupils with PMLD (Young et al., 2011). MSST has also been noted to be successful across a range of ability (Grove et al., 2015). Ten Brug et al., (2015) have highlighted that studies on MSST have typically only examined overall levels of alertness during MSST. Therefore, in their 2015 study they focused on changes in alertness over time by comparing four different storytelling sessions with 27 direct support people reading an MSST book 20 times – the 1st, 5th, 10th and 20th storytelling sessions being recorded. Higher levels of active alertness were observed when sensory stimuli were actively presented. It was concluded that storytellers should present stimuli actively

and for longer periods, in order to increase the alertness of listeners during storytelling. It was also noted that storytellers should be aware of the relationship between their storytelling behaviour and the alertness of their listeners. The results of this study highlight important factors when attempting to engage pupils with PMLD in MSST: firstly, the need to actively use sensory stimuli throughout a story telling session. Given my experience of delivering MSST sessions to pupils with PMLD for over 18 years, I would agree that it is vital to not fall back into 'just telling the story.' Words need to have meaning for pupils and this requires the use of interesting and motivating sensory experiences to bring the story to life. Secondly, Ten Brug et al., (2015) make the point that the length of time sensory materials are presented for has to be carefully considered. Pupils need varying amounts of time to process the sensory experiences and the supporting adult must be skillful in knowing the length of time required. Thirdly, the adult needs to be mindful of how effective they are in presenting sensory materials to pupils. There is no point in dangling a shiny piece of tinsel at a pupil who has limited vision. It is recognised that there is an ongoing need to increase knowledge about the individuals' abilities and preferences in order to attune support to the needs and wishes of the individual (Ten Brug et al., 2013). With regard to the use of smell, it is important that the supporting adult uses a responsive approach, being aware of and sensitive to the pupil's needs and preferences, in how they present stimuli as part of this multi-sensory learning experience.

The work of Pagliano (2012, 2001) has featured predominantly in the field of multi-sensory learning. His authorship has included a number of texts detailing the practical use of multi-sensory rooms and environments (MSE). He has also produced *The Multi-Sensory Handbook (2012)* which offers a range of multi-sensory assessment tools and

intervention strategies with an overview of research and theory into the field of sensory learning. With reference to smell, Pagliano provides one of the most contemporary literature bases to the theory behind and practical application of this sense. Although specific sections with reference to smell are brief, he shows the beginnings of an exploration into the physiology of smell, considerations in designing an olfactory space within the educational context and provides a chemosensation assessment tool within which smell and taste can be explored. Within his assessment framework, he identifies levels of response to smell in terms of awareness, attention, localisation, recognition and understanding. He also presents the idea of sensory thresholds or boundaries, as mentioned earlier, wherein an individual's ability to detect, recognise or differentiate between sensory experiences can be defined. These theoretical propositions provide a useful lens through which responses to smell can be viewed. They put forward the idea that smell can perform a function beyond simple levels of awareness or attention. Pagliano (2012:16) asserts that the sense of smell can signal "the familiar: people, places and objects" and "therefore, play an important role in the development of memory." However, he does not provide research evidence to support these assertions. Nevertheless, as highlighted earlier, a few authors such as Pagliano have extensive professional experience, and offer valuable insights to practitioners working within the field.

Equally, Joanne Grace (2018) offers a discrete section about smell or the olfactory sense in her recent book *Sensory-Being for Sensory Beings: Creating entrancing sensory experiences*. She considers the value of smell, explores how the olfactory experiences we have access to in early life can be used to support learning and describes the physical process of smelling alongside providing "take-away tips" to use

in supporting teaching and learning for pupils with PMLD. She emphasises the role that smell can play in nurturing our emotional wellbeing and memory function.

2.9. Summary

In summary, the above literature search has highlighted the difficulties faced by pupils with PMLD. Profound learning disabilities alongside other multiple needs are compounding factors which limit the pupils' ability to engage with the world around them. They are arguably the most vulnerable group of pupils within the educational system. There is agreement that pupils with PMLD need access to personalised and specialist approaches to learning. However, the history of approaches to teaching and learning have not necessarily dealt with the distinctive needs of this pupil group. Approaches such as intensive interaction, multi-sensory learning and MSST have been instrumental in supporting the needs of pupils who function at these very early stages of development and assessment tools have been devised to work alongside these developmental and process-centred approaches. However, the sense of smell has not necessarily featured greatly within educational texts; it has simply been losing out to the other senses.

The aim of this study has not been to negate the importance of using a multi-sensory approach; rather it is to look into how the use of smell may support and encourage further learning amongst pupils with PMLD within a multi-sensory environment. One aim of my study is to build on the provisional insights and claims offered by such writers as Longhorn and Pagliano. By means of my analysis and interrogation of pupil responses, I propose to explore and assess their suggestions and hypotheses – including, for example, the view that the sense of smell can help to support memory function.

Chapter Three - Methodology

3.1. Introduction

Given that the aim of this study was to explore the role of the sense of smell in enriching the learning experiences of pupils with PMLD, it was necessary to identify a methodology suited to the profile and knowledge base relating to this distinctive cohort. The literature review highlighted a lack of research and pedagogical guidance regarding the impact that smell can have on the learning experiences of these pupils. It also highlighted that they are amongst the most vulnerable cohort within the education system owing to their profound impairments and communication difficulties; these concerns have underpinned my chosen methodological approach. This chapter outlines my philosophical perspective, methodology and methods, research study design, case selection and analytical strategy. It addresses issues relating to my position as an insider researcher and other ethical considerations relating to this study.

3.2. A philosophical perspective

This study aimed to explore the responses of pupils with PMLD in relation to smell. However, as mentioned earlier, this cohort is known to have only a limited capacity to express themselves and experience great difficulty in communicating their needs, thoughts and wishes. This creates a situation within which it is difficult to ascertain the pupils' interpretations of their world. Owing to the need to interpret and represent the pupils' views, it has been necessary to consider the perspectives of others known to them and who have worked most closely with the pupils themselves. Consequently, the ways in which knowledge has been acquired has relied on a collective of subjective opinion from the adult participants involved, together with my own perspectives as the

main researcher. In light of this, the epistemological position I took for this study was subjectivist, in that meaning was “generated from the consciousness of human beings” (Simmons and Watson, 2014:113). It followed that the theoretical underpinnings of this study include resources from the traditions of social constructivism and interpretivism which take the world view that:

Reality is socially constructed; that is, there is no single, observable reality. Rather there are multiple realities, or interpretations, of a single event. Researchers do not find knowledge; they construct it.

(Merriam and Tisdell, 2016:9)

The subjects of social constructivism, subjectivism and epistemology generally are, of course, large and complex. All I can do here is to indicate a general orientation, which, I believe is suited to the nature of the research I wish to undertake.

3.3. Methodological approach

The specific characteristics of this exceptional cohort of pupils with PMLD presented research challenges that were simultaneously ethical as well as methodological. I will discuss the ethical issues in detail later but firstly, the reasoning behind my chosen methodological approach.

In order to explore the pupils’ responses to smell within the learning environment, I adopted a qualitative, interpretivist methodology. There were three main reasons why I felt this was a suitable approach. Firstly, the use of qualitative methodology, and the associated methods, are well suited to my aim of achieving a detailed and in depth

understanding of individuals' lives and depicting the real-life experiences of the pupils within my study (Lacey et al., 2015; Simmons, 2011; Nind et al., 2008; Grove et al., 1999) that would support a better understanding of the pupils' responses to smell.

Secondly, a qualitative approach is recognized as allowing for the research to be conducted within a natural setting. In the case of this study this offered a more suitable environment within which the pupils' responses could be interpreted (Grove et al., 1999). It would be important that the pupils involved in this study felt at ease throughout the research process. It was also imperative that they were not subjected to experiments or testing or the use of sterile and/or unfamiliar environments which may have the potential to affect their responses and cause unnecessary anxiety or stress.

Thirdly, it has been suggested that for those individuals who have difficulties with communication, as would be the case for pupils with PMLD, an approach that allowed for the use of multiple perspectives would assist in offering a more informed view of real-life events (Nind et al., 2008). My primary concern was being able to interpret meaning from the pupils' responses. Given the profound nature of the pupils' communication difficulties, I needed to adopt a methodological approach that allowed for their communicative attempts to be recognised. The use of a qualitative perspective, with its philosophical underpinnings rooted in knowledge being socially constructed, meant that evidence gathered formed a collective of subjective opinion or perception. It was based on the understanding that what was actually happening within the classroom environment could be best represented by the perspectives of those significant others.

3.4. Case study strategy

Within this research study, my primary aim was to generate in-depth empirical data on the pupils' responses to smell in order to answer my research question. It was not concerned with making generalisations in relation to the wider pupil population but to build a deeper understanding of the function of this sense and its potential for use in the context of learning in the specific setting. This meant that the nature of my study focussed on the specific or 'the particular rather than the general' (Thomas, 2011:3).

Case study research, ethnography, participatory research and action research are all approaches that reside within the qualitative paradigm and deal with specific situations or problems within a social context (McNiff and Whitehead, 2009; Cohen et al., 2007; Mertens and McLaughlin, 2004; Robson, 2002). They each perform a specific function which sets them apart from each other: Case study research is concerned with the study of a unique case or cases within their natural setting, using multiple sources of evidence and engaging in in-depth data collection to answer 'how and why' questions (Candappa, 2017); ethnography possesses some similar characteristics but involves the study of individuals or cultures over an extended period of time in order to understand and describe those individuals or culture (O'Connell, 2017), participatory research and action research have a focus on participation, action and reflection and seek to improve or reform practice (Cohen et al., 2007).

Unlike ethnographic research, this study did not aim to describe or interpret a particular culture nor did it require the immersion of the researcher in that social group over an extensive period of time (Robson, 2002:89). It was an investigation into a particular phenomenon over a shorter period sufficient to gather enough evidence to make an

informed decision about the nature of the pupils' responses. Unlike participatory and action research, the primary focus was to gain a greater understanding of the pupils' situation, rather than primarily aiming to instigate change as part of the research process. Its focus was not on 'transforming inquiry into praxis or action' (Denzin and Lincoln, 2011:21) but to carry out a detailed exploration of the situation itself.

Research within the PMLD and learning disability field has reflected the use of a number of these and other qualitative approaches, for example, interpretivist-participatory research (Simmons, 2011; Nind et al., 2008) case study research (Murdoch et al., 2014; Nind, Flewitt and Paylor, 2010), ethnography and narrative research (Nind et al., 2008) and qualitative phenomenology (Simmons, 2011).

Of particular relevance to this study is the work of Murdoch et al., (2014), previously discussed in my literature review. This case study offered interesting insights in terms of its findings and methodological approach: the positive outcomes of Murdoch's work typified how a case study strategy allowed for the consideration of the complex and diverse characteristics of the deafblind cohort (Murdoch et al., 2014: 264). The use of a range of methods including semi-structured interviews with the students' keyworkers and other staff, direct and video-recorded observations of students' choice making, and written diary records of students' food choices and responses all lent themselves to a holistic, informed and in-depth investigation of the students' situation.

Similarly, I needed a flexible approach that allowed for a closer inspection of my pupils' responses to smell, taking into consideration the exceptional characteristics of my PMLD cohort; a study that was able to use multiple sources of evidence to inform what

was happening within the classroom context and use multiple perspectives to interpret meaning from the pupils' responses. I therefore adopted a case study approach but, unlike the work of Murdoch, this study needed to go further in terms of interpreting the pupils' responses owing to the profound nature of their cognitive and communicative difficulties. It had to pay greater attention to the pupils' experience of smell; how smell was being presented, considering what factors might be influencing the pupils' responses, how their reactions were being interpreted by significant others and how the use of smell provided a support to learning.

Case studies are known to take many forms. Candappa (2017:174) posits that the term case study is "used in a variety of circumstances and contexts with different meanings." Within social science, authors such as Stake (1995:3) have identified three main types of case studies by interest, as "intrinsic, instrumental or collective studies." Intrinsic case studies are guided by a specific interest in the particular case itself, for example, the individual, group or organisation. When a case study is used to understand something else it is deemed to be instrumental. When it is a collective case study it involves more than one case, or an instrumental study extended to several cases (1995:3). This piece of research sits most closely with what Stake (1995) would describe as an instrumental case study as it seeks to facilitate an understanding of a wider phenomenon, i.e. the impact of smell on learning. Or as Nelson and Martin (2013:14) describe, its, "primary research objective is to use the case to understand more about a particular problem or issue...it is interesting not just for its own sake but for the light it sheds on a wider issue." This study was also a collective or multiple case study as it extends to a number of cases using a selection of pupils as a basis to understanding the use of smell.

Other authors have used different ways of categorising case studies: Grosvenor and Rose (2001:70) distinguish case studies in respect of their capacity to be “theory-testing or theory-seeking”, “story-telling or picture-drawing” or “evaluative” in nature; Yin (2014:238) has identified the use of case studies in terms of being “exploratory, descriptive or explanatory case studies.” This study was not a theory-testing case study, since it did not adopt a hypothesis for testing during the course of the research; rather it was largely taken up with the interpretations of pupil responses within the research process itself in order to answer the research question. The study was inductive and grounded in generating empirical knowledge about what pupils might actually perceive. This was also very different from attempting an evaluative study in which established systems or events would need to be measured and compared. It was not storytelling or picture-drawing as it did not simply attempt to describe the pupils’ responses but sought to understand the function of smell in their learning. As my primary research objective was to understand more about the impact of smell this meant that the study was exploratory since it aimed to get a better understanding of a situation where little established knowledge existed (Yin, 2014).

Case studies have perceived strengths and weaknesses in respect of their ability to lay claims to knowledge. Key strengths associated with case study research include the ability to: retain a holistic and real-world perspective (Yin, 2014); offer a rich or thick description of the phenomenon under study (Candappa, 2017; Thomas, 2011); identify unique features that may be lost in larger scale data and embrace unanticipated events (Thomas, 2011; Cohen et al., 2007); and contribute to the generation of new knowledge (Candappa, 2017; Yin, 2014).

My aim was to capture the 'reality' of the classroom situation, because I felt this would offer the most effective insight into the pupils' actual responses to learning experiences through smell. As mentioned earlier, it meant that the pupils were not subject to any experiment or situation that was unfamiliar to them or had the potential to cause distress. By using a case study approach, there was the ability to use multiple sources of evidence and multiple perspectives. For example, observations and interviews with significant others, complementing one another, in order to gain an in-depth and information rich understanding of each case in context (Candappa, 2017). A record of any minute changes in the pupils' behaviour or any unanticipated changes to their situation could also be explored which meant that there was the opportunity to examine the unique features of each case thoroughly and in detail which would support the generation of empirical knowledge.

One of the perceived key limitations associated with case studies has been the inability to make formal generalizations to a wider population (Stake, 1995). Consequently, it would not be possible to use any observations made of a single case within my study to form a general statement about other cases within the PMLD population. However, authors such as Yin (2014), Flyvbjerg (2006) and Stake (1995) contend that a single case can contribute to the development of scientific knowledge and propose alternative forms of generalisation. What Yin (2014:40) defines as 'analytic generalisation' is the 'opportunity to shed empirical light about theoretical concepts or principles,' which sets aside the traditional meaning of generalisation which he refers to as 'statistical generalisation'. Stake (1995: pp.85-88) advocates a form of 'naturalistic generalisation' wherein the researcher can learn from single cases and come to conclusions based on personal engagement or experience. In respect of this study, wherein there was a small sample of cases comprising pupils with complex and

diverse needs, there would be no expectation of reaching any formal or statistical generalisations. It is the case that generalisations may appear within each of the cases from the recurrence of certain behaviours or consistencies in the responses of pupils. This would fit most closely with what Stake (1995) would describe as naturalistic generalisation.

3.5. Overview of the fieldwork process

Date	Aim	Method	Reliability/ validity
Spring 2014	To develop an awareness of existing teaching and learning practice in relation to smell	Sourcing, collating and analysing educational documents on the 7 selected case study pupils: <ul style="list-style-type: none"> the pupils' educational statements Multidisciplinary reports Termly reports Other teacher planning and assessment material 	Triangulation of information within documents
	To develop an awareness of the nature of the seven case study pupils' responses	Conducting informal observations of the 7 case study pupils within the classroom context	Same observation schedule/protocol for each pupil when conducting informal observations
Summer 2014	To gather insights into the role and value of smell in supporting learning as perceived by adult participants	Piloting interview questions with a sample of the adult participants	Triangulation of data from interviewing
	To develop an understanding of the nature of the case study pupils' responses to smell as perceived by the adult participants	Carrying out interviews with the 7 parents and 5 teachers of the case study pupils and with 2 senior leaders and 1 therapist (n=15 interviews)	Each participant group, e.g. teachers and parents/senior leaders and therapist received the same interview questions
	To use a series of observations of the seven case study pupils to ascertain their responses to smell	Developing an observation schedule for the video-recording of observations of the 7 case study pupils	Same observation schedule/measures for each pupil
	To develop an understanding of teaching and learning strategies used in practice	Delivering of a series of video-recorded observations of the 7 case study pupils across a range of subject areas within a eight week period (n=92 videos)	
	To analyse the video recorded observations of pupils to ascertain their perceptions of pupil responses as perceived by adult participants	Individual parent, teacher and therapist interviews with the viewing of video-recorded observations (n= 13 discussion meetings)	Member checking/ triangulation
Spring 2015 -	To examine the impact of smell on the learning experiences of pupils	Qualitative data analysis/evaluation of entire study	Triangulation
	To devise ways forward in developing teaching material to support learning through smell		

Table 2: Overview of the fieldwork process.

The design of the study consisted of four stages. During the initial stage of the research process (Spring Term, 2014) I gathered background information on the seven case study pupils. I sourced, collated and analysed information from educational and healthcare documents including the pupils' educational statements and annual reports. My intention *inter alia* was to extract any observations on the pupils' use of smell and also to begin to develop an awareness of how learning was supported through the use of this sense.

I also conducted unstructured observations of the pupils within their classrooms over a two-week period (Spring Term 2014), in order to develop my familiarity with their responses and behaviours. These observations were aimed at developing a sense of how the pupil communicated, how their impairments seemed to impact on their abilities to learn and how they explored and interacted with their environment (Notes on initial observations, See Appendix 9).

Following this, I piloted questions and interviewed the full range of adult participants who had consented to being involved in the study (Summer Term, 2014). These interviews were conducted on an individual basis and included the teachers and parents of each pupil and three other teaching professionals within the school: the Executive Deputy Head teacher, Head of School (senior leaders) and school therapist. The aim was to gather background information, as perceived by these adult participants, on the role and value of smell in supporting learning, their knowledge of the pupils' responses to smell, preferences and any incidental information or insights relating to smell that may have a bearing on the study (See Appendix 3).

The pupils were then involved in a series of video-recorded observations – 92 in total - over an eight-week period (Summer Term, 2014). These were recordings of the pupils' reactions to smell within sensory based activities that were already part of their weekly routine, for example, in massage and relaxation sessions, at mealtimes or during sensory story sessions (See observation schedule). The intention was to examine these observations based on the input of the parents, teachers and school therapist and to analyse the nature of pupil responses and the impact on learning (See Appendix 10).

3.6. Case selection

My aim was to focus in-depth on a small number of information-rich cases, selected to address the research questions under study. This case selection was what Flyvbjerg (2006:230) would describe as an 'information-oriented selection' as it aimed to "maximise the utility of information from small samples and single cases."

In order to achieve an 'information-orientated selection' I drew on Patton's 'maximum variation sampling strategy' to select a diverse range of pupils. Maximum Variation sampling involves "purposefully picking a wide range of cases to get variation on dimensions of interest" (Patton, 2015:267). It is also what Merriam and Tisdell (2016:257) describe as allowing "for the possibility of a greater range of application by readers or consumers of the research." This form of sampling strategy fitted with the intentions of this study because my aim was to use a selection of cases which reflected a range of complex needs within the PMLD population of the school.

The number of individual cases selected for this study began with a notional sample size of ten pupils. This allowed for a wide range of complex needs, for example, pupils with a combination of visual, hearing and physical impairments coupled with complex

medical and behavioural needs. However, the final pupil sample was dependent primarily on parental consent and the availability of pupils during the research period itself. Some parents were concerned about their child being video-recorded, how information would be used and with whom it would be shared and chose not to participate in the study. A number of pupils I was originally interested in involving in the research were unwell or due for an operation during the research period which meant they were not available when the study was taking place.

The final sample, of seven case study pupils, still offered a range of pupils satisfactory to the needs of the study and reflected a range of disability associated with this cohort although it was not representative, nor did it intend to be representative, of the wider PMLD population.

I now provide brief pen portraits of the seven case study pupils anonymised as Zara, Andrew, Maria, Mohammed, Matthew, Saeeda and Patrick. All seven of the pupils were known to me as I had been Mohammed and Matthew's class teacher for four years and Andrew, Maria, Saeeda and Patrick's teacher for two years. Zara, I had known from facilitating expressive arts events and whole school assemblies but had not taught exclusively. Here I provide background information has been taken from the pupils' statements of special educational needs (SEN), information from the teachers and parents at interview (I) and my initial observations (OBS). This is followed by a summary of their needs illustrated in Tables Two and Three.

Zara

Zara was six years old at the beginning of the research period, she had a genetic condition known as Cockayne Syndrome which had resulted in difficulties such as premature ageing, loss of motor skills and deterioration in cognitive skills. She also

had a bilateral hearing loss, visual impairment, developmental delay, eczema and joint contracture (scoliosis) (SSEN). Her hearing loss meant that she wore hearing aids, but would only tolerate them for 20 minutes at a time. Her visual difficulties meant that she wore glasses all the time (SSEN and OBS). Zara was dependent on adults for all her self-care needs (OBS). She could feed herself small amounts of food provided from home but feeding was a significant issue for her. She received most of her nutrition via a gastrostomy tube (OBS). Zara was a pre-verbal communicator and expressed herself through a range of vocalisations. She indicated pleasure through a high-pitched call and a smile or laugh and discomfort through a low-pitched cry and would frown. She sometimes used her own form of sign language to communicate her needs but this was quite idiosyncratic in nature (OBS and I). Zara was able to sit on a sofa but needed support to remain upright, otherwise she would hunch over and slide to the side. With support, she could take a few steps but her legs were stiff and movements were slow. Zara could use her hands to manipulate objects but her hand control was poor and she found it hard to manage smaller objects (SSEN and OBS). There was no record of her functional use of smell within her educational statement but it was noted that it would be beneficial for her to have access to a range of sensory based approaches to learning (SSEN).

Andrew

Andrew was also six years old at the beginning of the research period and had a diagnosis of a severe cortical visual impairment with poor visual responses, profound developmental delay, hypotonia, and epilepsy (SSEN). He was dependent on adults for all of his daily care needs (OBS and I). Andrew had a severe physical disability. He found it difficult to sit up unaided and needed to be supported at all times. He could

occasionally raise his head a little from a lying position but had difficulty co-ordinating his movements (SSEN). Due to his severe visual impairment he had problems fixating on faces. Andrew showed a visual awareness of large objects, he appeared to locate and follow bright objects if they were slowly moved to his left. Generally, he appeared to respond more when objects were presented to his right side (OBS and I). He had oral pharyngeal dysphagia (swallowing difficulties) and delayed oral skills and was at risk of aspirating on normal fluids into his lungs. Therefore, he ate a range of soft or pureed foods which were fed to him with a spoon; he had thickened drinks (I). Andrew did not use words to communicate but would vocalise when he was content and happy. He used a range of babble sounds, for example, “aa” or “baa” at such times. He would smile when he was happy and frown when he was sad (OBS). There was no record of his responses to smell within his educational statement. However, it was noted in his statement that he should have access to a multi-sensory curriculum (SSEN).

Maria

Maria was a sociable and engaging seven-year-old girl who had cerebral palsy-spastic quadriplegia and global developmental delay with associated speech and language difficulties. She also suffered from epileptic seizures which were controlled with medication. She had dysphagia needs and was at risk of choking on solid foods (SSEN). Therefore, she required food items of a soft consistency and fluids to be thickened to a syrup like consistency. She was also dependent on adults for all her daily self-care needs (OBS and I). Maria’s physical development was significantly delayed (SSEN). Like Zara and Andrew, she was unable to sit upright without the support of an adult and had access to specialist seating. She could hold her head up and was able to turn to look around particularly when she was lying on her front. She

also had delayed fine motor skills. Maria could make a fist with her hands but had difficulty grasping and holding objects. There were no reported concerns regarding her vision or hearing (SSEN) however this was under investigation at the time of this study (I). Maria communicated through a range of vocalisations and occasionally demonstrated self-harming behaviours. She smiled and laughed when happy and would cry, frown, turn away or bite her hands if upset. There was no record of her functional use of smell within her educational statement (SSEN).

