

provided a means for students to self-advocate in a 'real world' presentation of their achievements in a UK special educational needs school. This study was conducted within a mixed ability special needs classroom. This chapter resulted in a descriptive case study and a grounded analysis of the empirical evidence and led to three qualitative categories: *Designing for Self-Advocacy*, *Design Concerns* and *Reflections on Approach*, which are discussed in detail in relation to wider literature.

The final study, *Chapter 7 – Sounds and stories*, turns from introducing new novel digital systems that support teachers and students to use digital media, to introducing systems that support existing classroom practices through the use of digital media. This is considered through an embedded and inductive approach to the research. Through a grounded analysis of the empirical evidence the study results in the discussion of two conceptual categories: *Existing Classroom Practices* and *Reflections on Approach*, and a set of qualitative design insights for those in the interaction design community working in mixed ability special educational needs classroom contexts.

### **8.3 Digital media in a mixed ability SEN classroom: key concepts and guidelines**

This is a discussion of the key concepts and guidelines that were iteratively developed through an inductive, grounded analysis of the empirical evidence gathered through four design-led research studies. This was carried out from my perspective as an interaction designer and researcher. This thesis has considered the social interactions that occur within a mixed ability special needs classroom and how these affect and in turn are effected by the design and introduction of interactive systems for working with digital media. This final discussion draws together the array of individual phenomena that occurred within the broad range of research experiences represented in this thesis. The phenomena that arose and are categorised in the grounded coding maps presented throughout the thesis are fluid, dynamic and chaotic. Any representation will only ever be partial. The participants, including myself, are all unique but share enough commonalities with others in similar contexts to make the research presented here useful for others. The categories and guidelines presented here are thus points of departure which researchers, designers and educators can use to apply and adapt to the specific people, context and place that they find themselves working within.

The following discussion of key insights and resulting guidelines was developed through a grounded meta-analysis of the findings of each of the studies detailed in this

thesis. This was done to thematically draw together the insights from across all of the studies and to outline a set of key design guidelines for the wider interaction design community.

The analysis process went as follows. I began by reading through all of the findings of the four studies and from this I created a single focused code map of all the categories and sub-categories developed in those studies. I drew out pertinent themes from the code map and when combining sub-categories, I would return to the concrete examples that informed them to iteratively support the development of the final thematic category formation. Through this process three key thematic categories appeared which describe the findings of this thesis relating to the design and use of digital media in a special educational needs classroom. The 'Digital Media in a Mixed ability SEN classroom thematic map' shown below illustrates the results of these processes and is used to structure the key insights and guidelines section in this chapter.

Each of the categories is summarised, based on the more detailed discussions that have been presented in the individual study chapters. These discussions in the main body of the thesis are signposted for more detailed review and are considered in relation to other categories in the final grounded coding map. For each of the categories a guideline is presented in order to clearly support researchers, designers and educators working at the intersection of digital media, mixed ability special educational needs classrooms and interaction design.

The studies that have been presented in this thesis have all been focused on the potential uses of digital media to support learning and social development in the context of a mixed-ability SEN classroom. As the literature review shows, technologies that support the use of digital media can offer a number of benefits for both teachers and students with special educational needs; identity formation, communication, literacy skills and self-advocacy. (Bonsignore et al., 2013; O'Mara et al., 2000; Polkinghorne, 1991; Reese et al., 2010).

Cuban, Buckingham and Selwyn (Buckingham, 2007; Cuban, 1986; Selwyn, 2009) have all argued that it is not the technology that brings about change in itself but that changes occur within the social interactions in the classroom that accompany its use. In order then to discuss the design of digital media technologies in a SEN classroom setting we must also consider the social context in which they are used.

In the following sections I use the thematic map, developed from the empirical evidence and analysis of the four studies in this thesis, as a structure to present key insights and guidelines relating to the design and use of interactive systems to support the use of digital media in a mixed ability classroom. There are three main thematic categories which represent three important aspects of the research conducted in this thesis.

In *supporting self-advocacy*, I set out important insights and guidelines that we as interaction designers must