Mohammed

Mohammed was a ten-year-old boy, who had been diagnosed with quadriplegic cerebral palsy, microcephaly and epilepsy. He also had a severe visual impairment and a significant global developmental delay (SSEN). Mohammed was totally dependent on adult support for his care needs (OBS).

Mohammed's epilepsy was being controlled by medication and he received nutrition through a gastrostomy tube (OBS). Mohammed had severely delayed motor skills and required specialist equipment to help him maintain an upright position. He had stiff muscles in all four limbs and experienced severe spasms that pulled his body into a curled up or extended position. He showed some response to visual stimulation which mainly took the form of a sensitivity to light and dark (OBS). There were no reported concerns regarding his hearing (OBS and I). Mohammed communicated through smiles, vocalisations and head movement. He used different sounds when he was happy and sad. His ability to understand language was very limited. It had been noted that he recognised his family's voices or the sound of a familiar people speaking to him and would become still, listen and turn his head towards them (OBS and I). There was no record of his functional use of smell within his educational statement (SSEN).

Matthew

Matthew was a ten-year-old boy at the beginning of the research period, experiencing spastic quadriplegia, epilepsy and a severe visual impairment. He had complex medical needs and received nutrition through a gastrostomy tube (SSEN). He was completely dependent on adults to meet his daily care needs (OBS). He required specialist equipment to enable him to sit or stand, and maintain a correctly aligned position. He found active movement very difficult (SSEN). Matthew could make some noises and sounds to communicate. He had happy sounds for when he was content and cried or screamed to indicate distress (OBS and I). Matthew had a severe visual impairment, showing a sensitivity to light and dark; he could not distinguish shapes or faces (SSEN). There was no record of his responses to smell within his educational statement (SSEN).

Saeeda

Saeeda was a nineteen-year-old girl with profound and multiple learning disabilities. She had a severe visual impairment (SSEN) which meant that she found it difficult to move around confidently and explore her immediate environment. At the time of this research, Saeeda was developing the ability to sit and stand independently (OBS). She also had profound communication difficulties and epilepsy. There were no concerns with her hearing (SSEN). Saeeda needed 1:1 support with all of her personal care needs (OBS). Saeeda was generally interested in speech and would listen attentively if spoken to by a familiar person. She had some situational understanding and would respond to simple verbal directions when accompanied by a physical cue or body sign. She expressed her preferences in activities and enjoyment of adult interaction through smiles, vocalisations, whole body rocking actions and echolalia

(repetition of speech) (OBS). There were no concerns with her ability to eat and drink, she ate well, mostly consuming soft foods and seemed to favour savoury tastes at snack times. There was no record of her functional use of smell within her educational statement (SSEN).

Patrick

Patrick was a nineteen-year-old young man with a history of complex medical difficulties. These included hydrocephalus (shunt inserted), microcephaly, spastic quadriplegia, a severe visual impairment and associated learning disabilities (SSEN). Patrick's visual, gross and fine motor difficulties had affected his play skills. However, he was keen to explore objects through touch particularly if he could get an auditory response such as a loud noise or crashing sound. Patrick was able to hold objects in his right hand and transfer objects from left to right. Patrick's arms were less affected than his legs and he had more control with his right arm (OBS). He required specialist equipment to support his sitting and standing. The tightening or muscle shortening in his lower body impeded his ability to move, stand and sit (SSEN). Patrick's medical difficulties had affected his eating and drinking skills. He used a gastronomy tube in order to meet his nutritional needs (SSEN). Patrick was dependent on adults for all his daily care needs (OBS). Patrick communicated predominantly through pre-verbal means. He expressed discontent and discomfort through crying, vocalising and hitting himself or pulling at his face. He would vocalise and smile or become still if he found something pleasurable. Patrick requested simple activities or objects by reaching out and would also reject something by pushing it away or discarding it (OBS). There were no concerns regarding his hearing (SSEN). There was no record of his responses to smell within his educational statement (SSEN).

Summary of pupils' needs

Table 3 provides a summary of the pupils' multiple impairments and complex needs (sourced from their statements of SEN) and Figure 3 shows the frequency of impairments experienced by the case study pupils.

Pupil names	Zara	Andrew	Maria	Mohammed	Matthew	Saeeda	Patrick
Age range	Primary	Primary	Primary	Secondary	Secondary	Post 16	Post 16
Communication	Vocalisation Some sign language	Vocalisation Facial expression	Vocalisation Facial expression	Vocalisation Facial expression	Vocalisation Facial expression	Some words Facial expression Direct action	Vocalisation Facial expression Direct action
Behavioural difficulties	Self-harming behaviour	n/a	Self-harming behaviour	n/a	n/a	Self-harming behaviour	Self-harming behaviour
Visual impairment	Visually impaired	Severe visual impairment	None stated	Severe visual impairment	Severe visual impairment	Severe visual impairment	Visually impaired
Hearing impairment	Bilateral hearing loss	None stated	None stated	None stated	None stated	None stated	None stated
Physical impairment	Scoliosis	Hypotonia	Cerebral palsy-spastic quadriplegia	Quadriplegic cerebral palsy	Cerebral palsy-severe Spastic quadriplegia	None stated	Cerebral palsy-spastic quadriplegia
Other medical needs	Cockayne Syndrome Eczema Gastronomy tube fed	Epilepsy	Epilepsy Gastronomy tube fed	Epilepsy Gastronomy tube fed	Epilepsy Gastronomy tube fed	Epilepsy	Hydrocephalus microcephaly Gastronomy tube fed

Table 3: Summary of pupils' needs.

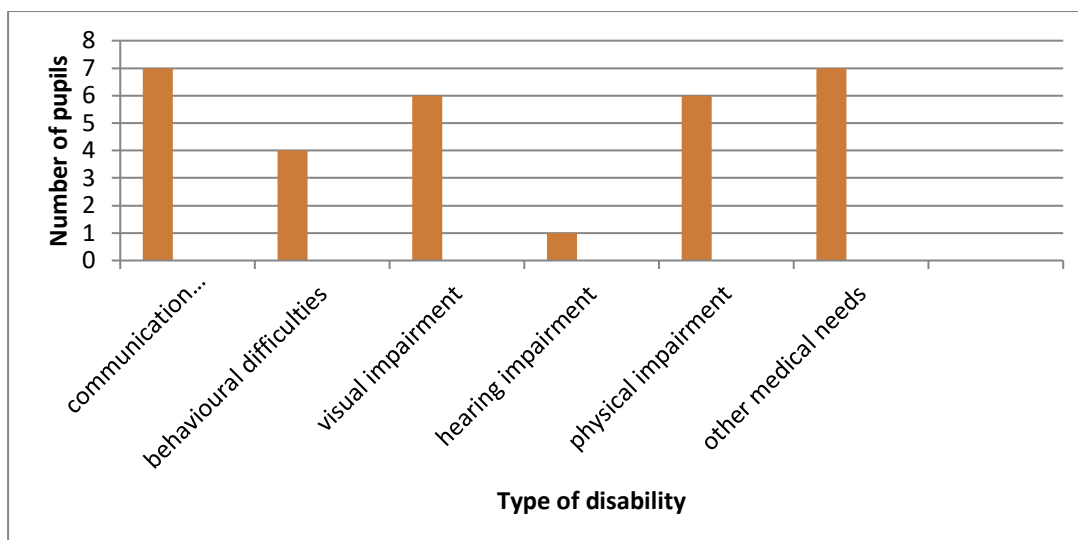


Figure 3: Frequency of impairments among the case study pupils.

3.7. Methods of investigation

There have been a range of qualitative methods used within PMLD research, for example, direct, participatory and non-participatory observations (McDermott, 2014; Murdoch et al., 2014; Simmons, 2011; Nind, Flewitt and Paylor, 2010; Nind and Hewett, 1994), semi-structured interviews (Murdoch et al., 2014; Simmons, 2011; Mencap, 2010), written diary records, parent diaries and field notes (Murdoch et al., 2014; Nind, Flewitt and Paylor, 2010) and questionnaires and surveys (McDermott, 2014; Mencap, 2010; Nind et al., 2008). Case studies within the field, though sparse, have tended to reflect the use of a smaller range of methods, mainly direct, participatory and non-participatory observations (Arnold, 2014; Murdoch et al., 2014; Simmons, 2011), semi-structured interviews and focus groups (Murdoch et al., 2014; Simmons, 2011) and field notes (Murdoch et al., 2014).

Decisions with regard to the relevance of each of these methods have been based on a range of factors: the pre-verbal nature of pupils and need to interpret meaning from

their responses (Murdoch et al., 2014), the aim of gathering information on real-life events (Nind et al., 2008) and of understanding the individual or situation (Murdoch et al., 2014; Simmons, 2011). For this study, I have used documentary evidence such as the pupils' annual reports and statements of SEN; two types of observations, one unstructured and recorded in fieldnotes, and the other structured and video-recorded and also audio-recorded semi-structured and unstructured interviews. A summary of methods chosen can be viewed below.

	Documentary evidence	Unstructured observations with field notes	Audio-recorded, semi-structured interviews	Video-recorded, structured observations	Audio-recorded, unstructured interviews
No. of adult participants	Researcher only	Researcher only	15 all adult participants interviewed	2 number of teachers who video-recorded	13 teachers, parents and school therapist
No. of times used	Each of the 7 pupils' educational statements used	14 two of each pupil within a two-week period	15 one interview per adult participant	92 video-recordings made	13 one interview per adult participant
Dates	Spring 2014	Spring 2014	Summer 2014	Summer 2014	Summer 2014
Duration	/	Average 30 mins	Average 45 mins	Average one min	Up to two hours

Table 4: Summary of Methods.

I will now discuss each of my chosen methods in detail, explaining the rationale behind my decision to use them.

Documents

My intention was to use a number of professional documents, for example, the pupils' statements of SEN, speech and language therapy and paediatric reports and the pupils' annual reports, as a starting point in gathering information about the individual

pupil's needs, their smell abilities and responses. I also felt that this documentation would be a useful referent throughout the research process and one which I could draw upon to validate any observations made or interview comments given by the adult participants. Vulliamy and Webb (1992:58) highlight the dual role documents can provide in being "a background of information" and in adding "credence to data collected by interview, observation, and diary recording." Robson (2002:349) also emphasises the value that documents have in being a source of information that is "unobtrusive and non-reactive." This is to say that, unlike an interview or questionnaire, the information given would not have been written with the intention of being used as research evidence and thus had greater potential not to be influenced by the research. In relation to this study, the use of such documents would offer an insight into classroom practice and the responses of pupils as perceived by the teacher prior to the research period. However, on inspection, the only documentation that seemed to offer any insights into smell related observations of pupils were the pupils' annual reports, within which comments were sparse.

Interviews

Cohen et al., (2007:349) write that the use of interview in research marks:

A move away from seeing human subjects as simply manipulable and data as somehow external to individuals, and towards regarding knowledge as generated between humans.

The philosophical and methodological underpinnings of this research study supported the idea that an understanding of the pupils' situation could be gained through the insights of those who were known to, and worked most closely with, the case study pupils themselves. This study, therefore, has viewed the use of interviews as a key channel through which knowledge can be acquired.

Yin (2014:110) has asserted that “interviews are one of the most important sources of case study evidence” and are instrumental in providing a forum through which in-depth information can be gathered. However, there are many variations in the style or type of interview that can be employed. Robson (2002) describes three main types of interview: structured, semi-structured and unstructured. Yin (2014) refers to the use of intensive, in-depth or unstructured interviews and Cohen et al., (2007) refer to exploratory interviews, informal conversation interviews, closed quantitative interviews and standardised open-ended interviews.

Cohen et al., (2007:354) make a valid point in stating that, “a major difference appears to lie in the degree of structure in the interview, which, itself, reflects the purposes of the interview.” This research study used a flexible design and sought to facilitate, through in-depth and personalised individual discussions with the adult participants, the role of smell in supporting learning for this pupil cohort. Consequently, it made use of what most closely can be described as semi-structured and unstructured interviews. These two types of interview were used on separate occasions during the research period.

The first set of interviews was conducted at the outset of the study using a semi-structured style and primarily aimed at gathering background information on the individual case study pupils themselves including any responses to smell perceived by the teachers and parents prior to the study. These semi-structured interviews included all the adult participants involved in the research study: the teachers, parents, senior leaders and the school therapist. However, the senior leaders and school therapist were asked different questions as they had not exclusively dealt with the case study

pupils themselves. It was also the case that they had extensive experience in working with the PMLD cohort within the school and the interviews offered an opportunity to gain insights from their experiences of teaching through the medium of smell and their views on the value of this sense (See Appendix 3.)

These semi structured interviews lasted approximately 45 minutes each and took place within a two-week period (Summer, 2014). The teachers, senior leaders and school therapist arranged times before or after school. Of the seven parents invited for interview only five parents were able to attend. Therefore, alternative approaches to face to face interviews had to be devised for the remaining two parents: telephone interviews and the interview questions being sent home in written form. However, the face-to-face interviews had a much more 'personal touch,' they fostered the development of positive working relationships and there were more channels open to communication in terms of how you could interpret meaning from non-verbal cues or the nuances of a change in facial expression or tone.

The second set of interviews took an unstructured approach and were conducted after the period of observation. They primarily involved eliciting the adult participants' interpretations of the video-recorded material. As the focus of these sessions was to gather their perspectives on what was observed within the class, a more open-ended approach was required. There were no preconceived or direct questions – the participant was invited to give a response to events within the video material. There were a number of benefits in taking a less structured approach at this later stage. For example, the ability to engage in in-depth discussion about the individual case study pupils and to pick up on incidental information volunteered by the adult participants.

All of the interviews were carried out on an individual basis with the intention of gathering in depth and open personal accounts from each of the adult participants. The focus of the research was to capture each individual's perspectives on the case study pupils' responses to smell without being influenced or affected by the opinions of others. Gillham (2000:78) refers to how "powerfully distorting" group dynamics can be, therefore for those who had the potential to be dominated in group situations, and for the purposes of facilitating an intimate and trusting atmosphere, individual interviews were chosen.

Observations

I felt the use of observational material would be an invaluable source of data. I was very much aware that the use of documentation and interviews would represent 'second hand' accounts of events (Cohen et al., 2007:396). As it was not possible to conduct any form of interview with the case study pupils, due to their severe communication difficulties, I needed an approach that attempted to capture the real-life situation of the pupils themselves. I also wanted to have the opportunity to witness the pupils in action for myself. Yin (2014:106) identifies the challenges in using direct observations as a research method, saying they can be "time consuming and difficult without a team of observers."

Co-ordinating such a venture would be very difficult and there would be many factors to consider, for example, if the adult participants had the time available to carry out the observations, if they were willing to commit to numerous visits to the school and if it would be possible to co-ordinate sessions with multiple observers. There was also the issue of how the pupils and class staff would be affected by a number of adults

observing them during classroom activities. I needed a system for observing pupils that would help to overcome the issue of 'time' and 'availability,' that attempted to minimise the impact on the pupils and their class staff but gave access to an objective viewing of pupil responses within the classroom context. Consequently, I felt the use of video recording and the analysis of observational material at a later stage would be an appropriate method. My desire to involve all the adult participants in the observations made of pupils, and the limits to which I could realise this goal in respect of their time and availability, meant that the use of video recording would be a good alternative tool.

The non-participatory nature of the observations meant that any interruptions to the pupils' learning were limited due to there being only familiar class staff within the learning environment. Video material was recorded by teachers within normal learning activities or myself, as the researcher.

However, this meant that the observation process would take on a different form. There would not be an adult or group of adults sitting in a class and making notes from their observations of pupils but someone recording events. This use of video, as Gillham (2000) points would in some ways take on the form of a piece of "documentary evidence." However, it would not be a 'second hand' account unlike the other documents used within the study. This would be a record of live events which could be revisited and analysed by the adult participants at a later date.

There were obvious drawbacks from the use of video-recording, for example, there was the potential for pupils to be aware that they were being recorded and as a result

they may have become distracted by the person recording them. Bassey (1999:82) makes this point in stating: "video work can be a problem because it entails pointing the camera at someone and thus making it clear that he or she is being directly observed." The challenge was for the act of video-recording to be as unobtrusive as possible.

Initially, I had envisaged conducting all the video-recorded observations myself. Although, this would have been a time-consuming process - I had been able to arrange with the Head of School and respective class teachers to make myself available for each of the observations of pupils. My role would be non-intrusive or, as Robson (2002:319) describes, that of an "observer-as-participant." I did not aim to take part in the activities in any of the classrooms but my intentions and status as a researcher would be made known to the class team. The idea was to get a snapshot as a passive observer enabling me to view and record how the pupils interacted with the objects, people and the environment within their normal classroom setting. In such instances, if the case study pupils themselves were aware of and alerted by my presence, my intention was to introduce myself or be introduced by the teacher or team member.

However, when I spoke to the individual class teachers a number of them asked whether they could video-record the class sessions themselves, therefore performing a role similar to technical assistants within the research. The benefits to them, as explicitly stated by the teachers themselves, were that it would be more convenient. They felt that they could go ahead with class activities as normal and video-record smell related elements as they arose. They also felt that there was a greater likelihood

that the pupils would not be affected by the recording taking place if it were conducted by familiar class staff.

Ensuring that the video recordings adequately served the research purpose and were of acceptable quality was going to be a challenge. I asked the teacher participants to make a few short video recordings of their pupils as a pilot exercise. The purpose of this piloting exercise was to check that, within the recordings made, the pupils were in full view of the camera, that observations were carried out in an unobtrusive manner, that activities related specifically to smell and allowed enough time to capture the whole smelling experience. These criteria were explained to the teachers. All of the recordings were made using class video cameras. These were good quality hand held cameras with a video recording function. These were later viewed by myself and each of the teachers. This was a very fruitful exercise as there were a number of instances when the recordings made did not meet the given criteria. I decided that I, as the researcher, should take over the main responsibility of video-recording the case study pupils. However, a couple of the teacher participants who were more confident in making video-recordings carried out their own. Consequently, I led the recordings for five of the seven pupils – Matthew, Andrew, Saeeda, Patrick and Mohammed. Zara and Maria's teachers and class team felt confident and happy to carry out their own recordings and the pilot material they had produced proved to me that they could do this to a good standard.

In terms of the organisation of video-recorded observations there were a number of factors to consider: the focus of the observation, frequency of observations and length of observation period (Cohen et al., 2007:399). Simmons (2011) makes a critical point

in suggesting that observations cannot necessarily be conducted in a systematic manner when dealing with the PMLD cohort due to their often-idiosyncratic responses. He suggests that a more flexible process is necessary in gathering empirical evidence. This complies with the work of Arnold (2014:16) whose case study investigation into the impact of sensory stories on pupils with PMLD highlights the need for sensitivity to:

The time of day, the setting for the session, the learner's body position, health issues, medication, as well as levels of tiredness, all impact on the learner's responses to sensory work.

For there to be a reliable amount of data I decided, alongside the adult participants, that at least an eight-week period of recording should take place. This was based on an agreement about how long it would take to establish a picture of the pupils' responses and within what time adults were willing to participate in the research study. Discussions were conducted with the teachers with regard to preferable times of the day to record pupils - when the pupils were most alert - and to take into consideration particular classroom activities that included the use of smell and were suitable for recording. It was agreed that approximately three separate activities would be recorded on a weekly basis, over the eight-week period, with each of the case study pupils. Table 5 shows the schedule for video-recorded observations of pupils per week. The choice of smells used is explored in the next section – *Selection of smells*.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Pupil/ activity and time	Mohammed/ Matthew Morning circle 10am (eucalyptus/ vanilla) Matthew End of day circle 3pm (rosemary)	Patrick/Saeeda Morning circle 10am (eucalyptus) Zara Sensory story 2pm (spices) Maria Scented bubbles/ Cooking 2pm (fruits)	Andrew Arriving 9.15am (citrus) Morning circle 10am (geranium) Snack time 10.30am (fruit) Maria Massage 2pm (strawberry cream)	Mohammed Greeting a familiar adult wearing perfume 10am Matthew Massage 2pm (cocoa butter)	Zara Morning circle/ massage 10am (peppermint/ vanilla) Patrick/Saeeda Sensory story 11am (vinegar/ chocolate)

Table 5: Weekly schedule for video-recording observations of pupils' responses to smell.

The length of each recording was guided by the duration of each smell experience and accounted for the strategies used by the adult participants to present the smells to pupils, for the pupils to respond and allowing the pupils control over when to end the smelling experience. For example, some pupils demonstrated an interest in exploring smells with their hands and recordings continued until the pupil had clearly communicated that they were finished. In other cases, pupils pushed or turned their head away from odorous items soon after they were presented and recordings were ended quickly.

Pupils	Matthew	Mohammed	Saeeda	Patrick	Maria	Zara	Andrew
Number of video- recorded observations	14	15	19	13	11	9	11
Total time of observations (minutes)	3.74	5.18	4.20	2.94	22.23	6.23	5.41
Median	0.23	0.64	0.20	0.23	2.30	1.29	0.75
Mean	0.27	0.35	0.22	0.23	2.02	0.70	0.49
Mode	0.23	0.26	0.20	0.20/0.23	1.18/1.19	-	0.33

Table 6: Video-recorded observations in total, mean, median and mode.

Table 6 shows the total number of video-recorded observations carried out for each pupil, the total of time observed, median, mean and mode calculations. The most common time period for the video-recorded observations was between 20 and 23 seconds. This occurred on repeated occasions when recordings were made of Matthew, Mohammed, Patrick and Saeeda. Interestingly, these pupils had quite different needs and required varying levels of support from the adults. However, it appeared that the 20 – 23 second time period had been sufficient in allowing each of these pupils to communicate a response to the smells presented to them and for them to indicate that they wanted to finish the smelling experience. Recordings that lasted longer tended to include the use of multiple smells.

Selection of smells

The selection of smells focused upon within the fieldwork period (See Table 7) was decided upon in agreement with participating teachers and parents. There was concern expressed, at the outset, by a number of the adult participants in both groups that any changes to the pupils' normal routines, the use of additional or particularly strong smells may have a detrimental impact on the pupils' wellbeing and learning opportunities. As mentioned earlier, it was the case that a number of the school staff and pupils had particular sensitivities to smell. This did not include any of the pupils involved in the research; however, it did include pupils within the pupil participants' class groups. As a result, it was important that I could reassure the adult participants that there would be minimal disruptions to the pupils existing routines. It was also the case that, as an exploratory study, my intentions were primarily to consider the merits to the use of smell within existing practice. Therefore, the odours that were focused upon within the fieldwork period (See Table 7) included scented items that were

already part of or were in the process of being introduced within the pupils' school routine. These included: scented massage creams – strawberry, cocoa butter and vanilla - and strawberry scented bubbles used in relaxation sessions; a range of spices, chocolate powder and vinegar used sensory story sessions; peppermint, eucalyptus and geranium essential oils used in morning activities; a range of whole and pureed natural fruits such as bananas, apples and strawberries used at snack times and also in cookery sessions. I asked if anyone had considered the impact of perfume worn by staff and one teacher, who normally wore perfume, offered to focus on one pupil's responses to her throughout the fieldwork period.

		Name of pupil						
		Matthew	Mohammed	Saeeda	Patrick	Maria	Zara	Andrew
Type of smell	Chocolate (powder)			X	X			
	Strawberry (scented bubbles)					X		
	Strawberry (massage cream)					X		
	Strawberry (Whole fruit)					X		
	Pureed fruit							X
	Banana (whole fruit)					X		
	Apple (whole fruit)					X		
	Orange juice					X		
	Peppermint (concentrated oil)						X	
	Eucalyptus (concentrated oil)	X	X	X	X			
	Rosemary (concentrated oil)	X						
	Geranium (concentrated oil)							X
	Spices						X	
	Vanilla (massage cream)	X	X				X	
	Cocoa butter (massage cream)	X						
	Vinegar			X	X			
	Perfume worn by adult		X					

Table 7: Smells experienced by pupils throughout the (eight week) fieldwork period

3.8. Adult Participants

Participants are those whose social positions in a research setting give them specialist knowledge about other people, processes or happenings that is more extensive, detailed or privileged than ordinary people, and who are therefore particularly valuable sources of information to a researcher, not least in the early stages of a project.

(Payne and Payne, 2004:134)

The use of adult participants, with specialist and in-depth knowledge, was a vital and integral part of this research process. Such participants were a purposeful sample of fifteen adults: five teachers, seven parents, two senior leaders and one school therapist. As a number of the pupils were in the same class only five (as opposed to seven) teachers were used. Each of the pupils was represented by one teacher and one parent. The senior leaders were involved in the initial interview stage due to their background knowledge of PMLD working practice and the school therapist was involved throughout the fieldwork period offering an alternative perspective from the teachers and parents.

All of the adult participants were interviewed initially, using a semi-structured style, with the primary aim of gathering background information on the individual case study pupils themselves. The senior leaders and school therapist were asked different questions owing to their extensive experience in working with PMLD pupils and potential input in relation to teaching and learning (See Appendix 3). The teachers worked alongside me, as the main researcher, to make the video-recorded observations of pupils. The parents, teachers and school therapist were then involved in the analysis of the video-recorded observational data – this took the form of an

unstructured interview approach. The input of the school therapist was also involved at this stage. This allowed for “observer triangulation” (Robson, 2002:174).

I had hoped to additionally incorporate the views of a speech and language therapist. Within Beechleaf school, speech and language therapists (SLTs) provide a key role in supporting the development of communication skills and dysphagia awareness⁶. Unfortunately, this was not possible during the period of time that this research study took place.

3.9. Analysis

It has been recognised that techniques or strategies aimed at analysing and interpreting case studies have not been well defined (Candappa 2017; Yin, 2014) and that the way data is treated should primarily be measured against the issue of “fitness for purpose” (Cohen et al., 2007:261). Central to my choice of analytical approach was the need to answer my overarching research question. This meant that I required a strategy that allowed for a detailed exploration into how my individual case study pupils were responding to smell experiences to inform ways through which this sense may be used to support their learning.

Firstly, this study was exploratory as it aimed to consider and better understand the pupils’ responses to smell (Yin, 2014). Secondly, it involved a cross-case analysis wherein I contrasted and compared information from documents, interviews and observations of each of the individual cases in order to develop any themes or consistencies that had emerged. As insights from this study have been drawn from the

⁶ Dysphagia is the medical term used to describe cases where an individual may have swallowing difficulties.

data itself it has also reflected an inductive approach in that it has involved the movement from, “raw data to categories” (Merriam and Tisdell, 2016: 19).

In terms of analytical strategies, I viewed suggestions by a range of authors (Candappa 2017; Yin, 2014; Thomas, 2011; Cohen et al., 2007; Braun and Clarke, 2006; Gillham, 2000; Stake, 1995; Miles and Huberman, 1994) and based my chosen analytical approach accordingly. I felt this study primarily reflected a thematic approach as it sought to identify and categorize key patterns or themes to explain the ways in which the pupils’ learning experiences were being supported by smell (Thomas, 2011; Braun and Clarke, 2006; Miles and Huberman, 1994).

The process of analysing the data was based on a phased guide drawn from the work of Braun and Clarke (2006) which is detailed in Appendix 5. It also reflected a participatory model in that it involved the perceptions of the adult participants in generating and analysing the information gathered within the research process (Crabtree and Miller, 1999). Within my discussion, I also wanted to reflect on literature I had sourced in order to relate any existing theory or practice-based knowledge and build on any explanations or theories in respect of my findings.

3.10. Ethical considerations

In the design of any research, an ethic of respect for persons should govern the participation of all individuals. This most especially applied to the pupils involved in this research who, owing to their complex needs and profound learning disabilities, had only a limited capacity to express themselves, were unable to communicate their thoughts and wishes in the form of spoken or written language and therefore, did not have the capacity to give consent to any research carried out on their behalf.

Appropriately addressing these ethical questions is what underpins good research in so far as it is designed to respect and protect each participant's rights and wishes. These are discussed below. The ethical issues arising out of this study included questions about consent, the right to withdraw, best interests, privacy and disclosure, confidentiality and anonymity and data curation (BERA, 2018, 2011).

Given the vulnerability of the PMLD cohort reference to more than one source of ethical guidance has therefore been necessary. Whilst the main framework drawn on was the *BERA Ethical Guidelines (2018, 2011)* the research has been informed also by the *Mental Capacity Act (2005)*; the *Code of Human Research Ethics (BPS, 2014, 2010)*; and guidance from the British Psychological Society, including *Conducting research with people not having the capacity to consent to their participation (BPS, 2008)* and *Guidance on determining the best interests of adults who lack the capacity to make a decision for themselves (BPS, 2007)*.

Consent

'Voluntary informed consent' is defined in BERA's (2018) Ethical Guidelines as follows:

The Association takes voluntary informed consent to be the condition in which participants understand and agree to their participation without any duress, prior to the research getting underway.

(BERA, 2018:9)

This poses problems in the case of pupils with PMLD, who may not have the capacity to understand or competency to consent to their participation in a research study. As mentioned, pupils with PMLD work at very early developmental levels, and significant cognitive impairments alongside physical and sensory difficulties limit their ability to actively engage in decision making. Does it follow that we should not carry out

research with this group? ‘Drawing on principles 3 and 4 of the BPS Code of Human Research Ethics (2014), I would argue that this research falls within the remit of “a shared collective duty for the welfare of human beings” (p.10), and considered from the standpoint of the research participants it seeks to maximise benefit and the risk of harm is “no greater than that encountered in ordinary life” (p.11). I would further argue that given the potential future educational benefits to this cohort it would be unethical not to undertake the research.

Guidance from the British Psychological Society (BPS, 2008) has been developed to support researchers on this issue and includes four criteria that assist in judging whether an individual lacks capacity. These include:

The presence of an impairment or disturbance (disability, condition) that affects the way the person is able to think; whether the impairment is permanent, temporary or fluctuating; the nature of the decision – the person may be able to make decisions about some things but not others; and the timing of the decision – the person may be able to make a decision on the matter in question if the decision is delayed for another time.

(BPS, 2008:14)

Based on these criteria, all pupil participants considered as eligible for this research study did indeed lack capacity. The pupils themselves had profound and multiple learning disabilities alongside other complex medical needs. They had a history of dependency on adults in terms of educational and care provision with parents and carers acting on their behalf in any decision-making process. Whilst most of the participating pupils were children in terms of the Children Act (1989) and therefore required parental consent to participate in research, two young people were over the

age of 16. Articles of the Mental Capacity Act (2005) were applied in these cases. In particular and complying with Section 32 (2) of the Act, steps were taken to identify a person who ‘otherwise than in a professional capacity or for remuneration, is engaged in caring for P [the person to be researched]’ for consent to participate and to be consulted by the researcher under that section. The respective parents agreed to act in this capacity, and it was noted that if the parent consulted “advises R [researcher] that in his opinion P's wishes and feelings would be likely to lead him to decline to take part in the project (or to wish to withdraw from it)” (Section 32(5)) s/he would be withdrawn from the research.

Following this, any decision about any other persons acting on behalf of pupils in the research process involved consultation and authorisation by parents and carers as those chiefly responsible for and ‘acting in guardianship’ of the pupils themselves. Or in their absence, clinical or care teams who play a significant role and have knowledge of the pupils (BERA, 2011; BPS, 2008). Since this study included observations of activities within the learning context, classroom practitioners, healthcare and educational professionals were also involved, in a sense as a ‘special interest group,’ given the consent of parents. They were required to give, to the best of their knowledge, a sincere and balanced representation of the pupils’ responses and were made accountable in representing their best interests.

The process of gaining consent, for all pupils, necessitated that all adults representing the pupils were aware of, and in agreement with, the aims of the study and that they were assured that it was in the best interests of the pupil or young person. For parents, this involved communication via letters of consent (See Appendix 6), follow up phone

calls and meetings with respective individuals as required. For staff members and healthcare professionals, such as the school therapist, communication was carried out within school via discussion.

Right to Withdraw

In line with BERA (2018) guidance, it was made clear from the outset that all participants reserved the right to withdraw from the research at any point within the study (See Appendix 6). Adult participants were encouraged to inform the researcher immediately when it was felt that the continuation of research or elements of it were not in the best interests of pupils. This was required out of respect for the autonomy and dignity of pupil participants, and served as a safeguard from any activity that may cause unforeseen harm or distress. It was not possible to ascertain from the outset what responses pupil participants would have to particular aspects of the research. Therefore, the constant monitoring of pupil comfort levels and indications of their desire to withdraw needed to be prioritised throughout the research process. As the pupils themselves were dependent on the judgements of the adult participants this meant that these adults were relied upon to interpret pupils' responses throughout the research process.

Best interests

The consideration of best interests is commonly included as “a method for making decisions...which requires the decision maker to think what the ‘best course of action’ is for a person...who lacks capacity.” (BPS, 2007:7) Representing the best interests

of vulnerable individuals has been recognised in recent years as needing more rigorous statutory procedures. As a result, The MCA (2005) includes a series of factors to be considered when attempting to make decisions on behalf of individuals who lack capacity, (outlined in Section 4). In line with the MCA (2005) each of the following criteria was given serious consideration:

4(1) In determining for the purposes of this Act what is in a person's best interests, the person making the determination must not make it merely on the basis of:

(a) the person's age or appearance; or

(b) a condition of his, or an aspect of his behaviour, which might lead others to make unjustified assumptions about what might be in his best interests.

Adult participants other than parents, for example, learning support assistants or teachers, who were recognised as caring for and working most closely with the pupils themselves, also acted in loco parentis. For those pupils over the age of 16, the class team played an essential role in interpreting their communicative attempts and representing their best interests. This meant that they were required to provide sincere and balanced judgements on the pupils' responses throughout the study and offer an appropriate and respectful evaluation of activities or approaches used within the research. The adult participants had to utilise a sensitive and responsive approach at all times. There were occasions when pupils showed a dislike for certain smells and this needed to be recognised and respected. One example of this was when Patrick showed a dislike for the smell of vinegar and pushed it away with his hand. It was important that the adult working with him was able to astutely respond to his wishes and withdraw the smell. Alternatively, when pupils showed their preference for a smell, or a willingness to reach out and touch it, it was important that they were given the

opportunity to do so. The main aim was to elicit accurate judgements on pupils' responses to smells within the learning environment and to ensure that, throughout, the wellbeing and wishes of pupils were respected and protected.

Privacy and disclosure

In line with BERA guidance (2018), all adult participants acting on behalf of pupils were fully informed about, and had opportunities to discuss how the data collected would be recorded, stored and used, and with whom it would be shared. Details were documented and signed by participating adults prior to the research commencing. For example, all participants were informed of my wish to video-record the pupils' responses to smells; it was necessary that parental consent was granted for all video-recording, and for any subsequent use made of that video-record, including its storage and any dissemination (See Appendix 6).

A key issue in relation to this study was how the identity of pupil participants was to be anonymised given the need to video-record their responses within the educational context. Consent was based on an appreciation of the practical limits of anonymity and confidentiality in this instance. It was important for parents to understand that comprehensive anonymity was not entirely possible with the use of video material but that all pupils' details would be anonymized and that all personal information was kept strictly confidential. The decision as to whether the adult participants' names and identities would remain anonymous would rest finally with the participants themselves. The initial and clear expectation would be that all participants' details would be anonymised, as far as possible, to protect both the current and future interests of participants and the pupils they were representing.

Data Curation

All of the data gathered for use in this study has been stored securely in accordance with the Data Protection Act (2018) and in agreement with parents. Documents and audio recorded materials were kept in a locked cupboard with restricted access; video-recorded material was downloaded onto a secure hard drive and a password protected laptop, accessible to the researcher only. The original video-recordings were deleted from hand held cameras after uploading data to my personal computer. It was agreed by all of the parents that data could be kept until the final thesis was published. For the purposes of teacher training within the school, a small number of parents also agreed that the video-recorded observations could be shared. However, this was to be discussed further post thesis publication stage.

3.11. My role as an insider researcher

In conjunction with the aforementioned ethical considerations, there were issues to be addressed in terms of my role as an insider researcher. As I was a member of the school community carrying out a study directly concerned with my work, this meant that I was in the position of having “insider status” (Denzin and Lincoln, 2011:662). There were many advantages in delivering the research within my educational setting, as Robson (2002:382) highlights: “having access to information, being located within the setting that the research was taking place and having intimate knowledge of the context.” As a class teacher and DHOS, I had a “certain feel of credibility as someone who understood what the research entailed and what stresses and strains existed.” Sikes and Potts (2008:177) go further in stating that the advantages of insider research are, “knowing the language of those being studied” along with having an

“understanding of them” which would be “less likely to foster distrust and hostility.” My dual role was beneficial in that I had a good working rapport with most of the parents and teachers before the research period had started. This enabled me to establish trusting relationships with these adult participants quite quickly and be reassured they were comfortable and informed about the research methods, processes and procedures. This meant that the adult participants would often be more willing “to discuss private knowledge with those who are personally part of their world.” However, my main concern was that my status, being the DHOS, might affect the responses given by each of the adult participants and that as a well-established member of this professional community, my own values and beliefs were not going to impinge on the responses given by them. I needed to take pre-emptive steps to ensure the credibility of my research study was secured. I needed to adopt a reflexive approach.

Robson (2002:382) points out that “although it is increasingly common for researchers to engage in empirical study within their own educational setting it is known to present difficulties.” Denzin and Lincoln (2011:662) also highlight how the researcher’s positionality can negatively influence research studies. They argue that “the challenges of insider research within educational settings include ethics, access, intrusiveness, familiarity, rapport, bias, and reciprocity.” It would be the manner in which I, as the researcher, responded to these dilemmas that would give the research its credibility.

Within interviews, steps were taken to avoid bias, or the use of leading questions. Probes were used carefully, if needed, to extract further detail within the interview process and the careful use of questioning. For example, if a participant responded with a ‘yes’ or ‘no’ answer, I asked if they could provide any more details but did not

give examples or pursue the issue if the participant seemed uncomfortable. To ensure adult participants were not responding at any point during the interview in terms of what they might have perceived to be expected of them I assured them at the outset that this research was about 'their perspectives' and that the role of smell was something that there was only a limited awareness and understanding of and that their contribution was unique and significant to the research. As mentioned above, whilst conducting my observations and video-recording pupils, my role was non-intrusive or, as Robson (2002:319) would describe, that of an "observer-as-participant." However, Cohen et al., (2007:409) raise a valid ethical issue in that we need to be careful in observing, as we can cause the participants to be treated as "research objects." Within this study, the adults and pupils themselves would be carrying on with their normal classroom activities but these were video-recorded over an eight-week period in short bursts. Irrespective of my attempts to reassure the adult participants and to carry on as normal, they were still a little anxious and essentially 'wanted to get it right.' It was important that I emphasised the need for things to be as normal as possible and not for the adults to put on an act. I explained that I was simply trying to develop a greater understanding of the pupils' responses and that it was not a measure of the professional conduct or practice of the class team themselves. Bassey (1999:82) makes this point in saying, "Like interviews, observation of educational events has a sense of formality. The personal skills of the researcher are important in terms of putting the actors at their ease." With regard to the pupils themselves, only one pupil – Zara - showed she was aware of being video-recorded. This was on two of the occasions. As she was used to being photographed and video-recorded she just turned momentarily, smiled at the camera and then returned to her task at hand.

Chapter 4: Findings and Analysis

4.1. Introduction

This chapter will present and discuss the findings of my research, which includes an interpretation of the data and a discussion based on these interpretations. Data interpretation was undertaken with the support of parents and school staff discussed in the previous chapter. The chapter has been structured according to themes and guided by my overarching and subsidiary research questions, as outlined below. In presenting findings, at times, I use data relating to one or a small number of cases that best exemplify the point being discussed, rather than the whole cohort. I justify my choice in each of these cases.

Overarching research question: Can the sense of smell be used to support the education of pupils with profound and multiple learning disabilities (PMLD), and in what ways?			
Subsidiary Questions	Research	Themes	Methods or data collection tools
1.How do pupils respond to smell experiences within the classroom context?		4.2. The type of reactions to smells	Video-recorded observations Interviews
2.How can we best interpret possible responses to smell of pupils with PMLD given the nature of their communication difficulties?		4.3. The presentation of smells <ul style="list-style-type: none"> • The containment of smells • The role of the adult 4.4. Sensory thresholds	Video-recorded observations Interviews
3.How can the sense of smell be used to provide support for learning?		4.5. Smell as an alternative and an additional way of learning 4.6. Smell as a support for eating and drinking routines 4.7. Smell as part of a multi-sensory approach 4.8. Smell as a support to the development of recognition	Video-recorded observations Interviews

Table 8: Research questions and themes

The theme that has been identified, in response to my first research question, has aimed to illustrate how the pupils were responding to smell experiences within the classroom context. This has been evidenced through the type of reactions to smell

observed by adult participants on viewing the video-recordings of pupils and from my own observations.

The aim of my second research question was to link any theories or practice-based, experiential knowledge to my own observations to facilitate the interpretation of responses to smell. Evidence emanating from this study has highlighted firstly, the need to reflect on the various ways in which smells were presented to pupils. This has included the role of the adult and the containment of smells. Secondly, a consideration of the pupils' sensory thresholds in relation to smell - aligning the work of Pagliano (2012).

The third research question, presented in Table 8, focused on how the sense of smell could be used to provide support for learning. Themes included the use of smell as an alternative and additional way of learning, in support of the experience of eating and drinking, as part of a multi-sensory approach and in the development of recognition.

It is important to note that interpreting the pupils' responses presented its difficulties. As mentioned earlier, the pupils themselves were not able to verbally assert or affirm their needs, wishes or opinions. Given that the pupils did not use spoken language; it was necessary to ascertain meaning from a collective of subjective opinion, aligned with my own interpretations of pupil response. Judgements had to be based upon any changes in the pupils' eye, head, mouth or hand movement, facial expression or, for a small number of pupils, their utterances or vocalisations. It was also clear that, although the adult participants knew the pupils well, ascertaining the exact nature of a response to smell was a new area of practice and, therefore, was particularly challenging for all those involved in the study. Although the difficulties faced by the adult participants in interpreting the pupils' responses to smell were genuine and

complex, there have been a range of consistencies in the pupils' responses which have been identified and that have formed the basis to key findings within this study.

4.2. The type of reactions to smells

Before I present my findings on the pupils' reactions to smell, I feel it is important to highlight that no clinical smell assessments had been carried out on any of the pupils prior to this study. This was evident in the comments made at interview by the parents and teachers and apparent in the lack of information about smell within pupils' educational statements, despite references to other senses such as the pupils' functional use of vision and hearing. The teachers were not aware of any assessment tools specific to measuring their pupils' sense of smell. This meant that their knowledge of their pupils' smell abilities was experiential. This issue was highlighted in a comment made by the Executive Vice Principal, at interview, who stated, "we have left it too much to teachers... to sort out their own ways of taking smell forward."

This distinct lack of information was significant. It meant that the teachers' perceptions of the pupils' responses to smell had not been based on any clinical assessment. It was not necessarily known if or to what extent the pupils were able to detect smells. However, of the five teachers involved in the study, four teachers were able to offer some detail on their pupils' responses at interview. Of the seven parents involved in this study, five parents were able to provide some details of their child's responses to smell within the home. The remaining two parents and one teacher remarked: "I don't know," "No idea," and "No." This meant that there was some level of awareness of the pupils' abilities to respond to smells and given the findings of this study consistencies in the adult participants' interpretations of the pupils' reactions to smells emerged which helped inform my findings.

Findings

Responses noted to smell	Number of occurrences out of the 92 observations made
Mouth/tongue movements Including the opening of the mouth, licking of lips, moving or protruding tongue, swallowing and sucking.	76 (83%)
Hand and arm movements Including hand clapping, reaching out, grasping and pushing away.	63 (68%)
Eye movements Including widening of the eyes, eyebrow movements, directional gazing and blinking.	61 (66%)
Head movements Including moving head up or to the side	53 (58%)
Stilling	32 (35%)
Vocalising	31 (34%)
Nostril movements Including sniffing or inhaling	24 (26%)
Whole body movements Including moving forward or backward	13 (14%)
No change	6 (7%)
Other facial expression	6 (7%)

Table 9: Pupil responses to smell experiences throughout the fieldwork period

92 observations of the pupils' responses to smell were recorded. Due to varying levels of absence from school, some pupils were unable to be observed as frequently as others. However, on average approximately 13 recordings were made of each pupil over the research period. Findings that were deemed to be of particular interest are presented here because they are considered to have a great bearing on this elusive field of study and to the overall research aims.

As Table 9 shows, there were a wide range of pupil responses noted. Overall, mouth and tongue movements were the most frequent responses to smell, with seventy-six observations made which accounted for 83% of the recorded responses. These reactions included mouths widening, tongues protruding, salivating, the licking of lips, swallowing and sucking. Eye, hand and arm movements also scored highly with 61 (66%) and 63 (68%) occurrences respectively across the 92 video recordings

observed. These responses included eyes widening, gazing, eyebrow movement, directional eye gazing, reaching out, pushing away, grasping, hand clapping and hugging. There were only 24 (26%) responses noted which reflected nostril movement or activity; for example, inhaling or sniffing.

It is significant that when asked at interview how the pupils reacted to smells, only three of the adult participants made a reference to 'mouthing' and 'tongue protruding' movements (Maria's teacher and Saeeda's teacher and her parent). However, after viewing the video recordings of pupils, mouth movements were noted on 76 occasions out of the 92 observations made by the adult participants.

Interpretation of findings

The data shows that the predominant responses to smell included mouth and tongue movement followed by hand and arm, eye and head movement. Whilst stilling (or pausing), vocalising, nostril and whole-body movements were less evident. What is surprising is that nostril movements were only recorded a total of 24 times. This suggests that responses to smell may not be evidenced through nostril movements alone. It would seem that by the end of the research period there was a heightened awareness of the incidences of mouth and tongue movements in relation to smell. This included those pupils who could not eat orally and did not normally receive taste experiences as part of their normal routine. Therefore, a careful observation of other responses such as mouth and tongue movement would be important for practitioners in the interpretation of any responses to smell.

Of significance is that authors within the field of special education have historically struggled to interpret the responses of pupils with PMLD in relation to smell (Hulsegge and Verheul, 1987) and have failed to include this sense within practitioner material

(DfES, 2004; Murphy, 1997). This has been exacerbated by the lack of clinical assessment on smell available to pupils with PMLD (Pagliano, 2012) leaving practitioners to rely on their experiential knowledge. However, the outcomes of this research have helped to identify a range of responses in relation to the experience of smell. In particular, the connection between mouth and tongue movement which suggests that smell and taste work together and that mouth and tongue movement play a role in receiving and deciphering information about odours within the environment (DeVere and Calvert, 2011). This is consistent with the ideas of Frasnelli (2012) and Morris (1984), discussed earlier in my literature review, who assert that we perceive flavours through 'retronasal function' referring to odours taken in through our mouths.

As a result of these findings, a template of observed responses has been formulated for the use of teachers (See Appendix 1). This has been used as an assessment tool and piloted with a small range of teachers from Beechleaf school and was found to be very helpful in identifying individual responses to smell.

4.3. The presentation of smells

Another important consideration that emanated from this study was the manner in which smells were presented to pupils. Within this, there appeared to be two main factors which influenced the pupils' responses: firstly, the method through which smells were contained. Secondly, the nature of adult intervention. In this section, I aim to explore both these factors and the extent to which each of the approaches used had a bearing on the quality of the experience received by the pupils.

The containment of smells

Findings

As Table 10 shows there were a wide range of methods used for containing smells: in semi-solid and liquid form within containers; in powder form within containers; as whole, mashed or purred food items and within massage creams. Essential oils were either presented on cotton wool or directly from their original bottles.

		Method of containment						
		Massage cream	Powder placed in containers or packets	Concentrated essential oil placed on cotton wool	Concentrated essential oil direct from original bottles	Liquid form in a container	Whole food items on a plate	Semi-solid, mashed or pureed form in container or spoon
Type of smell	Chocolate		x					
	Strawberry	x				x	x	x
	Banana						x	x
	Apple						x	x
	Orange					x	x	x
	Lemon curd							x
	Peppermint			x				
	Eucalyptus			x	x			
	Rosemary			x				
	Spices		x					
	Vanilla	x						
	Vinegar					x		
	Cocoa butter	x						
	Perfume					x		

Table 10: How scented items were contained within the fieldwork period.

The most frequently used method of presenting smells was in semi-solid, pureed or mashed form, from a small container or spoon, with five types of food items being presented to pupils at snacktime. This included four of the seven pupils - Andrew, Zara, Maria and Saeeda - who were unable to tolerate whole foods due to their swallowing difficulties. Four food items were presented in solid or whole form, for example, apples and bananas. Four types of liquid solutions were used in the form of

perfume, strawberry scented bubbles, orange juice and vinegar. Three types of essential oils were presented to pupils on cotton wool which included peppermint, eucalyptus and rosemary. One teacher offered the smell of eucalyptus directly from its original bottle or container.

The pupils' responses to these methods of containment varied. Here, I will present a sample of my observations of Zara and Maria, whose reactions to the ways in which certain smells were contained suggested this had a greater impact on their willingness and abilities to engage in the smelling activity itself.

In her morning circle activities, Zara was presented with the smell of peppermint on a piece of cotton wool. As can be seen from the observation notes below, Zara initially reaches out to touch the container holding the scented cotton wool, but does not try to engage with the cotton wool itself, she then pulls her hand back and puts her head down. Even after repeated attempts to encourage Zara to engage with the smell, she turns away.

Observation P10120190: Zara experiencing the smell of peppermint on cotton wool

Zara is seated on her class chair, looking toward her teacher who is approximately one metre away holding a small container of peppermint scented cotton wool. The adult moves closer to Zara and says, "Zara, have a smell." She then holds the container just in front of Zara, slightly above her knees. Zara puts her hand out to touch the container, looks into it and then pulls her hand back and puts her head down. The adult rests the container on Zara's knee and says, "There you go, you try." Zara continues to keep her head stooped allowing the container to remain on her knee. The teacher takes one piece of cotton wool out of the container and tries to give it to Zara but she turns her head away. The teacher withdraws.

From my observation of Zara during her weekly sensory story, where she was offered a packet of spices, she looks, reaches out and grasps the packet with both hands proceeding to try to put her hand in the packet until the adult stops the activity.

Observation P1020234: Zara experiencing the smell of spices from a packet

Zara is seated on her class chair, looking toward the adult, and is presented with a packet of spices. The adult moves closer to Zara and encourages her to smell the spices. Zara looks briefly into the packet and up at the adult. The adult encourages Zara to hold the packet. Zara takes the packet with both hands and puts her head into it to smell. She then lifts her right hand and tries to put it into the packet. The adult stops Zara from doing this. Zara smiles.

The evidence presented here suggests that Zara was more interested in engaging with the packet of spices than the cotton wool. As a result, the experience of smelling spices was prolonged and the engagement with the peppermint smell on cotton wool is shortened. This was reflected in the comments made by adult participants who viewed the video-recordings of Zara – detailed below in tables 11 and 12.

Name/number of video	Responses noted by the parent	Responses noted by the teacher	Responses noted by the school therapist
P1020190	Maybe not comfortable with cotton wool – similar reaction as before	She knows it's there – putting head to it – opting out – knew it was a scent – she hasn't reached out to it	Head down – not going to do what the adult wants her to do – turning her head

Table 11: Zara's responses to the smell of peppermint on cotton wool.

Name/number of video	Responses noted by the parent	Responses noted by the teacher	Responses noted by the school therapist
P1020190	She likes this one – she put her hands in it - gives these more chance – likes to feel and search – better that she can hold it – cotton wool not interesting	Did put nose into it – face drops and head into the package – just exploring –	Looking right inside – enjoying the activity – mouth and head movements -

Table 12: Zara's responses to the smell of spices in different packets.

It was significant that Zara’s mother was quite specific about her lack of interest in engaging with the cotton wool. She later commented that she felt Zara preferred scented items that had been placed in bright and solid containers:

She is not comfortable with the cotton wool...she likes different packets and different containers and colours...she was more interested and she gave it a chance.

Another example was Maria, who despite her profound physical impairment, appeared to respond better to scented items she could grasp and hold. Figure 4 shows the range of responses she demonstrated when presented with cooking ingredients, scented massage creams and bubbles.

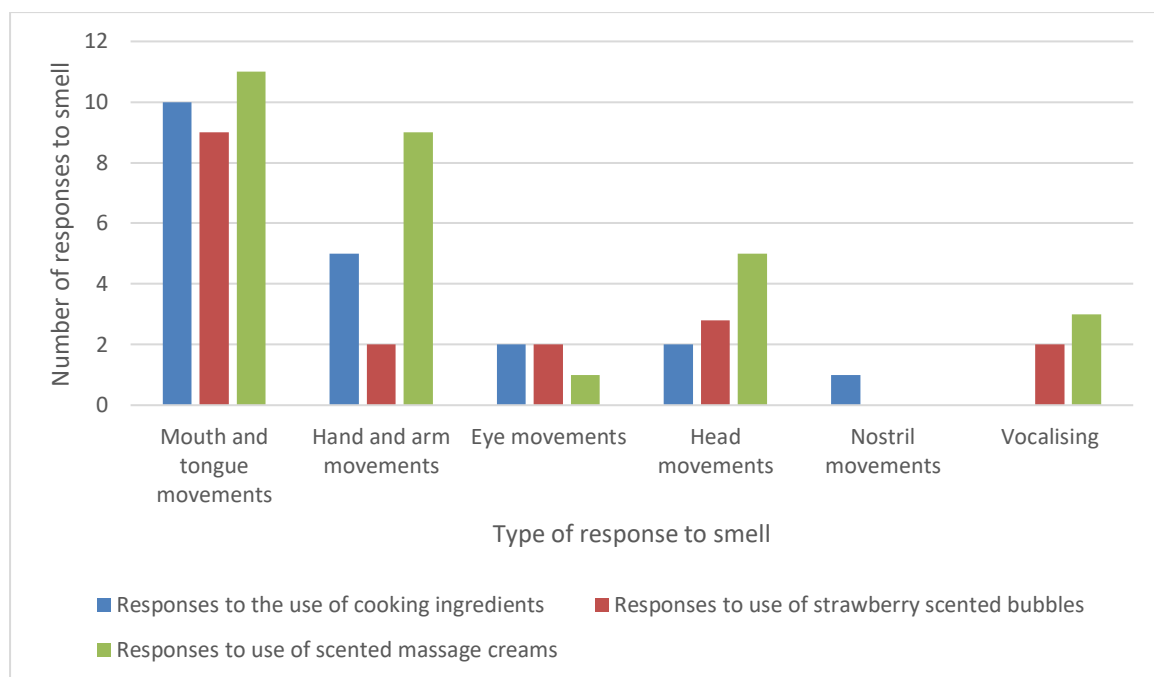


Figure 4: Maria’s responses to the use of scented massage creams, scented bubbles and cooking ingredients.

The evidence here suggested that there were more frequent responses to the scented massage creams (n=29) and cooking ingredients (n=20) than the scented bubbles (n=18). The use of hand and arm, mouth and tongue movements were the most frequently observed type of response to smell. Of note, was the lack of hand and arm

movement whilst experiencing the scented bubbles. From my observations, Maria had expressed an interest in tasting and engaging tactually with the ingredients used in cooking sessions, and the massage cream in relaxation times. She had was not able to physically engage with the scented bubbles.

Interpretation of findings

From my observations of Zara and Maria, there appeared to be an increased level of engagement when they had an opportunity to touch and taste the scented item at hand. As Zara did not appear to respond well to the use of scented cotton wool it would follow that its use as a method of presenting a smell for her may be counterproductive. This draws attention to the need for the experience of smell to be used as part of multi-sensory approach, wherein a range of pupils' senses are utilised, and that sensitivity is shown to preferred methods of containment.

My literature search had sourced information from practitioner texts on how smells could be contained. For example, depositing a drop of essential oil onto a piece of cotton wool (Pagliano, 2001), using a smell strip or having a specific smell area in the classroom wherein small pots are contained (Longhorn, 1988) or using smell trays, tubes, bags and bottles (Hulsegge and Verheul, 1987). However, there did not appear to be any form of rationale given as to why each of these methods may have been used and to what benefit. Equally, the methods chosen to contain smells by teachers within this study seemed to be arbitrary and without any specific logic applied. It was the case that smells were presented in different ways within different activities. The findings from this study suggested that an individualised approach was needed. Zara was specifically motivated by the use of bright packets or containers rather than pieces of scented cotton wool and Maria, who had profound physical disabilities, needed

smells experiences to be facilitated that allowed tactile exploration, the opportunity to taste and smell given her responses that showed an interest in engaging in a multi-sensory way.

The role of the adult

It was the case that all of the pupils observed within this study required a high level of adult support. This meant that the nature of the pupils' experiences of smell was to varying degrees controlled by the adult working with them. The findings here explore the various ways through which the adults supported the pupils smell experiences. It highlights the approaches that appeared to elicit positive and negative responses from pupils and thus, suggests potential ways forward in terms of the presentation of smells.

Findings

From the responses given at interview, seen in Table 13, four out the seven adult participants from each group – teachers and parents - felt that smells needed to be brought to pupils in order for them to access them. Patrick's teacher perceived that he would not reach forward to smell by himself. Similarly, Andrew's parent commented that she felt it was necessary to present scented items to him as he did not consistently reach his head forward.

Name of pupil	Teachers' comment	Parent's comment
Mohammed	The adult would bring the smell to him	In the kitchen when baking, eating, cooking is happening and in bath or shower gels
Matthew	Adults must bring it to him	Needs to be brought to him – unless a space has a smell
Maria	Someone needs to bring it close to her	No answer given
Andrew	He will move his head	We have to bring it to him...I think he might reach his head forward but that is not consistent...
Saeeda	This particular student can pick things	I've noticed that she doesn't like to be in an environment that's steamy...the smell or maybe the steam...
Patrick	You must bring smells to him generally...I have never seen him reach forward to access a smell	If you are out and about he will sniff...whether that's because he smells cars or people...with a cake you'll get him to smell a cake but I'm bringing it to him...
Zara	She can reach out for it... but we have to be careful with this particular child as she has a lot of issues around vomiting ...so what we do is give her things like yoghurt...things that don't have a strong smell to it...we avoid cooked smells.	You bring it to her with her hands – she likes to touch...

Table 13: Adult participants' comments at interview about how the pupils accessed smells.

However, three of the parents remarked on their pupils' abilities to detect environmental odours without support, for example, the smell of cars and people (Patrick's parent), baking and cooking (Mohammed's parent) and a steamy environment (Saeeda's parent.). Only one teacher mentioned odours that may be present within the environment – the adverse effect of cooked smells on Zara.

After viewing the video-recorded observations of pupils, 11 of the adult participants made specific comments in relation to the adult's interactions with the pupils (See Appendix Eleven). For example, the school therapist felt that Matthew was "more awake and aware" when he was interacting with an adult he seemed to like. Matthew's parent also indicated that he was responding to the voice of the adult and seemed to recognise it. However, at times the adult's input was perceived to be overbearing. Matthew's teacher remarked that the "voices can take over." Zara's parent similarly expressed some concern that Zara had become "distracted" by the adult. She felt that

Zara should have a “scent on her own at a table.” However, Zara’s teacher noted that the activity had enabled her to engage the adult.

In terms of the adult’s use of touch, Matthew’s parent commented that the adult stroking Matthew’s nose was a “good prompt.” Andrew’s mother felt that the adult touching his nose had made him, “stop...thinking and taking in the smell...inhaling.” Saeeda’s mother noted, “Maybe she recognises the cue of being touched on the nose and will open her mouth – she is stimulated by smells – she stills and then increases her movements.” In one video-recording the adult did not touch Saeeda’s nose and her mother then remarked, “No-one touched Saeeda’s nose as a cue in these videos – maybe that’s why she didn’t open her mouth.”

Comments made by Maria and Saeeda’s parents implied that there were missed opportunities for the pupils to taste. For example, Saeeda’s parent noted that, “It would be good for pupils that experience these smells to be allowed to taste them.”

A summary of strategies used by the adults is presented below. This includes the use of a verbal cue; a touch cue, for example, stroking the pupils’ nose; positional considerations such as bringing a smell gradually closer to the pupils; encouraging independent exploration and being sensitive to their responses such as withdrawing a smell when they seemed to express displeasure.

Strategies used by supporting adults to present smells to pupils.

Type of strategy	Strategies observations within the research period
Using a verbal prompt or vocal cue	<ul style="list-style-type: none"> • The use of a familiar adult • Stating that it was time for 'Smelling' • Telling the pupil what smell they would be experiencing
Using a physical prompt or touch cue	<ul style="list-style-type: none"> • Touching or stroking the pupil's nose as a cue to smelling • Touching the pupils' lips with a spoonful of food • Touching or stroking the pupils' head
Positioning the smell in different ways	<ul style="list-style-type: none"> • Holding a smell directly under the pupil's nose • Gradually bringing a smell to their nose from a distance • Moving a smell from one nostril to another and back again
Encouraging independent exploration	<ul style="list-style-type: none"> • Placing scented items in the pupils' hands and allowing them to explore independently if possible
Being sensitive to the pupils' responses	<ul style="list-style-type: none"> • Withdrawing the smell when the pupil showed signs of displeasure • Holding a smell under the pupil's nose for extended periods of time when they showed signs of pleasure

Table 14: Strategies used by supporting adults to present smells to pupils.

Interpretation of findings

The merits to each of the strategies used by adults have been identified in Table 15 where my observations have been aligned with insights offered by the adult participants. It categorises the strategies according to whether they elicited a positive or negative response. For example, the use of a familiar voice as a cue to the smelling activity was perceived to have helped to gain the pupils' attention. However, the overuse of the adult's voice during the smelling activities appeared to distract some of the pupils – Matthew and Zara.

Type of strategy	Positive responses including smiling, mouth opening or tongue protruding, reaching out, grasping or holding	Negative responses including pushing away, tightening lips, moving head away, looking away, fleeting eye movement
Using a verbal prompt or vocal cue	The use of a familiar adult, stating the pupils' name and that it was time for 'smelling' and what they would be smelling. (All pupils)	The overuse of voice within an interaction or voices that were too loud (Matthew and Zara)
Using a physical prompt or touch cue	Touching or stroking the pupil's nose as a cue to smelling (All pupils except Andrew on one occasion.)	Touching the pupils' lips with a spoonful of food (Andrew and Maria) Touching or stroking the pupils' nose too quickly (Andrew)
Positioning the smell in different ways	Holding a smell directly under the pupil's nose (Patrick, Saeeda and Mohammed) Gradually bringing a smell to their nose from a distance (Mohammed and Matthew) Gradually presenting a smell to each nostril (Mohammed and Matthew)	Holding a smell directly under the pupil's nose (Mohammed) Moving a smell from one nostril to another and back again (Matthew and Mohammed)
Encouraging independent exploration	Placing scented items in the pupils' hands and allowing them to explore independently if possible (Saeeda, Maria and Zara)	
Being sensitive to the pupils' responses	Withdrawing the smell when the pupil showed signs of displeasure (Patrick) Holding a smell under the pupil's nose for extended periods of time when they showed signs of pleasure (Maria and Saeeda)	Not responding to the desire for the pupils to taste scented items (Saeeda, Zara and Maria)

Table 15: Observations of the pupils' responses to different types of adult intervention.

Matthew was noted by his teacher to have continued to exhibit fleeting eye movements in response to the continued dialogue of the adult and Zara was suggested by her parent and teacher to have become distracted by the adult. These insights would suggest that the use of a verbal prompt at the initial stages of the smelling activity was useful. However, the adult's voice being too loud or there being a continued dialogue detracted from the experience itself. Interestingly, Zara's teacher noted that the scented object seemed to offer Zara a way of engaging with the adult. This was an important observation as it implied that Zara was able to take greater control of the interaction. This would suggest that there was value in using the smell with Zara not just for the purposes of experiencing the scent itself but as a way of developing her communication and interaction skills.

The way in which the adults used touch as a cue to the pupils' smelling experiences was perceived to have positive and negative effects. When an adult touched the pupils' noses prior to smelling the pupils' responses were mostly positive. For example, Patrick, Matthew, Mohammed, Maria, Zara and Saeeda's showed a moment of pausing or stilling and the direction of their attention toward the adult or smell. There was only one occasion when Andrew frowned at his nose being touched. This suggested that he did not like or had not anticipated the experience. This was an important consideration. It seemed to be the case that for the other pupils a vocal prompt was offered and this helped raise the pupils' awareness of the adult's presence before they made physical contact with the pupil.

There were other occasions when the adults touched the pupils' lips as part of the smelling experience. This was when they were presented with a spoonful of food for tasting. This was responded to negatively by Andrew and Maria on two occasions. Again, it suggested that the pupils did not like the experience or had not anticipated it.

The positioning of odours by supporting adults during the smell activities varied. For example, gradually bringing a smell to their nose from a distance (Mohammed and Matthew); holding a smell directly under the pupil's nose (Patrick, Saeeda, Zara, Andrew, Maria and Mohammed); moving a smell from one nostril to another and back again (Matthew, Maria and Mohammed) and gradually presenting a smell to each nostril (Mohammed and Matthew). It was the case that none of the adult participants commented specifically on these various strategies. My observations suggested that the most frequent method of presenting the smell was to hold it directly under the pupil's nose. However, this did not always have a positive effect. In one of my observations of Mohammed, he seemed overwhelmed by the smell. This resulted in him turning away from the smell and disengaging with the activity. Similarly, when

Mohammed and Matthew had a smell presented to both nostrils and moved back and forth from one nostril to another, this seemed to cause fleeting eye movements and they became distracted.

Another interesting observation was that there were occasions when the adult gave the pupil complete control over the smelling activity and that this had resulted in positive change. For example, when Saeeda, Zara and Maria were allowed to touch and explore scented items they became more engaged. However, it was remarked by two of the parents that the pupils also appeared to want to taste the scented items being presented to them but that this did not happen. This would suggest that the opportunity to taste a smell whenever possible would be preferable. There were some situations when it was not recommended that pupils tasted certain smells. For example, Zara's teacher noted that strong cooked smells made her unwell so only some milder scented food items were encouraged.

It is important to note that, at interview, three of the parents but only one of the teachers remarked on environmental odours that were perceived to be detected by the pupils. For example, Mohammed's mother noted how he could pick up smells when she was baking, at mealtimes or bath times. Patrick's mother remarked that he actively "sniffed" when they are "out and about." This seemed to suggest that the teachers were less attuned to the pupils' abilities to detect environmental smells.

Literature sourced for this study has offered some suggestions in terms of how adults should present smells to pupils. However, this has primarily resided within the work of Longhorn (1988) with some suggestions from Pagliano (2012). The table below has aligned guidance provided by both these authors with the various ways in which I observed smells being presented to pupils within this study.

Type of strategy	Longhorn's and Pagliano's recommendations	Observations from this study
Use of a verbal cue	Talk to the child beforehand, explaining what is going to happen before doing anything and tell the child which smell objects he will be smelling (Longhorn, 1988:105).	Stating the pupil's name and that it was time for 'smelling.' Telling the pupil what smell they will be experiencing.
Use of a physical cue		Touching or stroking the pupil's nose as a cue to smelling.
Use of positioning the smell	Place the smell in a variety of positions, e.g. near, far, above, close to and next to nose (Longhorn, 1988:105). Bring to the nose for smelling and then control the intensity of the odour by modulation (Pagliano, 2012:70)	Holding a smell directly under the pupil's nose. Gradually bringing a smell to their nose from a distance. Moving a smell from one nostril to another and back again.
Encouraging independent exploration	Encourage movement toward the smell (Longhorn, 1988:105).	Placing scented items in the pupils' hands and allowing them to explore independently if possible.
Time	Allow time for the child to have a good smell (Longhorn, 1988:105).	Withdrawing the smell when the pupil showed signs of displeasure. Holding a smell under the pupil's nose for extended periods of time when they showed signs of pleasure.
Concentration of the smell	Offering the strongest smell last (Longhorn, 1988:105). Present a mild intensity and then increase as necessary (Pagliano, 2012:70)	

Table 16: Aligning the work of Longhorn (1988) and Pagliano (2012) with strategies used within this study.

The various strategies seen above show numerous similarities and differences in the approaches given. For example, Longhorn suggests placing smells in a variety of positions and a discrete range of positions were observed as having a positive outcome within this study. However, my observations suggested that it was preferable to primarily be sensitive to the level of concentration of the odour through presenting a smell gradually from a distance and to not move the location of the smell whilst the pupil was experiencing it. This can be more closely aligned with Pagliano's (2012:70) suggestion of "controlling the intensity of the odour."

Longhorn also emphasises the need to talk to the child to explain what was happening and similarly there was evidence within this study that the pupils were told it was “time for smelling;” there was also a recognised need to facilitate opportunities for the pupils to engage with the smelling experience at their own discretion and in their own time – allowing them to engage tactually with items and have time to have “a good smell.” This was also reflected in my observations.

Of note was Longhorn’s recommendation to use the strongest smell at the end of a session. This was a feature not observed within the study period as only one scent was used within each activity. However, the idea of the intensity or strength of an odour having a bearing on the responses of pupils was evident within discussion with the adult participants and is reflected in Pagliano’s suggestions which I will discuss in greater detail in the next section *Sensory Thresholds*.

One consideration that was not mentioned in Longhorn’s work was the use of a touch nose, i.e. touching the pupils’ noses as a cue to smelling. The findings of this study suggested that this was a useful intervention to direct the pupil’s attention to the smell, if carried out in a sensitive manner.

Overall, the combination of strategies offered by Longhorn and those observed within this study seemed to suggest that the most important way forward was to be sensitive to, and respectful of, the pupils’ responses. There seemed to be a need to continually gauge the point or range at which the pupils were appropriately stimulated and engaged with the smell experience without being under- or over-stimulated by it. The strategies used by adults that elicited positive responses have formed the basis to the development of sensory profiles for pupils at Beechleaf school which is now an integral part of the teachers’ planning for multi-sensory learning (See Appendix 8).

4.4. Sensory thresholds

Within this study, it appeared that the intensity of a smell experience, irrespective of its specific scent, had a significant impact on four of the pupils' responses. This bears on how smells should be presented. In this section, I will provide accounts of Mohammed, Matthew, Andrew and Saeeda's responses to certain smells, and consider how the concentration of the odour impacted on their abilities to engage with the experience itself.

Findings

Mohammed

During the research period, Mohammed was observed being presented with the smell of vanilla, eucalyptus and perfume worn by a familiar adult. From my own observations and from the comments made by the adult participants there appeared to be occasions when these smells had been quite overpowering:

[He is] making a noise – noise wasn't comfortable – inhaling

(Mohammed's teacher observing his response to the adult wearing perfume)

He likes the vanilla – it didn't cause as much stress as the eucalyptus

(School therapist and use of vanilla)

Looks like he pulled away (School therapist and use of eucalyptus)

The adult participants' remarks suggested that he was at times not comfortable; that the eucalyptus smell had been "stressful" unlike the vanilla and that he had on occasion "pulled away" from the smell. From my own observations, Mohammed tended to smile, vocalise cheerfully and pause when he liked a smell. However, a dislike was indicated by pulling or turning his head away, closing his lips and vocalising in disdain. The suggestion that he was not happy or overpowered by smells was

evident from my observations of Mohammed on two occasions: once when he was presented with the smell of eucalyptus at close proximity and on another occasion when the adult wearing perfume had positioned herself very close to his face.

Matthew

In Matthew's case, there seemed to be occasions when he had not detected smells. This occurred when cocoa butter massage cream was presented to him during a relaxation activity. Comments made by the adult participants included:

Wasn't sure at first (School therapist)

Hasn't responded (Matthew's teacher)

No movement in his eyes (Matthew's mother)

These comments suggested that there were no significant responses from Matthew that could be interpreted as a reaction to the smell. It was interesting that Matthew's mother specifically identified a lack of eye movement as a pivotal sign of his lack of response.

Andrew

From my observations of Andrew being presented with the smell of his snack, he appeared to display an increasing number of responses which had resulted in his desire to taste the food. An example of this, was one occasion, when he, at first, did not seem to respond to the smell but then showed an increase in hand and eye movement followed by the opening of his mouth and protruding of his tongue. This was remarked upon by both his parents and teacher:

Hands stopped – hands are moving - moving mouth, face, increased movement
(School therapist)

Not as responsive – now moving - moved mouth and tongue (Andrew's teacher)

Saeeda

Like Andrew, Saeeda also displayed increasing responses when presented with the smell of vinegar at the latter stages of the research period. From one of my observations, she at first was moving her head from side to side, she then paused intermittently to experience the scent. She then leaned forward, closed her eyes and moved her mouth close to the container of vinegar, touching it to taste the vinegar. This was also noted by the adult participants:

She's moving her head – wants to drink – amazing how responses change (Saeeda's teacher)

She wants to explore it – she's trying to drink it (School therapist)

Interpretation of findings

Both Mohammed and Matthew's experiences suggested that there were differing levels of strength needed for the individual pupils to be able to engage meaningfully. Mohammed had appeared to be quite overpowered by certain smelling experiences which had resulted in his inhaling and pulling away from the scent. This seemed to suggest that he needed a milder concentration of the smell. Matthew, on the other hand, seemed to show no response to the smell of cocoa butter. Since he was known to have experienced this smell numerous times in the past, it appeared that the odour may have been too weak for him to detect. With respect to Andrew and Saeeda, it seemed to be the case that there was a progression in their range of responses from fleeting eye movements and pausing to the opening of their mouths and intent in tasting the scented food items. The findings suggested that certain boundaries or "thresholds" existed in terms of whether a smell was too strong, too weak or just right and that these were quite individualised (Pagliano, 2012; Rouby et al., 2002).

Interestingly, the progression in response – displayed by Andrew and Saeeda – seemed to indicate a development in their associations with the scents.

As discussed in my literature review, Pagliano (2012:20) has identified three different sensory thresholds: detection, recognition and differential thresholds. In the following sections, I will present evidence to suggest that two of these sensory thresholds could be viewed from my observations of Andrew and Saeeda.

When Andrew was presented with the smell of food, he at first did not respond but then showed an increase in hand and eye movement. As remarked upon by both his parents and teacher, this seemed to indicate that he had detected the smell or had begun to show an awareness of it. Andrew's responses then changed to the protruding of his tongue and opening of his mouth. It appeared that he had then made an association with the smell as his snack. The figure below aligns Pagliano's (2012) idea of detection and recognition thresholds with Andrew's responses.

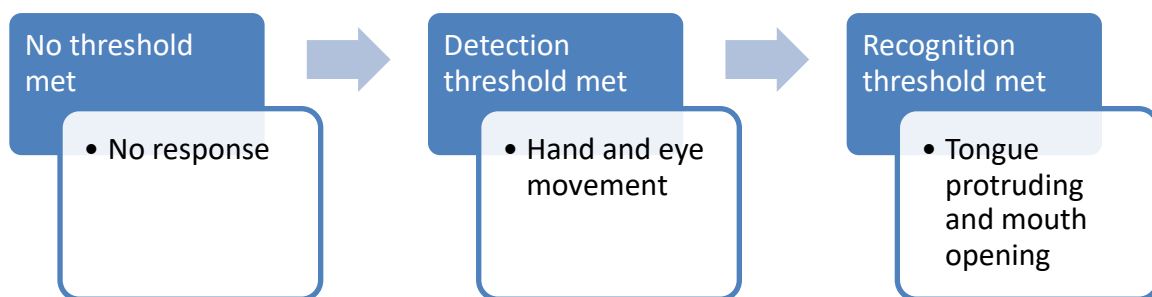


Figure 5: Andrew's responses in relation to sensory thresholds.

In Saeeda's case, she at first displayed a change in her head movements in response to the smell of vinegar. For example, pausing intermittently to experience the scent and then returning to moving her head from side to side. This was the first indication that she had detected the smell. She then leaned forward, closed her eyes and moved

her mouth close to the container, touching it to taste the vinegar. It then appeared that Saeeda had made the association with the vinegar as being something she wanted to taste. These observations have also been aligned with Pagliano's (2012) idea of sensory thresholds:

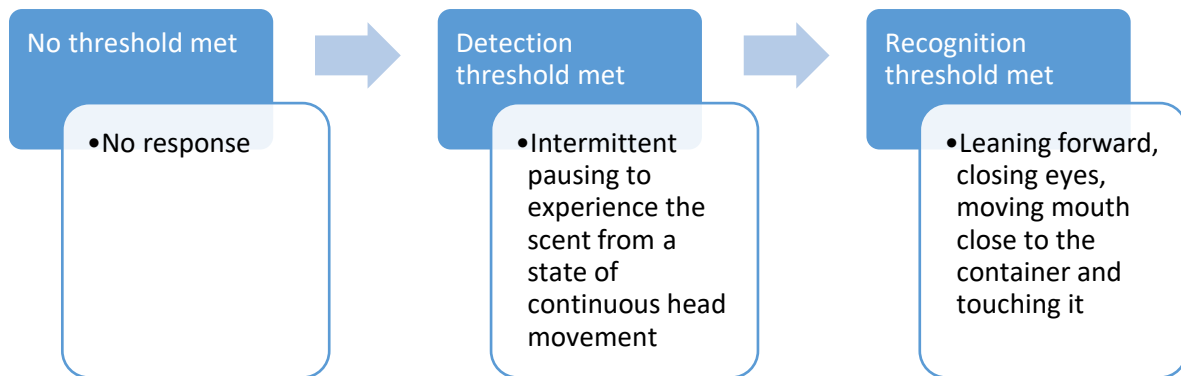


Figure 6: Saeeda's responses in relation to sensory thresholds.

However, it was clear that these occasions only existed when the adults working with the pupils had employed a *responsive approach*. By this I mean that they were sensitive to the pupils' reactions and adapted their approach accordingly. For example, initially keeping smells at a certain distance and then drawing them closer until the pupil responded; pausing intermittently, moving the scent away and back from the pupil or allowing the pupil to move away from or toward the scent themselves. This in some ways reflected the "Methods of Limits" approach to defining and measuring sensory thresholds (Swets, 1961) - wherein the intensity of a sensory stimulus is increased and decreased.

Through the use of the sensory threshold model offered by Pagliano, the responses of pupils could be suggested to have aligned with the ideas of "detection" and "recognition." However, it was difficult to ascertain if a differential threshold was or could be met as it implied a "perceived change" in the smell itself (Pagliano, 2012:21).

It was not the case that the vinegar or fruit snack experienced by the pupils had been changed in any way.

A further investigation into the idea of sensory thresholds led me to the possibility of a “terminal threshold” which is known to be “the point at which a sensory stimulus is so strong that the sensory receptors no longer detect the stimulus” (Lumen, 2021). I felt that a sensory threshold model that included the idea of a terminal threshold better suited the nature of my findings, given that Mohammed seemed to have been overpowered by the smell of eucalyptus and on occasion the adult’s perfume.

Consequently, Figure 7 includes, on one hand, the progressive movement from a point of “no threshold” to the “detection” and “recognition” thresholds. Also, the direct movement from a point of “no threshold” to “terminal threshold” representing the idea of being overpowered by a sensory experience.

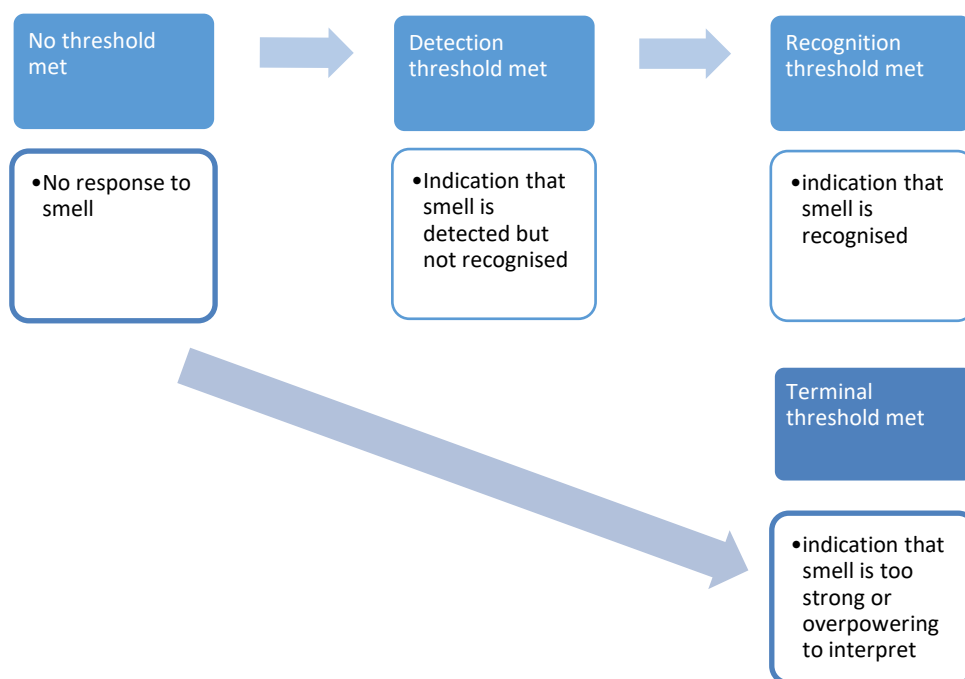


Figure 7: Pupils’ responses in relation to sensory thresholds throughout the study period.

4.5. Smell as an alternative and an additional way of learning

As mentioned earlier, it has been recognized that there exists a high prevalence of sensory impairments within the PMLD population, with UK studies suggesting that up to 68% of individuals experience physical impairments, 53% with visual and 8% with hearing difficulties (Mencap, 2010). These statistics would imply that over half of the PMLD population are potentially limited in their abilities to physically engage with objects and materials within their immediate environment. Coupled with this, as noted in Chapter Two, is the probability that, in addition, they may also experience visual and/or hearing difficulties which further limit their capacity to access information about their surroundings. Of the seven case study pupils involved in this study, six pupils had a combination of physical and visual impairments and one pupil also had a hearing impairment. This meant that all of the pupils had very limited functional vision and mobility and that one pupil had in addition limited use of her hearing.

This study has provided evidence to suggest that the use of certain smells helped to stimulate the pupils' engagement in activities. Within this section I explore in detail one significant example of this – Matthew's case. Matthew arguably had the severest of physical and visual disabilities amongst the pupil group, leaving smell as one of few senses left active, allowing closer observation of his use of this. Unlike the other pupils, he could not actively move his fingers, hands, arms or legs to physically engage with objects and was not able to interpret any form of visual stimulus. However, despite the severity of his impairments he was able to actively engage in smelling activities, and the nature of his responses appeared to be increasingly positive over the fieldwork period.

The following three extracts reflect my own and the adult participants' observations of Matthew over the eight-week study given his responses to the smell of rosemary used within his end of day routine.

Findings

On Week one, I observed the following:

Rose (adult support) was seated close to Matthew who was in his wheelchair. Although, the activity was a group session, both Matthew and Rose were positioned in a discrete area of the classroom, slightly away from the group. Rose introduced the smell experience by stating, "It's the end of the day, so we are going to have our smell." She then proceeded to touch Matthew's nose saying, "You are going to use your nose. Ready!" Matthew appeared to roll his eyes upwards and lifted his head in response to the adult. She then presented the smell of rosemary on a piece of cotton wool close to his nose. He dropped his head, licked his lips and began to inhale the smell. His eyes seemed to move to the left and right as he inhaled. The adult moved the piece of cotton wool back and forward between his two nostrils saying, "Do you remember that, do you remember that smell?" Matthew continued to move his eyes to the left and right, licking his lips and then dropped his head further. Rose said, "I think you do remember, I think you do remember the end of the day smell." She then removed the cotton wool.

On this, my first observation of Matthew, there were a number of changes in his responses which seemed to have been a result of his experience with the rosemary smell. For example, he demonstrated fleeting eye movements, the licking of his lips, the drooping of his head and his inhalation. These responses, at this early stage in the research, seemed to indicate that he had shown an awareness of the smell. Matthew's parent, teacher and the school therapist were invited to give their views on Matthew's responses on this occasion. The following remarks were made by these participants after viewing the video recording of this observation:

He recognised the smell. (Parent)

He's opening his eyes and paying attention. (Teacher)

He is responding, moving his head and eyes but I'm not sure if he likes it. (School therapist)

These perspectives offered a range of interpretations of Matthew's responses. For example, the teacher felt he had attended to the smell; the therapist noted his head and eye movements, although he was uncertain as to what it meant, and Matthew's parent thought he recognised the smell.

By week three, I observed the following:

Sally (adult support) was seated close to Matthew who was in his wheelchair. As before, Matthew was positioned in a discrete area of the classroom, slightly away from the group. Sally introduced the smell experience by stating, "I'm going to touch your nose, cause you are going to smell the end of the day smell." Then Sally proceeded to touch Matthew's nose. He responded by moving his head in the direction of the adult, shifting his eye gaze and smiling. The adult then began to move the rosemary smell (on cotton wool) towards his nose to which he began to open his mouth and lick his lips. His eye gaze and head movement continued to shift slightly to the left and right. He then moved his head toward the cotton wool and touched it with his nose, smiling. He then licked his lips and took a deep breath. The adult moved the smell away. Matthew continued to lick his lips for a short time and shifted his eye gaze again momentarily.

These responses were very different from my initial observations of Matthew. When the rosemary smell was presented close to his nose, Matthew opened his mouth and licked his lips, he moved his head toward the cotton wool and touched it with his nose, smiling, continuing to lick his lips and inhale. This response seemed to suggest there was greater intent and a heightened level of engagement in the whole experience. The following comments were made by his parent, teacher and the school therapist:

He alerted, he was really happy, he lent forward, he wanted to smell it and knew it was coming.
(Parent)

He's smiling and moving his mouth. (Teacher)

He likes the adult, smiles, makes sounds, moving mouth and head and is more awake and aware. (School therapist)

The above remarks indicated that Matthew was perceived by all the adult participants as responding more positively to the smell experience. It was significant that he was noted to have smiled, moved his mouth and head and made sounds. However, it was implied by the school therapist that these responses were possibly partially a result of his interaction with Sally. Consequently, I wondered to what extent this adult's presence had influenced his responses. Could it have been that Matthew was more receptive to the smell given that he liked, and was familiar with, the adult working with him?

Matthew's parent, again, suggested that he "knew it [the smell] was coming," indicating that he may have somehow recognised and anticipated the use of the smell. This was not acknowledged by any of the other adult participants.

By week five, I observed the following:

Again, seated slightly away from the group, the smell experience was introduced by Tina (adult support) who said "Hi, Matthew," touched his nose, and continued to say, "Here's our smell of the day, rosemary smell." She moved the rosemary smell (on cotton wool) to his nose and held it under each nostril for approximately 5 seconds. Matthew's eye movement increased and he began to protrude his tongue slightly at first. He flinched and then moved his head in the direction of the smell. When the cotton wool was moved toward his left nostril, he moved his head up and again to the right side and smiled. He licked his lips and vocalised. Tina responded with a 'hmmm' sound and he smiled again.

This observation of Matthew showed changes again in his responses. For example, alongside the noticeable eye movement, his tongue protruded on smelling the

rosemary, he tilted his head toward the smell, smiled and vocalised. These responses seemed to suggest a more pronounced engagement with the smell experience.

Comments from the adult participants included:

He widened his eyes, smiled and recognised the smell and voice too. (Parent)

He opened his eyes, is smiling and moving his mouth a little bit. (Teacher)

He smiled, there's water down his mouth, it took a little time for him to respond. (School therapist)

Once again, the experience was perceived as eliciting positive responses including eye, mouth movement and smiles. Again, his parent felt he had recognised the smell.

Throughout the fieldwork period, Matthew's mother repeatedly implied that he could recognise smells. At interview, she commented that, "He knows his hospice nurse due to the perfume – he knows the smells of places – the house, hospital and Granny – he recognises the perfume." When analysing the video-recorded material on Matthew's responses to the rosemary smell, as we find here, his mother reiterated that he "recognised it" or "knew it was coming." So, what made her so confident? During my discussion with Matthew's mother, after her analysis of recorded material, it appeared that she was making certain associations that had supported her assertions. Although, she admitted that she hadn't systematically been interrogating his responses to smell at home, the family had been working on other sensory cues, "We have worked on cues when he approaches home – now when approaching the house, he recognises bumps on pathway" She continued to say, "it takes time for him to recognise cues – he knows (when) it's consistent." The idea of using a consistent approach was aligned with descriptions of Matthew's responses that had assured her he had recognised the smell - such as the widening of his eyes and smiling. She continued to explain the

different kinds of responses Matthew displayed and what each of these meant. For example, eyes rolling and head drooping meant that he was probably tired.

Interpretation of findings

The evidence provided here seemed to suggest that Matthew had benefitted from the experience of smell. Given that Matthew had a profound visual and physical impairment, it appeared that the use of smell had provided an alternative source of information resulting in a noticeable increase in his levels of awareness and engagement. His responses in week one had included fleeting eye movements, the lowering of his head, licking of his lips and inhaling. By week three, he appeared to open his mouth in response to the smell, move his head forward and touch the scented cotton wool. By week five, he was protruding his tongue, smiling and moving his head in the direction of the smell.

However, there were still unanswered questions. For example, why were the adult participants' interpretations of Matthew's responses so different? And how could we be certain that Matthew's responses were linked to the smell alone? In response to these questions, it is necessary to consider a number of factors: the relationship between Matthew and each of the adult participants; the nature and impact of the adult working with Matthew, the manner in which the smell was presented and other environmental factors that may have impacted on Matthew's responses. All of which I discuss in the next section.

When we consider the relationship between Matthew and his mother and compare it to that of the school therapist who knew Matthew less well we can understand why the therapist found it difficult to interpret his responses - "He is responding, moving his head and eyes but I'm not sure if he likes it." It would follow that Matthew's mother was

better equipped to decipher what his responses could mean as she knew him more intimately and so could give a better insight into what he may actually be perceiving. It was significant that the adult working with Matthew agreed with what his mother was saying. So, did Matthew actually recognise the rosemary smell? As Matthew was not able to tell us himself, we still question these many interpretations. I would suggest that it is in Matthew's best interests to do so.

It is also important to take into consideration the influence of the adult working with Matthew on his responses. The relationship between Sally and Matthew appeared to be a positive one – noted by the school therapist and his parent who remarked that Matthew, “liked the adult” and “recognised the voice too.” Could this alone have not been the reason for Matthew's smiles and mouth movement observed in the second video-recording? Or could it have been that Matthew was more receptive to the smell given that he liked, and was familiar with, the adult working with him?

It was the case that all of the pupils observed within this study required a high level of adult support. This meant that the nature of the pupils' experiences of smell were inextricably intertwined with the adult working with them. Consequently, a positive or negative response to the smell of rosemary would in some way have been shaped by the adult. My suggestion is that it is not necessarily the case that the adult was solely responsible for Matthew's actual responses to the smell but that they added to the experience itself.

One final point I want to make is that the influence of environmental factors needs to be taken into consideration when observing pupils within a classroom environment. The sounds of other adults' and pupils' voices, the lighting, temperature all can have an impact on the pupils' responses. During Matthew's experiences of smelling

rosemary, other environmental factors were not remarked upon by the adult participants. Given that Matthew was positioned in a discrete area of the classroom this may have helped to contain other possible environmental factors. However, they are important to keep in mind.

4.6. Smell as a support for eating and drinking routines

From my observations, there appeared to be evidence to suggest that the experience of smell supported eating and drinking routines. It was the case that even those pupils who had difficulties with swallowing and those for whom taste was not normally permitted, the act of smelling ignited responses that indicated a desire to taste. For example, the opening of the pupils' mouths, leaning their heads forward and protruding of their tongues.

Within this section, I will explore observations made of one student, Andrew, at snack time to support this claim. Andrew had a severe visual and physical impairment which meant he was unable to visually locate or hold food items. He also experienced difficulties with swallowing (oral pharyngeal dysphagia) and consequently, required intensive adult support to help him with feeding, so presents a useful case for exploring the potential of the sense of smell in supporting eating and drinking. Here I draw on video-recordings of Andrew's responses at snack or mealtimes: he was the only pupil to be video-recorded at these times, and this was a research decision made to allow close observation and analysis of what I deemed a significant case in this regard. The findings here seem to suggest that the sense of smell had helped to raise his awareness of the presence of food and allowed him to anticipate feeding routines. This was an important finding given the nature of Andrew's impairments.

Further evidence to support the close connection between smell and taste has been included in the following sections: 4.7 Smell as part of a multi-sensory approach, and 4.8 Smell as a support for the development of recognition where Saeeda, Zara and Maria's responses suggested a desire to taste food items.

Findings

Here, I will present the comments made by the adult participants on the video-recordings of Andrew at snack time.

Name of video-recording	Responses noted by the parent	Responses noted by the teacher	Responses noted by the school therapist
00003	Moving his mouth – hands more quiet – more interested	Swallowing and mouthing	Looking up – hands moving
00023	Smiled – eyebrows moved up - thinking	Hands stilled – moved mouth and tightened lips – doesn't want it - music is loud -	Stilling to smell – music very loud!
00028	Moving his lips but not as responsive	Moved mouth – hands stopping	Hands moving, mouth and face – eye fleeting and increased movement
00047	looking	Moved mouth and tongue	More movement -
Other comments	Good – he knows if he likes it	Definitely responds to vocal and smell cues – definitely taking in information more open on different days	No comment

Table 17: Comments made by the adult participants from observing video-recordings of Andrew at snack time.

As Table 17 shows there were a range of responses to smell noted by the adult participants which included changes in mouth, lip, tongue, eye and hand movement. Table 18 details the full range and frequency of these responses. It is of significance that mouth and tongue movements and stilling (or the decreasing of Andrew's body and hand movements) were the most frequent responses noted.

Responses noted to smell	Number of recorded responses made by the adult participants
Mouth/tongue movements Including the opening of the mouth, moving and tightening of his lips, moving or protruding tongue and swallowing	5
Hand and arm movements Including an increase and decrease in whole hand movement,	2
Eye movements Including looking up, moving eye brows, eye fleeting and directional gazing or looking	2
Head movements Including moving head up or to the side	1
Stilling Including a cease in hand and whole-body movement	5
Vocalising	0
Nostril movements Including sniffing or inhaling	0
Whole body movements Including moving forward or backward	1
No change	0
Other facial expression Smiling	0

Table 18: The range and frequency of Andrew's responses to smell noted by the adult participants.

However, it is also important to highlight that other factors were suggested to have had an impact on Andrew's responses within the video-recordings. For example, the "loud" music being played in the classroom during one of the observations, remarked upon by the teacher and school therapist and the influence of "vocal" cues, implying the voice of the supporting adult. My observations of the same video-recordings (See Appendix 12) suggested the following:

The first observation seemed to show that Andrew had displayed changes in mouth, hand and eye movements whilst experiencing the smell of his snack. He begun to open and close his mouth repetitively and his hand movements had decreased, from a state of constant motion to being still, when the bowl of fruit was presented at close proximity. In terms of his eye movements, Andrew seemed to be looking up and around prior to the intervention and his eyes were directed toward Mary (the supporting adult) when she presented the bowl of fruit to him. When the sound of the story tape increased momentarily Andrew's eye gaze moved to his left side.

In the second observation, Andrew was being offered a thickened drink by a different member of staff. The music being played was quite loud but this did not appear to be impacting on Andrew's ability to interact with the adult. At first, his drink was presented briefly under his nose and then the adult touched his lips with the spoonful of food. In response, Andrew initially displayed an increase in his hand movements, the raising of his eyebrows and seemed to smile. On the second occasion this happened Andrew frowned and tightened his lips. The adult made two further attempts to hold the spoonful of food close to Andrew's lips but he continued to tightly close his lips and frown.

The third observation seemed to show that Andrew had again displayed changes in mouth, hand and eye movements whilst experiencing the smell of his snack. On this occasion he was again supported by Mary. When he was presented with his bowl of fruit at close proximity, his eye gaze became fixed and his hand movements decreased. He then appeared to make mouth movements, opening his mouth and swallowing. On this occasion, the adult did not bring a spoonful of food to his mouth and he opened his mouth voluntarily.

In my final observation of Andrew, he was being supported by Mary again, it appeared that mouth, eye and hand movement were responses that featured greatly. Eye movements included gazing upwards, from left to right followed by the protruding of his tongue, emergence of drool, swallowing actions and the opening and closing of his mouth which suggested he was attempting to taste or prepare for mouthfuls of food.

Interpretation of findings

The experience of smell seemed to have caused a positive change in Andrew's responses, when initially presented with the smell of his snack there was an increase

in mouthing, decrease in hand movement and the fixating of his eye gaze. Head and whole-body movements were less evident and ironically, there appeared to be no evidence of Andrew actively sniffing his snack time food or thickened drink.

What was interesting was the ways in which the adult had tried to raise Andrew's awareness of his pending snack time routine. For example, how she spoke with him, touched his nose and allowed him to feel his bowl as a cue to eating. Altogether, these verbal, tactual and smelling prompts seemed to offer Andrew a multi-sensory experience to help prepare him for the eating experience. Each of these prompts had resulted in a response from Andrew, whether it caused a frown or change in eye or hand movement. However, the impact of the smell experience appeared to have been more pronounced. It did seem that Andrew's responses were stronger when given the opportunity to smell his food.

An important observation was that Andrew had tightened his lips, in the second observation, when the adult tried to press the spoonful of his thickened drink on his lips. This appeared to be an indication that he did not want his drink: this was interesting given that he had initially responded positively to the smell of it. From this observation of Andrew, it seemed that there was a contradiction in his responses to smell and taste. It suggested that a positive response to smell may not necessarily be followed by a desire to taste. In Andrew's case, this may have occurred for a number of possible reasons. Firstly, he may not have recognised that it was his drink. Alternatively, the manner in which the spoonful of food was presented to his lips may have caused him some distress, or he may not have had enough time to prepare for an eating experience. It was interesting that in previous observations, Andrew had opened his mouth in response to the smell of food whereas in this instance he had kept his lips sealed. It would appear that in Andrew's case, it may be important for the

adult supporting Andrew to wait and look for responses, such as the opening of his mouth and protruding of his tongue, as an indication that he is ready to eat.

As highlighted in my literature review, both the senses of smell and taste, known as the *chemical senses*, together perform a range of significant functions such as the ability to distinguish different flavours (Neil Martin, 2013; Pagliano, 2012; DeVere and Calvert, 2011). This also mirrored the sentiments of Longhorn (1988) who had described the combined functions of smell and taste as providing a necessary means to the 'stimulation and awareness of smells linked to tastes' and in 'improving feeding' (Longhorn, 1988:96).

From my observations of Andrew, the opportunity to smell his food seemed to provide an important cue to feeding. On all four separate occasions, when Andrew was offered a small sample of food close to his nose, prior to eating, he responded in a manner that suggested the experience of smell had been stimulating and helped to increase his levels of awareness of the presence of food.

His mother later remarked that she felt he only seemed to respond to the presence of his snack when given the opportunity to smell it. It was significant that the use of smell was evidenced by both his mother and through my own observations to be providing an important cue for Andrew in alerting his attention to the presence of food and helping him to prepare for his snack.

4.7. Smell as part of a multi-sensory approach

The idea of a multi-sensory approach, as highlighted in my literature review, is a method of teaching that aims to integrate a range of senses into the pupils' learning experiences (QIA, 2008). It is recognised that utilising more than one sense at a time

is a more effective means of supporting learning than using one sense alone (Coffield, 2004). Within this study, there were a range of observations made of pupils that suggested that the use of smell alongside other available sensory systems provided a more engaging and motivating learning experience for pupils.

Findings

In this section, I will present an overview of three of the pupils' responses to smells – Zara, Saeeda and Maria. The observations here include comments made by the adult participants and my own observations. Zara, Saeeda and Maria's responses are of particular interest because they illuminate how some pupils showed a desire to actively use a range of other senses to support their experience of smell, for example, touch, movement and taste. Matthew, Mohammed, Patrick or Andrew also used other senses when engaging with smell. However, the combination of their responses was subtler.

Observations of Zara

Responses noted to the smell of spices – cumin, garam masala, balti masala, lemon curd and peppermint	Number of occurrences noted within thirteen observations
Mouth/tongue movements Including the opening of the mouth, moving or protruding tongue	2
Hand and arm movements Including reaching out, grasping and pushing away.	9
Eye movements Including widening of the eyes, directional gazing and blinking.	1
Head movements Including moving or tilting head forward/backward	10
Vocalising	1
Nostril movements Including sniffing or inhaling	7
Whole body movements Including moving forward or backward	2
Other facial expression Including laughing and smiling	2

Table 19: Frequency of Zara's responses to different smells.

As Table 19 shows, Zara's head movements were the most frequent responses, with 10 observations noted within the research period. These reactions included Zara's

forward and backward head movements and the tilting of her head into the scent filled packets or containers. Hand and arm movements also scored highly with nine occurrences observed including reaching out toward, grasping, holding and putting her hands in or pushing away scent filled packets or containers. Nostril movements were observed on five occasions including inhaling and sniffing. Mouth and tongue, eye, whole-body movement, stilling, laughing and smiling were lesser evident.

Observations of Saeeda

Responses noted to the smell of chocolate powder, vinegar, tea tree and eucalyptus	Number of occurrences noted within twelve observations
Mouth/tongue movements Including the opening of the mouth and attempting to taste/drink scented items	12
Hand and arm movements Including hand clapping, reaching out, grasping and pushing away.	3
Eye movements Including widening of the eyes, eyebrow movements, directional gazing and blinking.	1
Head movements Including moving head forward/backward, swaying or nodding	19
Stilling	9
Vocalising	0
Nostril movements Including sniffing or inhaling	3
Whole body movements Including moving forward or backward	8
No change	3
Other facial expression Including smiling	2

Table 20: Frequency of Saeeda's responses to different smells.

As Table 20 shows, Saeeda's head movements were the most frequent responses, with 19 observations noted. These reactions included moving her head forward, backward and nodding her head. Mouth and tongue movements also scored highly with 12 observations noted - including the opening of her mouth and attempts made to taste or drink the scented items. Stilling, hand and arm, eye, nostril and whole-body movements and other facial expressions were lesser evident. Saeeda's head

movements were remarked upon, in particular, by the school therapist who commented:

No – turning head – moving away – might be whiffing using head movements to moderate how much she is taking in. (School therapist)

Observations of Maria

Responses noted to the smell of apple, banana, orange juice and strawberries (whole fruit and scented bubbles)	Number of occurrences noted within thirteen observations
Mouth/tongue movements Including the opening of the mouth, licking, moving or protruding tongue	41
Hand and arm movements Including arm raising, reaching out, grasping and pushing away.	18
Eye movements Including widening of the eyes, eyebrow movements, directional gazing and blinking.	5
Head movements Including moving head forward, up or to the side	11
Stilling	1
Vocalising	5
Nostril movements Including sniffing or inhaling	4
Whole body movements Including moving forward or backward	1
No change	0
Other facial expression Including smiling	2

Table 21: Frequency of Maria's responses to different smells.

As Table 21 shows, Maria's mouth and tongue movements were the most frequent responses, with 41 observations noted. These reactions included the opening of her mouth, protruding of her tongue and attempts to move her tongue or lick scented items. Hand and arm movements also scored highly in the use of arm raising, reaching out, grasping, and pushing scented items away. Head movements that included moving forward occurred on 11 occasions. Eye, nostril and whole-body movements, vocalisations, stilling and smiling were less evident.

The importance of being able to experience smell alongside other senses had been commented upon by three of the adult participants, at interview:

I think it should be integrated... we have five senses...we should engage with people at the level of five senses. (School therapist)

Smell helps as part of a sensory approach. (Maria's teacher)

It's a means of giving a holistic sensory experience. (Head of School).

However, there were occasions within the research period when the pupils were not given the opportunity to engage with smells using their other senses. During the fieldwork period, the teacher had not allowed Saeeda to taste the vinegar. Similarly, the adult working with Maria had not allowed her to taste any of the scented items used within her smelling sessions. For example, when she was presented with the smell of banana Maria had directed her head movement toward the smell, opening her mouth and protruding her tongue. However, the adult withdrew the smell before she could touch or taste it. It was notable that, in Saeeda's case, her mother later commented:

It would be good for pupils that experience these smells to be allowed to taste them!

For certain activities such as cooking, it was remarked that smell already played an integral part in the learning experience:

'In cooking...I wouldn't use it distinctly...you would touch it, feel it, see it and then smell it but I wouldn't have introduced it as a smell if it was part of what I was doing. (Head of School)

However, smell was not a sense that necessarily fitted into every learning activity. Other activities were specifically designed to include the use of smell. For example, massage and relaxation sessions that used scented creams and morning circle or going home sessions that used a fragrance as a signifier.

Of significance was that there were concerns raised when there was no clear contextual relevance to the use of certain smells. That is to say when smells were introduced without any distinct relation to the activity itself. For example, when Matthew was offered a rosemary smell to signify the end of his school day. One of the senior leaders expressed her concern that smells were being used indiscriminately, she remarked:

I know a teacher that uses a smell for the day...it's out of context...if we go to the sensory garden in context you get smells. That's natural and in context and if I replicate that in the class it doesn't seem right...it needs to be contextual.

The school therapist noted that he perceived that a lot of teachers felt they needed to include smells in every activity regardless of whether there was a clear logic underpinning why certain smells were being used:

I think everyone has a sense of wanting something sensory in terms of smell in all their lessons...but whether they know why they are doing it is another question.

This raised a contentious point. Was it necessary to include all of the senses in every activity? Given that certain activities may not lend themselves to the use of smells, was it really then necessary to include this sense?

Interpretation of findings

The findings suggested that each of the pupils' responses to smell were aligned with the use of other sensory functions. Zara and Saeeda appeared to more frequently demonstrate changes in head movement which was suggested to indicate the desire to control the distance between themselves and the odour. In Zara's case, this involved lowering her head in and out of opened packets of spices. With Saeeda, it appeared that she moved her head back and forth, in a swaying motion, pausing

intermittently as if to regulate the intake of the odour. This was also remarked upon by the school therapist. There was evidence to suggest that Zara and Maria often sought to physically engage with scented items through reaching out, trying to grasp and hold the scent filled packets, containers or items that were presented to them.

Maria and Saeeda exhibited frequent mouth and tongue movements which suggested a desire to taste. Maria, in particular, was noted to have either opened her mouth, protruded her tongue and attempted to lick scented items on 41 occasions. It was not apparent; however, why the adults working with the girls had not allowed them to taste the vinegar and banana food items. Saeeda was known to enjoy consuming a wide range of foods orally. Maria was fed via a gastrostomy tube; however, she was allowed small lip swipes of different flavours. It did seem that both girls should have been allowed to smell and taste in order to improve the quality of their experience.

Overall, these results suggested that, whether through touch, movement or taste, the pupils seemed to instinctively want to engage with the smell experience in a multi-sensory way. It would follow that, for future practice, pupils should be permitted to do so.

With regard to the incorporation of smells within activities that may not necessarily lend themselves to the use of a scent - for example, a music session or end of day circle time – it could be argued that, for this cohort, the use of a smell would provide an important sensory feature of any activity. However, to use a scent, such as rosemary, as a signifier for an end of day session may indeed be confusing if the pupil experienced the same smell on a routine visit to a sensory garden. It would follow that decisions about the use of smell incorporated these considerations.

4.8. Smell as a support for the development of recognition

What I aim to explore within this section, is evidence to suggest that five out of the seven pupils - Mohammed, Patrick, Saeeda, Andrew and Matthew – were perceived to have shown the ability to recognise certain smells. This is of particular significance given that pupils with PMLD are known to experience the severest of cognitive impairments with the ability to ‘recognise’ or ‘understand’ being a higher skill level for this cohort (PMLD Network, 2016; DfE, 2014; Simmons, 2011).

A point I wish to highlight is that, at the beginning of the fieldwork period, although a number of parents felt that their child could ‘recognise’ and ‘understand’ various people, places and events through their use of smell, the teachers, as a whole, did not share the same view. Smell was referred to as:

A form of stimulation...making the world more pleasant and interesting. (Executive Vice-Principal)

When asked how smell helped her pupils to learn, one teacher commented: “I don’t know.” However, after the research period it was clear that a progressive range of terms were used by teaching professionals to describe the pupils’ responses. These included the demonstration of the pupils’ ability to, ‘recognise,’ ‘understand’ and ‘anticipate’ classroom routines.

Findings

Here I present data from five of the parents who were of the opinion that their child could recognise either a place, person, food item or activity through its distinctive odour. The remaining two parents were unable to comment. See Table 22 below.

Name of pupil	Parent's comment
Matthew	He knows his hospice nurse due to the perfume – he knows the smells of places – the house, hospital and Granny – he recognises the perfume.
Mohammed	[He uses smell] to distinguish between rooms, places and activities.
Patrick	I think he associates me from the perfume I wear...he'll know, ah, it's mum. When we go to the farm he gets really, really excited from the smell of the cows and the pigs...its horrible...he seems to get really excited about that...I think because you get the smell first and then you hear the animals...he knows that something fun is happening.
Zara	She smells food in the home – she knows and likes banana yoghurt.
Saeeda	She recognises the smell of curry when I cook, my perfume (white musk) and the smell of fresh cut grass when they regularly visited the park.

Table 22: Parents' comments suggesting the pupils' abilities to recognise certain smells.

Matthew, Saeeda and Patrick's parents felt that they could recognise familiar people by the smell of their perfume, for example, the hospice nurse, granny and the parents themselves. There were references made to the pupils' ability to distinguish between different familiar places owing to their smell, for example, the hospital, park, farm or home. Zara's parent also remarked that she perceived Zara to be able to recognise one of her preferred foods - banana yoghurt.

At interview, it was only one teacher - Zara's teacher – who noted that having a routine smell cue during morning routines had helped her to anticipate the end of sessions but remarked that it had taken two terms for her to develop her understanding:

I think in the context of the morning circle and the sensory journey yeah it has...because we use that at the end of the morning circle she uses it as a marker...she will lift her head and look around and I think she's learning that after the smell something happens...it's given her a cue that something else is going to happen...it's taken time like two and a half terms.

Throughout the fieldwork period, there were changes in five of the pupils' reactions to certain smells that suggested an association had been made with these odours, as can be seen in Table 23 and discussed below.

Name of pupil	Smell	Activity	Changes in response
Andrew	Fruit	Snack time	Fleeting eye movement through to the protruding of tongue and opening of mouth
Matthew	Rosemary	End of day session	Licking of lips and inhaling to smiling, protruding of tongue and use of head movement in the direction of the smell
Mohammed	Perfume	1:1 adult intervention	Increased vocalisations, smiling and increased eye, head and mouth movement at latter stages of the research period
Patrick	Vinegar	Sensory story	Change from pushing away the vinegar smell to repeated attempts to inhale it and remain close to it
Saeeda	Vinegar	Sensory story	Indifference to the smell at the beginning of the research period to reaching forward, opening mouth and trying to hold and taste the vinegar.

Table 23: Pupils' response that suggested the ability to recognise a smell.

Matthew and Andrew

Matthew showed a noticeable increase in his responses to the smell of rosemary used in his end of day routine, as discussed earlier. His responses in week one had included fleeting eye movements, the lowering of his head, licking of his lips and inhaling. By week five, he was protruding his tongue, smiling and moving his head in the direction of the smell. His mother felt that he had “recognised it” and “knew it was coming.” As also evidenced in previous sections, Andrew’s responses to the smell of his snack had demonstrated a change from fleeting eye movements to the opening of his mouth and protruding of his tongue to receive food.

Mohammed

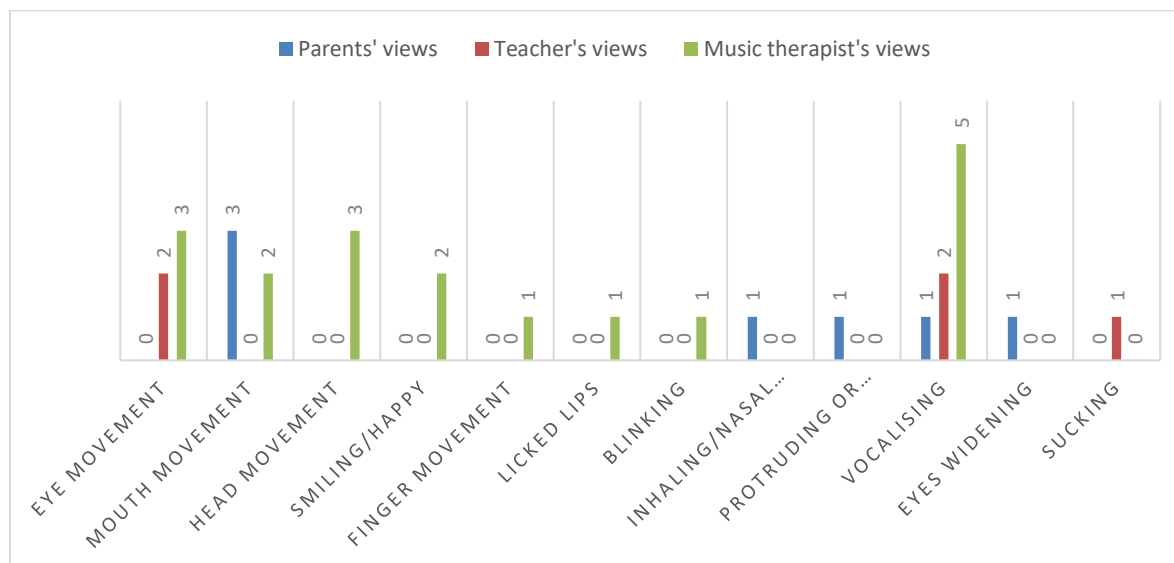


Figure 8: Nature and frequency of Mohammed's responses to an adult wearing perfume.

In Mohammed's case, his response to the presence of a familiar adult, known to wear the same perfume each day, showed repeated vocalisations and increased eye, mouth and head movement. This was significant given that the adult wearing the perfume was told not to speak with Mohammed during her approach. It followed that his mother suggested that he 'knew' and had 'smelt the adult' before they used their voice; his teacher acknowledged that Mohammed seemed to be demonstrating the ability to 'recognise' and had 'smelt and then started talking [to the adult]' and the school therapist indicated that the perfume had made him look up, drawing his attention to the adult (See Table 24).

Name of video-recording	Responses noted by the parent	Responses noted by the teacher	Responses noted by the school therapist
00101	Definitely moved mouth and lips when he first smelt the adult – it was like he knew they had come before they used their voice	Seems to be listening – recognising – did inhale – like he smelt but then started talking	Vocalises, mouthing and licking lips - the smell makes him look up, he draws his attention to the adult, seems to respond to the smell

Table 24: Comments made by the adult participants from observing video-recordings of Mohammed.

Patrick and Saeeda

My observations of Patrick and Saeeda suggested a progression in their responses from an initial dislike or indifference to the vinegar smell, to being actively interested in or tolerant of it after only a short number of weeks. At the beginning of the research period, I observed the following:

First observation of Saeeda:

Saeeda is sitting on her chair, hands on her lap. Her teacher is sitting close by, she touches her nose gently and says, "Are you ready for this Saeeda, smelling vinegar?" She then holds a small plastic container with some vinegar inside to Saeeda's nose. Saeeda continues to rock her head from side to side and the teacher follows her movements with the vinegar. Saeeda then stops and the teacher brings the smell closer to her nose saying, "Smell." Saeeda begins to move her head again from side to side. Saeeda pauses again to smell the vinegar for a short time and continues to move her head. The teacher moves the container away and strokes her arm once, saying "finished."

First observation of Patrick:

Patrick is seated in his wheelchair and is rocking his head from side to side. The adult states, "We've got some vinegar for you to smell." She then gently touches the side of his head and he pauses. She then touches his nose and brings a plastic container with vinegar close to his nose. Patrick pauses very briefly to experience the smell and then reaches forward with his arm to push the container away.

By the end of the research period the pupils' responses to the smell of vinegar were quite different, as detailed below. Saeeda's responses had changed from briefly attending to the smell to wanting to engage with it and taste it. Patrick seemed to have shown a lack of interest in the smell initially but at this later stage in the fieldwork period had begun to show an acceptance of and interest in it. I observed the following:

Saeeda:

Saeeda is again sitting on her chair. Katrina (adult support) is sitting close by and reaches out touching her nose saying, "You are going to use your nose." The adult holds the container with the vinegar in front of Saeeda. She leans forward, closes her eyes and moves her mouth close to the container, touching it. The adult says, "Oh, it's not a drink." Saeeda vocalises in response and pulls her head away. She reaches forward again with her mouth with greater intent and gently bites the edge of the container. Katrina repeats, "Oh" and pulls the container away to which Saeeda vocalises again. She rocks gently for a moment but her facial expression is quite disgruntled. Katrina continues to say, "Brilliant, good girl!" Saeeda remains still and vocalises quietly for a moment.

Patrick:

Patrick is in his wheelchair and seems to be sitting quite still. The teacher gently touches his nose and states, "It's vinegar, remember?" She holds the smell close to his nose. His eyes move from side to side as he inhales. He remains still. She continues to hold the smell close. Patrick continues to inhale and remain still. The teacher then removes the smell.

Saeeda's teacher affirmed my own judgements in that her responses to the smell changed over time, she remarked:

She wants to drink vinegar – [it's] amazing how responses change.

The therapist also felt that Saeeda was more accepting of the vinegar smell. He stated:

After smelling for so long could it be that she likes it or wants to drink it?

Patrick did not seem to push the smell away during the final observations. This was confirmed by the adult participants who later viewed the video material and commented that he gave clear and strong responses in respect of his intolerance to the vinegar smell at the beginning of the research period by initially pushing it away

with his arm. However, at a later stage he began to show an acceptance and interest in it. Comments concluded that he was:

Accepting smell – eyes rolling a bit – nodding head – liked it. (Teacher)

Hasn't pushed it away – sitting still and smelling it – greater tolerance. (School therapist)

Interpretation of findings

In Matthew and Andrew's cases the repeated use of particular odours within their existing daily routines – the preferred food at snack times and rosemary smell used at the end of each day – seemed to have supported their abilities to recognise the smells. Similarly, Mohammed's responses to the presence of a familiar adult, known to wear the same perfume each day, had shown repeated vocalisations and increased eye, mouth and head movement indicating his familiarity with the smell. This was supported by his mother suggested that he 'knew' and had 'smelt the adult' before they used their voice and acknowledging by his teacher.

Both Patrick and Saeeda's initial responses raised questions in terms of why the smell had caused such a negative or indifferent reaction. Was it too sharp or pungent an odour? And could the adult have been more sensitive to the pupils' responses when presenting the smell? Reflecting back on comments Patrick's mother had made about his use of smell at home showed that he actually enjoyed quite intense and distinctive smells. In her initial interview, she recollected times when the family had visited the local farm and spoke of how Patrick would delight in smelling the animals (See Table 22). Similarly, Saeeda's mother remarked that she really liked and recognised a range of strong and distinctive smells from home, for example, the smell of curry when she cooked, white musk that mum put on her each day and the smell of fresh cut grass when they regularly visited the park. Consequently, what appeared to be a possible

reason for Patrick and Saeeda's aversive responses was that they were simply not familiar with the vinegar smell at the beginning of the fieldwork period. It followed that later, at interview, Saeeda's mother suggested that she simply "didn't know what it [the vinegar smell] was" which may have been the reason why she reacted so indifferently to it.

From the outset of the study, as mentioned above, a number of parents had perceived that their child could recognise familiar people, places and events through their use of smell. This was an important and interesting finding for two reasons. Firstly, it provided evidence to suggest that the use of smell had enabled pupils to make such associations. Secondly, it implied that it was the 'familiar' or repeated use of, or exposure to, particular smells which had potentially supported the development of recognition. The progressive change in Matthew, Patrick and Saeeda's responses throughout the fieldwork period, in particular, seemed to suggest that the repeated use of odours had supported the pupils' abilities to become familiar with smells.

Within PMLD literature, we find a number of references to the importance of using a consistent approach (Doukas et al., 2017; Imray and Hinchcliffe, 2014; Pagliano, 2012). Within the context of this study, this would imply that the repetitive and consistent use of a particular smell within a given context has the potential to provide a more meaningful and effective approach to learning. Evidence from this study does appear to attest to this idea. Considering the range of observations made within this study, it seemed that the consistent and repetitive use of certain smells had helped to support memory function and enabled a number of the pupils to begin to associate with and recognise certain people and routine activities within their daily school lives.

Chapter Five – Conclusion

This chapter summarizes my research findings in relation to my research questions; it discusses the limitations and strengths of the study including my chosen methodology and methods, contributions to knowledge, implications for future research and professional practice.

5.1 My research questions and key findings

Importantly, there is no assumption on my part that generalisations to a wider population can be arrived at from the findings within this study. The pupils' responses were personal and individualised. However, there were regularities in the responses elicited by individual pupils which in themselves and in the wider context, of the case study pupils as a whole, have provided a basis for deeper professionally significant understanding.

Research question 1: How do pupils respond to smell experiences within the classroom context?

What became apparent, as a result of this study, was not that the pupils had 'changed' in any way but that the adults working with them and observing them became more attuned to the unique nature of response to smell. Although, there were a wide range of pupil responses noted, overall, mouth and tongue movements were the most frequent responses, with 78 observations made which accounted for 83% of the recorded responses to smell. It was significant that this included those pupils who could not eat orally and did not normally receive taste experiences as part of their normal routine. Of interest was also that there were only twenty-four (26%) responses noted which reflected nostril movement or activity. None of the adult participants at the

beginning of the research period made any association with the use of mouth or tongue movement in relation to smell. However, as stated, after the research period this response was the most frequent observation made.

Research question 2: How can perceived responses to smell of pupils with PMLD be best interpreted given the nature of their communication difficulties?

From the observations made within this study, there was evidence to suggest that certain sensory thresholds existed: detection and recognition. For example, when Andrew was presented with the smell of food, he at first showed an increase in hand and eye movement which was agreed by both his parents and teacher to be a detection of the smell. Andrew then appeared to protrude his tongue and open his mouth which was interpreted as a sign that he had recognised and wanted to taste his snack. Equally, Patrick and Saeeda demonstrated a progressive range of responses that suggested they had firstly detected and then after recognised the smell of vinegar within the fieldwork period. This seemed to align with Pagliano's (2012) idea of detection and recognition thresholds.

There were also occasions when Mohammed had been overpowered by the experience of smell and this had caused an aversive reaction. This was an important finding and raised an awareness of the need for a further threshold - a "terminal threshold" (Lumen, 2021). It highlighted the need for greater consideration to be given to the intensity of the smell experience and the role of the adult in appropriately presenting smells. This resulted in the acknowledgement of a slightly different set of thresholds, i.e. no detection, detection, recognition and terminal threshold.

Another key finding was that mouth and tongue movements were the most frequently recorded response to smell. It also appeared that the combined functions of smell and taste played a key role in raising an awareness of the presence of food, choice making and anticipating feeding routines, as seen in Andrew's responses. Aligned with this, could be suggested the idea of retronasal olfaction – smelling through the mouth - proposed by Frasnelli (2012) and how our sense of smell heightens our perceptions of food and flavours (DeVere and Calvert, 2011).

Finally, evidence from this study, given the comments made by the adult participants and my own observations, suggested that there were progressive measures of cognitive function within which the pupils' responses to smell could be ascertained from levels of awareness through to recognition. My main concern, at the outset of this study, was that smell was perceived to be nothing more than a pleasant or stimulating experience. In particular, it was not perceived by teachers as supporting memory function. By the end of the fieldwork period, the adult participants' descriptions of pupil response confirmed that the routine use of smell had helped the pupils to recognise and even anticipate certain activities within their daily routine. This had been reflected in the literature by Pagliano (2012, 2001), Aitken and Buultjen (1992) and Longhorn (1988) in relation to smell.

Research question 3: How can the sense of smell be used to provide support for learning?

A key finding within this study was the suggestion that the consistent use of smell had supported a progressive range of responses including a perceived ability to recognise certain smells. This was evidenced in the accounts of parents and teachers and through my own observations of the Mohammed, Saeeda, Patrick and Andrew's

responses. Mohammed appeared to have recognised a member of class staff through the smell of her perfume; Patrick, Saeeda and Matthew became familiar with the vinegar and rosemary smells within the study period and Andrew was noted to have recognised his snack through its smell. Evidence from this study also suggested that the use of smell had helped to raise Andrew's awareness of the presence of food and allowed him to anticipate his feeding routines.

Of significance was the need for adults to present smells sensitively. It was clear that each of the pupils had their own individual smell preferences and tolerances. The input of adults working with the pupils had a great bearing on the quality of the experience the pupils received. It was important that the pupils were not over- or under- stimulated. How smells were contained was also a contributing factor to the pupils' level of engagement. For certain pupils, such as Zara, it was preferable to present smells in packets or containers that she ignited her interest and that she could manipulate. For others pupils, there seemed to be a desire to taste scented items. Evidence from this study suggested that although the sense of smell had made a positive contribution to the pupils' learning, providing an additional and alternative way of learning, it was further enhanced by the use of other senses – as part of a multi-sensory experience.

5.2. Limitations and strengths of the research

A key constraint within this study, was that the pupils used pre-verbal forms of communication, for example, physical gestures, facial expression or vocalization. It was the case that the ways in which they expressed themselves could not easily be read by the uninitiated adult. Ultimately, it required significant others to intervene and act on the individual's behalf in an attempt to make their needs, wishes and preferences understood. Given that the pupils' responses to smell were not routinely

observed within the school setting this presented further challenges for the teachers. Therefore, the views of parents and teachers together who were able to support and represent the pupils' views best, given their close association with the child, were necessary. This offered a more informed view of what the pupils' responses might mean and ensured that they were interpreted as accurately as possible. Nevertheless, there were still occasions when both the teachers and parents were not sure whether the pupil had responded to the smells presented to them or not. There were a number of other environmental factors that had possibly impacted on the pupils' responses. For example, music being played loudly in the background when smells activities were happening and the voices of other adults and pupils which appeared to distract them. The views of the school therapist who did not know the pupils intimately provided another perspective. His interpretations of the pupils' responses at times complemented but also differed from the teachers and parents. It was the case that, together with my own observations, the collective of subjective opinion was insightful but not a 100% guarantee that every response to smell was agreed upon.

Being able to interview the parents and teachers on more than one occasion over the research period, meant that there was the ability to engage in in-depth discussion about the individual case study pupils and reflect on incidental information or occurrences as they arose. It was significant that the evolving nature of each participant's knowledge and understanding of the pupils' smell responses was also evident at later stages within the study. For example, one parent noted that her son's responses to smell, as observed on the video-recordings, were different from what she had originally perceived and stated in her initial interview.

Interviewing parents did present challenges in terms of time and availability. However, this was overcome in a number of ways: by carrying out telephone interviews on

occasions when parents were not available for face-to-face discussion and by sending home interview questions for parents to consider and respond to in written form. In an attempt to overcome the demands on time, interview meetings were also aligned with times and dates when parents were already planning to come into school for other reasons. The manner with which parent interviews were carried out, with some being face-to-face and others via telephone or written form meant that there were variations in the detail of information gained. Parents that were interviewed face-to-face were able to engage in lengthy discussion. Those who responded in written form or spoke over the telephone gave shorter comments. This was overcome by communicating regularly through the pupils' home/school books and further phone calls to update and inform the parents of developments within the research.

My initial desire to involve all the adult participants in the observations made of pupils and the limits to which I could realise this goal meant that the use of video recording was an effective alternative tool to use. This provided a record of live events which could be revisited and analysed by the adult participants at a later date. There were drawbacks to the use of video-recording, for example, there was the potential for pupils to be aware that they were being recorded and as a result they may have become distracted by the person recording them. However, videoing was primarily carried out by familiar class staff who knew the pupils well this minimised distraction and teachers felt that they could go ahead with class activities as normal. Only one pupil, Zara, became distracted in being video-recorded, however, this only happened on one occasion.

In hindsight, greater involvement with the parents could have been achieved through encouraging them to carry out their own observations within the home environment. For example, for parents to keep diary accounts of any reactions to smells that

naturally occurred in activities within the home such as cooking, meal or bath times. Parents could even have trialled their own investigations - wearing a new perfume and observing their child's reactions over the eight-week work fieldwork period.

A key strength of this study was the use of a qualitative, interpretivist methodology and case study strategy. I was able to use the perspectives of those who knew and had worked most closely with the pupils to acquire a reliable basis of detailed and in-depth information on the individual pupils' responses. My multi-method approach which drew insights from school documents, interviews with parents and professionals and the observations of the pupils themselves did offer a range of evidence to align any distinct findings. Overall, the ability to use a range of methods and utilise the perspectives of those individuals who knew and had worked most closely with the pupils, proved to be an essential tool through which insights into the pupils' responses could be explored.

5.3 Reflections and implications for future research design

This section comprises two parts: a proposed alternative research design and additional lessons learnt.

Reflecting on my research there are several lessons I have learned which lead me to the conclusion that, in any future research of this kind, involving pupils with PMLD and with an emphasis on smell, it would be better to adopt a research design different to the one adopted in this thesis. This would take the form of a more systematic study using mixed methods, a larger sample, and a more extensive period of fieldwork stretching over three school terms. With a view to enhancing the reliability of my data and analysis, the study would include a quasi-experimental pre- and post-intervention design and a sample of 10 - 12 pupil participants.

A pre- and post-intervention design

The pre- and post-intervention design would comprise four stages:

Stage One: pre-intervention, approximately twelve weeks. The emphasis would be on building a profile of the sample pupils in relation to smell competencies which would enable me to establish baseline data for the rest of the study, and to get an idea about data that are not available. This would include:

- a. A review of the education, health and care documents, including the pupils' Education, Health and Care (EHC) plans, health professional and teacher reports.
- b. A six-week observation period with schedules, implemented with the support of teachers, to record the pupils' responses to a range of stimuli within smell-related and non-smell-related routines. For example, I would record the sample pupils' responses to strawberry/lavender scented massage creams during relaxation, and sweet/sour ingredients during cooking sessions. In addition, I would record the pupils' responses to the use of non-scented stimuli such as cornflour used in messy play and paint used in art lessons. This would, for example, allow for enquiry into whether tongue protruding and nostril movements were observed in both smell-related and non-smell-related routines and how this might then be interpreted.
- c. Questionnaire surveys of parents of the sample pupils plus teachers and therapists to adduce their perceptions of the pupils' smell preferences and thresholds, to run concurrently with b above.
- d. An analysis of the above data.

Stage Two: development of intervention, approximately one week. This will comprise of one induction session with all the adult participants – teachers, school staff and parents - involved in the next stages of the study. I would explain what the subsequent stages will comprise and what is expected of participants.

Stage Three: intervention, approximately 14 weeks in total. This stage will firstly involve eight weeks studying the pupils' responses to smell-related stimuli more closely and systematically, in order to establish that the sample pupils are responding to smell rather than other ambient stimuli. Given the nature of these pupils' disabilities, one and the same set of smells would be presented to all sample pupils during daily and weekly activities (for example, peppermint, used daily as part of the morning routine and a vanilla scent used as part of a weekly sensory story session). Teachers/school staff would video-record the pupils' responses using class iPads.

In parallel, and in order to develop complementary data, parents would be asked to observe and record their children's responses to smell, for eight weeks, in the pupils' home/school diaries. For consistency of data all parents would be asked to maintain records of responses during mealtimes and bath times: pupils would be offered the smells in a way similar to that applied in the school during the intervention. Parents would also be encouraged to record any other significant smell-related incidents in the home in the home/school diary.

Secondly, six weeks will focus on using different methods of containment and of presenting smells to establish the optimal range and intensity of smells in order to develop best teaching practice. The parents of the sample pupils will similarly be asked

to use different methods of containment and of presenting smells within the home to complement school data.

Stage Four: post-intervention analysis, approximately eight weeks. This comprises an analysis of the intervention data. This would include using focus group interviews with all adult participants to interpret a selection of the video-recorded observations, along with additional interviews with parents with a view to exploring and interpreting their diary data. Following this, an analysis of the data collected throughout the entire study acknowledging any progress made by pupils and the development of knowledge and understanding of the pupils' responses by the adult participants.

Additional lessons learned

There are several additional points that I would like to emphasise.

One consideration is the sample size. I had originally arranged to involve 10 pupils in the study. However, a number of pupils were unwell or due for an operation during the research period which meant that they were not available when the study took place. Of the remaining seven pupils there were occasions when some were absent due to medical appointments or illness. This meant that a smaller range of video-recordings were made of these pupils than I had intended to make. In any future study, I would aim to establish a larger sample than the one used in my thesis to allow for attrition.

A key issue, for parents and teachers, was that I was attempting to conduct research with this especially vulnerable group of pupils and this, understandably, was the source of some anxiety. The concerns raised were twofold: firstly, some parents were worried about their child being video-recorded - how would the information be used? who would it be shared with? - and as a result they chose not to participate in the

study. Secondly, there was some apprehension, expressed by both parents and teachers, that the use of any additional smells may be overbearing for pupils and that the possible disruption to their routines may have a detrimental impact on their wellbeing and learning. Given these concerns, it was vital that I could offer reassurance. This meant communicating clearly to parents that all pupil information would be stored securely and shared only with the explicit agreement of the parents themselves. This, perhaps, could have been done more effectively than it was.

I should also have emphasised that the selection of smells focused upon during the fieldwork would include only those that were *already* part of the pupils' normal routine or those that were in the process of being introduced, by a teacher, at the time of the study. In hindsight, I can see that it may have been assumed that the research would require special arrangements involving new smells, and an experiment conducted outside the classroom. This, certainly, was no part of my research design, and no part of my research. In any future research it would be vital for parents and teachers to know exactly what the research comprises, to alleviate any fears, and, above all, to include them, as far as possible, in the research process from the outset.

If and when the parents were not able to attend their face-to-face interviews, I sent interview questions home and carried out telephone interviews. However, the responses received through these channels did not yield the same level of detail as elicited by face to face interviews. In hindsight, I should have ensured more effective and consistent communication with parents. Options such as virtual meetings, home visits or lengthening the interview period would have been useful.

One final point: although a number of parents and teachers preferred not to deviate from the pupils' use of smell within their existing routines, I found that that their

involvement in this study aroused interest in exploring the use of smell further. Contrary to the understandable fears of parents, evidence from this study suggests that students were not in fact overwhelmed by any of the smells encountered during fieldwork. It was observed, further, that the way in which smells were presented to pupils by adults had a bearing on whether the experience was positive or negative. I conclude that, in any future study, with suitable preparation and sharing of information, there may be scope for the limited introduction of new smells with a view to assessing their impact on students, and their role in their learning process.

5.4. Contributions to knowledge and implications for future research and professional practice

The fact that none of the pupils' functional use of smell had ever been formally assessed was a contentious issue. At interview, it was significant that none of the parents or teachers knew of any clinical assessment that had been carried out with their child or pupil, nor were they aware of any assessment tools specific to measuring the pupil's functional use of smell. However, the outcomes of this research study have identified a range of responses that seem to pertain to the experience of smell. As a result, a template of observed responses has been formulated into an assessment tool. This has been trialled by the teachers of Beechleaf school to a positive effect (See Appendix 1). It would be of interest to trial this assessment tool within a wider context with similar cohorts of pupils and beyond. For example, with pre-verbal pupils who have vision impairments or autism and for whom the ability to communicate their needs and preferences may be a particular challenge.

It was also evident, from the outset, that a number of the parents involved in this study were confident that smell provided a means through which their child could recognise

and understand various aspects of their daily lives. It was significant that it was only through the exercise of this research study that the teaching professionals came to the same realisation. This finding is of great importance because it highlights that schools can learn a lot about pupils with PMLD from the insights of their parents. It suggests that judgements about pupil response may be better informed if the views of parents are incorporated. This finding also highlights the importance of home and school working partnerships, acknowledging and integrating the perspectives of both teachers and parents in informing professional practice. My aim would be that together with closer working partnerships there could also be a commitment to integrating a wider range of smell experiences both at home and school in support of their learning and that future research included parents to a greater extent.

In general, the lack of prior knowledge and training held by the teachers in the use of smell was evident in the comments made at interview. Teaching practice was based on experiential learning and it appeared that there was no common knowledge base through which teaching and learning practice could be informed. Although, the practice of integrating smell was in effect quite an arbitrary affair the activities observed within the fieldwork period did show that some of the existing practice was effective in supporting the pupils' learning evidenced in the positive responses exhibited by pupils. There were some useful methods used by adults to present smells. For example, the classroom staff who were required to assist pupils within eating and drinking routines, on the whole, offered a verbal cue and the opportunity for pupils to smell their food before tasting. Zara, who liked to hold and explore materials tactually, was offered different packets of spices to investigate at her own discretion. This was suggested to have resulted in an increase in her level of engagement within the smell activity itself. For those pupils who already engaged with smells as part of their daily routines –

Andrew's smelling of his snack and Mohammed's teacher who regularly wore perfume - there seemed to be a heightened response that suggested a level of recognition. This appeared to be attributed to the consistent use of these smelling experiences.

However, there were occasions when the supporting adults could have provided richer opportunities for learning through smell. For example, on two occasions when Maria and Saeeda expressed an interest in tasting food items the adults withdrew the smell. It was also the case that the concentration odours could have been monitored more effectively in order not to over and under-stimulate the pupils. On occasion, smells were presented too closely to pupils or in too strong a concentration. Also, it seemed that some smells – in particular the massage creams – did not contain a strong enough odour to incite interest or an improved level of awareness from the pupils.

As a result of the observations made within this study, a summary of practical strategies for using and presenting smells has been devised (See Appendix 13); sensory profiles – I had previously developed within Beechleaf school - have been revised and updated to reflect these strategies (See Appendix 8). Also, I have had the opportunity to provide training sessions on smell to help staff improve their knowledge and expertise and to share good practice (See Appendix 7). Curriculum materials within Beechleaf school now reflect a broader range of smell related objectives to include the use of smell by association (See Appendix 14).

5.5. Final thoughts

In carrying out this research I feel I have helped to uncover the potential for smell to support the education of pupils with PMLD and pointed to certain ways forward in improving practice. The sharing and discussing of my findings have also opened up discussion about other lesser known senses, for example, the role of temperature

(thermoception) and pressure. It has shed light on how our sensory systems perform vital roles in establishing our sense of self and how we interact within our immediate environment. It is hoped that this thesis will inspire further exploration into the ways in which the senses can support learning for pupils with profound and multiple learning disabilities.

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Appendices

Appendix 1: The smell response assessment form

This observation schedule aims to provide a tool for the assessment of responses to smell. The design of this instrument has primarily been based upon the results of observations made on pupils during the initial stages of this research study. It has also been informed by other sensory assessment formats including the *The Exteroception Template – Chemosensation* by Pagliano (2012), *The Sensory Assessment Summary Form* by Fowler (2007), *The Affective Communication Assessment* by Coupe et al., (1985) and the *Vision for Doing* assessments by Aitken and Buultjens (1992). However, it is unique in that it offers a more extensive range of pupil response and has a specific focus on the reactions to smell experiences. For example, it pays greater attention to mouth and tongue movement and takes into account nasal activity unlike other assessment formats.

For the next stage of this research study, this tool aims to provide a more informed structure within which to record pupil response and for the future, it is hoped it may potentially be useful for the wider professional teaching community.

This schedule has been designed to record responses to smell stimuli over a period of time. The assessor is required to select or tick (✓) from a checklist of responses. There is also a 'comments' section at the end of the schedule which sets out a number of questions to help identify any recurring patterns in pupil behaviour, and to query the level of understanding it is felt the smell experience has merited over the assessment period.

Smell response assessment form

Pupil name: _____

Smell stimulus: _____ **Assessor:** _____

Responses to smell	Date:	Date:	Date:	Date:	Date:
Mouth and tongue movements					
Licking lips					
Tightening of lips					
Lip movement					
Sucking					
Salivating					
Swallowing					
Mouth movement					
Closing mouth					
Opening mouth					
Tongue movement					
Protruding tongue					
Other					
Nostril movements					
Inhaling					
Sniffing					
Scrunching or screwing up nose					
Nostril flaring					
Nasal sound					
Other					
Other facial expressions					
Startle					
Frowning					
Smiling					
Other					
Vocalisations					
Laughing					
Utterances					
Crying					
Other					
Hand and arm movements					
Increase in hand movements					
Decrease in hand movements					
Finger movement					
Opening hands					
Closing hands					
Touching					
Reaching out					

Grasping					
Holding					
Using hand or arm as an obstruction					
Using hands to cover face or head					
Raised arms					
Lowered arms					
Fiddling with hair					
Hand clapping					
Other					
Eye movements					
Opening eyes					
Closing eyes					
Blinking					
Widening eyes					
Eye movement up					
Eye movement down					
Eye movement to the left/right					
Eye pointing/in direction of stimuli					
Constant eye movement					
Staring/gazing/fixated					
Eyebrow movements					
Other					
Head movement					
Head up					
Head down					
Head backward					
Head forward					
Head turning to left/right					
Moving head side to side					
Nodding head					
Other					
Whole body movements					
Leaning forward					
Leaning backward					
Rocking					
Swaying					
Other					
Stilling					
Stilling of eye movements					
Stilling of head movements					
Stilling of whole body movements					
Stilling of arm and hand movements					
Stilling of mouth and tongue movements					
Other					
No change					

What were the most common responses exhibited by the pupil?

What do you think this indicated?

Did the pupil's responses change over time? If so, why do think this happened?

Indicate what level of understanding you feel the pupil exhibited: (Please tick (v))

	Started	Emergent	Consistent
Awareness			
Attention			
Exploration			
Recognition			
Understand			

Other comments

Signature: _____ **Date:** _____

Appendix 2: Overview of the fieldwork process

Date	Aim	Method	Reliability/ validity
Spring 2014	<p>To develop an awareness of existing teaching and learning practice in relation to smell</p> <p>To develop an awareness of the nature of the seven case study pupils' responses</p>	<p>Sourcing, collating and analysing educational documents on the 7 selected case study pupils:</p> <ul style="list-style-type: none"> the pupils' educational statements Multidisciplinary reports Termly reports Other teacher planning and assessment material <p>Conducting informal observations of the 7 case study pupils within the classroom context</p>	<p>Triangulation of information within documents</p> <p>Same observation schedule/protocol for each pupil when conducting informal observations</p>
Summer/ Autumn 2014	<p>To gather insights into the role and value of smell in supporting learning as perceived by adult participants</p> <p>To develop an understanding of the nature of the case study pupils' responses to smell as perceived by the adult participants</p>	<p>Piloting interview questions with a sample of the adult participants</p> <p>Carrying out interviews with the 7 parents and 5 teachers of the case study pupils and with 2 senior leaders and 1 therapist (n=15 interviews)</p>	<p>Triangulation of data from interviewing</p> <p>Each participant group, e.g. teachers and parents/senior leaders and therapist received the same interview questions</p>
	<p>To use a series of observations of the seven case study pupils to ascertain their responses to smell</p> <p>To develop an understanding of teaching and learning strategies used in practice</p>	<p>Developing an observation schedule for the video-recording of observations of the 7 case study pupils</p> <p>Delivering of a series of video-recorded observations of the 7 case study pupils across a range of subject areas within a eight week period (n=96 videos)</p>	<p>Same observation schedule/measures for each pupil</p>
	<p>To analyse the video recorded observations of pupils to ascertain their perceptions of pupil responses as perceived by adult participants</p>	<p>Individual parent, teacher and therapist interviews with the viewing of video-recorded observations (n= 13 discussion meetings)</p>	<p>Member checking/ triangulation</p>
Spring 2015 -	<p>To examine the impact of smell on the learning experiences of pupils</p> <p>To devise ways forward in developing teaching material to support learning through smell</p>	<p>Qualitative data analysis/evaluation of entire study</p>	<p>Triangulation</p>

During the initial stage of the research process (Spring Term, 2014) I gathered background information on the seven case study pupils. I sourced, collated and analysed information from educational and healthcare documents including the pupils' educational statements and annual reports. My intention was to extract any observations on the pupils' use of smell and also to begin to develop an awareness of how learning was supported through the use of this sense.

I also conducted informal observations of the pupils over a two week period (Spring Term 2014), in order to develop my familiarity with their responses and behaviours. These observations were aimed at developing a sense of how the pupil communicated, how their impairments seemed to impact on their abilities to learn and how they explored and interacted with their environment (Notes on initial observations, See Appendix 1).

Following this, I piloted questions and interviewed the full range of adult participants who had consented to being involved in the study (Summer Term, 2014). These interviews were conducted on an individual basis and included the teachers and parents of each pupil and three other teaching professionals within the school: the Executive Deputy Headteacher, Head of School and school therapist. The aim was to gather background information, as perceived by these adult participants, on the role and value of smell in supporting learning, their knowledge of the pupils' sensory abilities, preferences and any incidental information or insights relating to smell that may have a bearing on the study.

The pupils were then involved in a series of **video-recorded** observations over a eight week period (Summer Term, 2014). These were recordings of the pupils' reactions to smell within sensory based activities that were already part of their weekly routine, for example, in massage and relaxation sessions, at mealtimes or during sensory story sessions (See observation schedule). The intention was to examine these observations based on the input of the parents, teachers and school therapist and to discuss the nature of pupil responses and the impact on learning.

Appendix 3: Interview questions

Parent and teacher interview questions

Has X ever had their ability to smell assessed to your knowledge?	Assessment of smell
What do you know about their ability to smell?	
Can you identify any smell preferences?	Pupil responses
How do they access smells?	
How do they react?	
Do you think smell helps them to learn?	Impact of smell on learning and value judgements
Do you think smell is important in their lives and why?	
Have you ever had training on smell? (Teachers only)	

Senior leader and school therapist interview questions

Can you tell me about your knowledge and experience of using smell to educate PMLD pupils?	Knowledge and experience
Do you feel the use of smell within the educational context is of value to learning? Why?	Value judgements
Do you think the use of smell is more appropriate to the education of PMLD pupils as opposed to other pupil cohorts?	Value judgements
What knowledge and experience do you feel your teachers have of the use of smell as a tool for learning?	Knowledge and experience
Have you ever been involved in the assessment of smell or are aware of smell/olfactory assessments being carried out with pupils within or outside the educational context?	Assessment
To what extent do you feel smell is used in comparison to the other senses? What are your thoughts about this.	Value judgements
Are you aware of any barriers that impact on the use of smell within the educational context?	Value judgements

Appendix 4: Piloting exercises

Piloting interview questions

I had conducted two pilot interviews, with my teaching colleagues, where the interview questions were developed and my questioning technique was scrutinized. My aim had been to ensure questions were easy to interpret and able to generate discussion but presented in a reliable and unbiased manner. In delivering interviews, Robson (2002:275) highlights types of questions to be avoided, including: those involving 'too much jargon,' those that are 'leading' – or pointing the adult participants in a particular direction - and 'biased' - leading the interviewee by the manner in which the question was asked. The piloting exercise was crucial in ensuring the validity and reliability of the interview process, raising my awareness of the potential for bias, the unnecessary use of terminology that may be new or confusing to the adult participants and being able to respond in an impartial manner to the responses given by participants.

Piloting of video-recording observations of pupils

I asked the teacher participants to make a few short video recordings of their pupils as a pilot exercise. These were later viewed by myself and each of the teachers. The purpose of this piloting exercise was to check that, with the recordings made, the pupils were in full view of the camera, that observations were carried out in an unobtrusive manner and that activities related specifically to smell. This was a very fruitful exercise as there were a number of instances when the recordings made did not meet the given criteria. Also, some of the teachers did not feel confident in using the video camera and others were concerned they would not be able to capture a precise enough recording of actual events. I realised there were distinct qualities and skills the person carrying out the video recordings needed, for example, confidence in using the video

camera, ensuring they always had the pupil's face in view of the camera, were sensitive to and able to capture any unexpected pupil responses such as hand, tongue or mouth movements and to remain as discrete as possible throughout the recording. Cohen et al., (2007:399) highlight that if there is more than one researcher then it 'may be necessary to provide training sessions so that the team of researchers' proficiency, efficiency and consistency enter the same sort of data in the same categories.' In the case of **video-recording** observations of pupils, I needed to ensure I provided support to meet my criteria for recording observations. After facilitating a number of short 1:1 training and troubleshooting sessions with the teachers, I decided that I, as the researcher, should take over the main responsibility of **video-recording** the case study pupils. However, a few of the teacher participants who were more confident in using video camera were able to assist if needed.

Appendix 5: The analysis of data

The analysing of data emanating from this study has been based on a phased guide drawn from the work of Braun and Clarke's (2006) which included the following:

Phase One (familiarization with the data): This included listening to and transcribing the audio recordings of interviews with the adult participants; considering the documentary evidence collated, observing video material of pupils, transcribing and reflecting on the comments made by the adult participants on these recordings.

Step Two (generating initial codes): The second stage included analysing the transcripts and documents to identify initial codes that would begin to highlight any patterns or themes within the data. For example, the comments highlighted in yellow reflected references made to Matthew 'recognising' places, people or events through smell and those highlighted in purple reflected the nature of his response.

Question 3	Response from participant
Can you identify any smell preferences?	Parent answer: Recognising – he may be able to know what it is
	Teacher answer: Not for smell.
How does he react?	Parent answer Smile or a little grin.
	Teacher answer He will open his eyes or pull away from it
Question 7	
Do you think smell is important in his life and why?	Parent answer: He knows his AE (hospice nurse) due to the perfume – he knows the smells of places – the house, hospital and Granny – he recognises the perfume. We ask people to buy him a smelly bubble bath for Christmas.
	Teacher answer: Possibly

Interview answers from Matthew's parents and teacher.

Step three (searching for themes): After the initial coding, potential themes were identified to reflect the nature of comments that had emanated from the interviews and observations with the adult participants. For example, the ‘nature of pupil responses’ and the idea of ‘recognising’ a smell.

Phase Four (reviewing themes): The initial themes identified were reviewed and a number of these were grouped together. For example, within this phase the idea of recognising a smell was grouped alongside ‘anticipating’ and ‘identifying’ to create the theme about ‘supporting cognitive development.’

Theme	Response from participant
Supporting cognitive development: - Recognising - Anticipating - Identifying	He knows his AE (hospice nurse) due to the perfume – he knows the smell of places – the house, hospital and granny – he recognises the perfume (Matthew). To identify who you are (Saeeda). ‘It was like he knew you had come before you used your voice’ (Mohammed) recognition of people. The therapist commented that the ‘perfume drew his attention to the adult.’ The teacher of Saeeda commented that responses to smell changed over time from not being interested in a smell to wanting to explore it. The teacher remarked that the pupil was anticipating the activity and seemed The parent of Matthew remarked on 3 out of 5 occasions that he recognised the smell and that this was of value (end of day smell).
The use of smell in the absence of other senses.	He must use the sense of smell more in compensation for his visual impairment (Matthew). Because of the visual impairment it makes a collection of information (Saeeda.) The little girl we are talking about has a severe visual impairment and I think probably takes more notice of smells than I give her credit for (Zara).
Links with the experience of taste.	I think given she has limited opportunities to eat orally it’s nice to have the opportunity to smell alongside taste. It makes it a nice and enriching experience (Maria). Because he is tube fed it helps him explore food (Matthew). It helps her connect things before she brings it to her mouth (Zara). I think with her food issues it’s given her a comfort maybe (Zara). The teacher commented that Maria was combining smell and taste. The parent of Saeeda noted that she wanted to eat the chocolate powder.

Sample of comments made at interview and after observation by the adult participants.

Phase Five (Defining and naming themes): Each theme was then defined in terms of what scope and content it covered and named to reflect the essence of what it was about. For example, the initial theme 'supporting cognitive development' was finally named, 'The importance of smell in supporting cognitive development.'

Phase Six (Producing the report): This involved the final analysis and write-up of the report using evidence of the themes (with particular examples).

Appendix 6: Sample letter of consent

[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
Tel: [Redacted]
Email: [Redacted]

Dear,

I would like to ask for your support in a research study I am completing for my doctoral thesis at the Institute of Education during the summer term of 2014. The purpose of this study is to explore the role and importance of smell in the education of pupils with profound and multiple learning disabilities.

My aim is to involve parents, educational and healthcare professionals and the pupils themselves. The research will involve your child being **video-recorded** within the classroom environment at intervals over an eight-week period with a particular focus on their responses to smell. You will be asked to meet with myself, on an individual basis, on three occasions during the research period. Initially, to discuss how you perceive your child responds to smell. Secondly, to analyse **video-recorded** material of your child's responses to smell within the classroom and finally, to contribute to the overall findings of the research. The discussions can be conducted wherever you prefer (e.g. in your home or at school), and will be **audio-recorded**.

It is hoped that this research will offer insights into the role and value of this smell in the pupils' learning and generate interest in the further development of knowledge and expertise on the use of this sense.

Participation in this research is completely voluntary and you will have the right to withdraw at any point within the research period. There are no identified risks from participating in this research. Your personal information and comments made during discussion will be made anonymous and any information obtained about your child will remain strictly confidential.

If you have any questions please feel free to contact me at school or via my email as indicated above,

Yours sincerely,

Jo Fitzsimons

I agree to my child's participation in this research study and am happy to be interviewed myself as part of this research **Yes / No** (circle as appropriate)

Signed _____ (parent) Date _____

Please return this reply slip to school no later than Monday 28th March

Appendix 7: Training materials developed on smell

The Sense of Smell



Jo Fitzsimons
March 2017

Aims and objectives

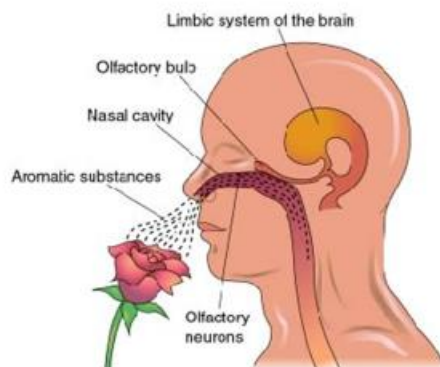
- To consider the role and importance of smell in supporting learning
- To trial a smell assessment tool

What you feel is the role and importance of smell in supporting learning?

Discuss



(Smell) Olfactory System



Interesting Facts 1

Recent studies, documented in the work of DeVere & Calvert (2011) suggest a correlation between memory and olfactory function in patients with Alzheimer's disease, schizophrenia and Parkinson's disease indicating that a decrease in olfactory ability can be associated with a decrease in memory function.

Certain smells or odours can have a powerful impact on certain cognitive functions, for example, peppermint and citrus flavours having a positive impact on levels of alertness and attention.

Warm, Zoladz and Raudenbush (2005)

Interesting Facts 2

The accuracy with which we recall a specific scent is suggested as being 65% accurate after a year in contrast to our ability to recall a visual stimulus which has been recorded at just 50% after four months.

(SOSI, 2012).

The sense of smell has been recognised as evoking stronger emotional responses than the senses of sight, sound and touch.

(DeVere & Calvert, 2011:37)

How smell can support learning 1

Smell can:

- influence behaviour and emotion;
- alerting us to danger, the smell of gas, smoke or spoilt food;
- help in establishing and maintaining maternal bonds;
- support early communication;
- Be used as a cue to memories.

(Lindsay, 2000 and Neil Martin, 2013).

How smell can support learning 2

Mercola (2015) found that given three cue types (word, picture, or smell) both young and older adults were able to recall more than twice as many memories when they were associated with a smell.

Murdoch et al. (2014) – who have more recently examined the effects of adding food fragrances to symbols to assist deafblind young people in choice making at mealtimes - concluded that it did support the students' understanding of mealtime choice making and their engagement with the process.


Longhorn (1993) has drawn from the work of Morris (1986:7) to show that 'when children were given a smell along with a word list they had to learn, they recalled it more easily and retained it better in memory than without a smell cue.'





Smell Assessment

- The University of Pennsylvania Smell Identification Test (UPSIT) (Doty, 2006)
- The Learner's Sense of Smell (Aitken & Bultjen, 1992)
- The Exteroception Template – Chemosensation (Pagliano, 2012).

These assessment materials represent the most appropriate publicized documentation available to assess smell function for pupils with special educational needs. However, despite their universal availability, these tools are often inaccessible to pupils with PMLD and complex needs. Therefore, even when using these tools, the classroom practitioner is ill equipped to make informed judgements about the smell function of each individual pupil.

Appendix 8: Sample sensory profile

Pupil Name: Andrew	Key stage: 2 Year: 6 Pupil Premium: N CLA:N	Staff: Jane Fraser Melaine Smith Uzma Khan	Date Reviewed: October 2018
Medical: <ul style="list-style-type: none"> • Profound developmental delay • Severe cortical visual impairment • Hypotonia • Epilepsy • Tube fed 		Coach: Jane Fraser	
Baseline: Andrew is generally a calm, quiet and happy young pupil. Due to his profound and complex needs he requires full support with his daily care. He follows our Reaching out curriculum and is working towards developing his early exploratory and communication skills			
Communication: <ul style="list-style-type: none"> • Andrew communicates through vocalisations, facial expression and direct action. • When Andrew is happy he will smile and vocalise and when he is unhappy/uncomfortable he will grimace and cry. 	What is important to Andrew <ul style="list-style-type: none"> • A learning environment that uses a total communication approach individualised to his needs, for example, access to sensory cues, body signing and the use AAC devices • Having familiar and consistent staff who can interpret his needs and preferences • To have control and independence within his learning 	What activities or resources does Andrew like? <ul style="list-style-type: none"> • Andrew responds well to a range of multi-sensory stimuli, for example, bright hanging mobiles that have bells and beads • He likes to interact with familiar staff on a 1:1 level • Andrew really likes to engage in all activities and responds well when lying on the bed 	
Vision 	My needs: <ul style="list-style-type: none"> • I have a severe cortical visual impairment • I have difficulty maintaining eye contact. 	Support me by: <ul style="list-style-type: none"> • Facilitate opportunities for Andrew to extend his visual awareness through the use of bright objects and contrasting backgrounds • Present objects in Andrew's upper visual field. (Above eye level) • Give Andrew longer time to look at objects and materials before you expect him to touch it. • Give Andrew time to look at, touch, smell and listen to objects before taking it away. 	

<p>Hearing</p> 	<p>My needs:</p> <ul style="list-style-type: none"> • There are no reported concerns with Andrew's hearing 	<p>Support me by:</p> <ul style="list-style-type: none"> • Make sure that Andrew know where a sound comes from. Start further away from him and then bring the sound closer. • Give Andrew lots of opportunities to listen to different sounds within the class and around him.
<p>Smell and taste</p> 	<p>My needs:</p> <ul style="list-style-type: none"> • Andrew has oral dysphagia and delayed oral skills • There are no reported concerns with his ability to smell 	<p>Support me by:</p> <ul style="list-style-type: none"> • Follow Andrew's eating and drinking guidelines which are available in class. • Andrew can only eat with staff who have been trained to feed him. • Andrew can only taste small amounts of soft, pureed food. • Gently introduce a smell or tasting activity through offering a verbal cue, touching Andrew's nose before asking him to smell something and wait for his responses. • It is likely he will open his mouth to indicate he wants food. • If Andrew pulls his head away or tightens his lips it means that he does not like the smell or wants to taste.
<p>Movement</p> 	<p>My needs:</p> <ul style="list-style-type: none"> • Andrew has hypotonia which means his muscle tone is low • He is non-ambulant and fully dependent on adults 	<p>Support me by:</p> <ul style="list-style-type: none"> • Ensuring that Andrew wears his body brace to support his posture • Checking that Andrew is positioned comfortably throughout the day • Give Andrew regular opportunities to change position throughout his school day • Give Andrew opportunities to move his arms and legs within learning activities
<p>Touch</p> 	<p>My needs:</p> <ul style="list-style-type: none"> • Andrew presents with an aversion to touch 	<p>Support me by:</p> <ul style="list-style-type: none"> • Place objects close to his hands and allow him time to reach out towards them. • Supporting Andrew with hand under hand support when necessary. • Give Andrew the time and opportunity to explore objects by himself.

Appendix 9: Sample of informal observations of pupils

Case study pupil – Mohammed

Mohammed has been diagnosed with quadriplegic cerebral palsy, microcephaly and epilepsy. He also has a severe visual impairment and a significant global developmental delay. He has a gastrostomy peg for feeding. He does not eat orally but can intake smells and have a few lip swipes of different foods to taste. (This was evident in cookery sessions where he smelt vanilla from a pot and tasted a small swipe of strawberry on his lips. This he loved!)

Mohammed shows he can be quite vocal. He appears to use “a” sounds to express happiness and when interacting with adults. He is known to recognise his family’s voices or familiar people speaking to him and will quieten, listen and turn his head towards the person. He responds with smiles and vocalises in a turn taking way when spoken to by the adults in class. He also responds with pleasure to singing and instruments. No concerns with his hearing.

Mohammed is unable to move between positions, sit or stand without support. He accesses a moulded wheelchair or is positioned on the class bed with cushioned support. He is able to use some whole arm and hand movement to reach toward objects of interest. For example, in morning circle he will accept holding the parachute and grip the loops on the parachute gently. His arms are predominantly held in a bent up and fistled position.

He shows some responses to visual stimulation. He makes no specific eye contact but with lights off in a room or under a dark parachute, he can fixate on very bright lights/objects presented to him.

Appendix 10: Sample of observations of pupils

Analysis of video material

Name of pupil: Mohammed

Stimuli: Morning smell - Vanilla

Name/number of video	Responses noted by parent	Responses noted by staff	Responses noted by other professionals
00026	Eyes widened on the left side – eyes moved in direction of smell	Looking toward smell/adult – opening eyes making a noise and turning to other side – really looks to smell	Looking in the direction of the cotton bud – seems to have awakened him – not a strong response – not salivating not moving his head
00027	Eyes widened as it gets closer to his nose – He closes his eyes – like he is trying to process – it is soothing	Eyes moved to voice at beginning - not this time as before...	Opening eyes – its appears he is content with the smell – he’s moving his head – he’s making an inhaling sound as if he likes it and wants more of it
00039	More alert	Opening eyes and sniffing	Responds – opening eyes – inhaling more – likes it
8613	More distracted with his chest	Opening mouth and using tongue	Lots of mouthing and making sounds – drawing in the scent
8660	More alert	Opening mouth and eyes	Smiling – eyes open – moving tongue – inhaling – he loves it!
	Other comments: Compared to sitting – more comfortable and alert on the bed		Other comments: He likes the vanilla – wants more of it and is excited by it – it didn’t cause as much stress as the eucalyptus

Appendix 11: Adult participants comments after viewing the video-recordings of pupils being supported by adults

Name of pupil	Teachers' comment	Parent's comment	School therapist's comment
Mohammed	He looked toward the adult	He responded to the voice of the adult as well as the cotton wool	
Matthew	He lifted his head after hearing the voice – adult spoke throughout and he moved eyes throughout... I think the video shows that the voices can take over...	Really good prompt (vocal cue and stroking of nose) – he knows it's consistent - definitely value the use of smell – he rolled his eyes all the time but recognised voices too when used It takes time for him to recognise cues/prompts Does he like this member of staff? – responding to her voice – becoming still and smelling it	He likes the adult – smiles – making sounds – moving mouth and head – more awake and aware
Maria		I think she looks at the adult wondering what she has to do apart from opening her mouth - feels like the teachers are going to put it in her mouth –	
Andrew		Staff member touched his nose and he stilled – he stopped and was thinking and taking in the smell – inhaling -	He likes it – he is smiling – there is something about the people he works with – they shape the experience
Saeeda		Maybe she recognises the cue of being touched on the nose and will open her mouth – she is stimulated by smells – she stills and then increases her movements No-one touched K's nose as a cue in these videos – maybe that's why she didn't open her mouth It would be good for pupils that experience these smells to be allowed to taste them–	
Patrick			
Zara	Depends on the adult She held it out for the adult's nose – she knows it's a smell - using smell to engage adult	Busy with adult - distracted easily She thinks it's a game – she concentrates on the adult signing Scent on her own at a table would be good – different tables – Halima also loves to copy	

Appendix 12: Observations of Andrew at snack time

First observation (00003): Andrew supported by an adult to eat his snack - pureed fruit

Mary (adult support) stood in front of Andrew who was positioned in his standing frame. They were in a discrete area of classroom whilst the other pupils were being supported by other adults elsewhere. A story tape was playing in the background. Andrew's eyes were looking up and around and both his hands were in an upright position but in constant motion. Mary gently rubbed Andrew's right cheek whilst saying "It's snack time. Now, what have we got here today? Let's have a little feel of the bowl." She proceeded to gently support Andrew's left hand to enable him to touch the edge of his bowl. Andrew's hand continued to move involuntarily. Mary pulled her hand back and then held the bowl just under Andrew's hand enabling him to make contact with it himself. Andrew touched the bowl briefly but then looked to the left. At this time, the sound of the story tape had increased in volume momentarily. Following this, Mary said, "Now, we are going to have a little smell." She then raised the bowl of fruit and held it under his nose for approx. 25 seconds continuing to say, "What do you think?" Andrew began to open and close his mouth, staring ahead and his hands remained still. Mary then sat the bowl down, stroked the side of Andrew's lips twice and said, "Are we ready for eating?" Andrew then looked up.

Second observation (00023):

Alexandra (adult support) was seated to the right of Andrew, who was in his wheelchair. Lively music was being played in the background and Andrew seemed to be moving his left hand very gently, looking ahead. Alexandra said, "Time for a drink?" and offered Andrew a small spoonful of thickened drink close to his nose briefly (2-3 seconds approx.) and then touched his lips with the edge of the spoon. Andrew immediately started to move both hands in a gentle flapping motion, raised his eyebrows and smiled. Alexandra commented, "Oh, is that a little smile there?" She continued to offer him the smell for 10 seconds, moving the spoon very slightly forward and backward from his nose. She then brought the spoon to his lips and gently pressed the spoon against them. Andrew immediately started to frown and began to tighten his lips. Alexandra moved the spoon back from his mouth and then over approx 20 seconds made two further attempts to bring the spoon to Andrew's lips. On both occasions he tightened his lips and frowned. Alexandra then withdrew.

Third observation (00028): Andrew supported by an adult to eat his snack - pureed fruit

Mary (adult support) was seated to the right side of Andrew who was positioned in his chair. Again, they were in a discrete area of classroom whilst the other pupils were listening to a story tape. Mary moved Andrew's chair closer to her and said, "Time for snack." Andrew's eyes were looking forward and his left hand was in an upright position gently moving in a flapping motion from side to side. Mary stroked his hair and Andrew blinked. She continued to put on his dinner time apron. Andrew's movements decreased briefly. Mary gently stroked his left cheek twice when she had finished putting his apron on and continued to say, "What has mummy made for you today? Mummy has made you fruit for your snack today." She stroked the outside of Andrew's right hand and moved the bowl to within his reach. Andrew paused briefly and looked downward. Mary then stroked Andrew's nose and said, "We will have a little smell." In response, Andrew blinked and frowned. Mary held the bowl of fruit to Andrew's nose for approx. 20 seconds. He began to make mouth movements and seemed to swallow. His eyes were facing forward throughout and his hand movements decreased for approx. 10 seconds. Mary then proceeded to lower the bowl of fruit.

Fourth observation (00047): Andrew supported by an adult to eat his snack - pureed fruit

Mary (adult support) stood close to Andrew who was positioned in his standing frame. They were in a discrete area of classroom whilst the other pupils were being supported by other adults elsewhere. Mary rubbed his left hand gently and said "Are you going to have your snack? You've got some fruit today." His eyes gazed upwards and his right hand shook slightly. She then stroked his nose gently twice and said "But first of all, we are going to give it a little smell." Andrew closed his eyes briefly in response to his nose being touched and frowned a little. Mary then supported his hand to feel the side of his bowl. He accepted Mary's gentle physical prompt to feel the bowl but withdrew his hand shortly after. Mary then tilted and held the small bowl of food toward his nose for 20 seconds. Andrew's responses showed an increase in hand movement from the instant Mary brought the bowl to his nose, he also demonstrated fleeting eye movements from left to right, the protruding of his tongue, emergence of drool, swallowing actions and the opening and closing of his mouth. Mary followed by saying, "Is that nice? Do you want to try some?"

Appendix 13:

Practical strategies for the presentation and use of smells for pupils with PMLD



- Use smells routinely with classroom activities as part of a multi-sensory activity
- Work consistently with pupils so that they are familiar with you
- Introduce yourself before beginning a smelling activity
- Tell the pupils what smell you are going to offer them
- Gently touch or stroke the pupil's nose as a cue to smelling if they cannot bring a scented item to their own nose
- Be sensitive to your pupil's responses
- Be aware of any other environmental factors, such as noise or talking, that may affect your pupil's responses to smell
- Look out for changes in mouth and tongue movement in response to smell
- Allow pupils to taste or lick scented items if they wish do so and if it is safe for them
- If you are offering food to a pupil who needs support with eating and drinking, offer its smell first and then wait for their response before bringing it to their lips
- If a pupil cannot consume food items, allow a lip swipe if it is allowed
- Allow pupils to touch and explore scented items with their hands or feet
- Ensure that the pupil is interested in and able to engage with any containers you use
- If pupils are not able to hold and bring scented items to their nose, gradually bring the smell to your pupil's nose from a distance until they appear to detect it and are comfortable with it
- Hold the smell in a position that is comfortable and allow the pupil to experience it for extended periods of time when they showed signs of pleasure
- Withdraw a smell if a pupil shows signs of displeasure or that they have had enough of the smelling activity

Appendix 14: Revised curriculum objectives in relation to smell

EOW 4.4 To enable them to develop the ability to use smell in orientation and route finding, pupils should be supported to:

- a. alert to strong smells in the environment
- b. alert to smells associated with the destination e.g. the smell of lunch in the dining hall or the smell of the swimming pool
- c. alert to established smells along a route e.g. a scented rose in a garden

EOW 4.5 To enable them to integrate information from smell and taste with information from their other senses, pupils should be supported to:

- a. participate in tasks involving objects with smell or taste e.g. cookery, massage
- b. use touch to explore scented objects e.g. in the sensory garden
- c. use vision to attend to scented objects e.g. in the sensory garden
- d. accept or reject scented objects
- e. accept or reject food items with distinctive tastes
- f. make choices between scented objects e.g. bubble bath
- g. make choices between food items with distinctive tastes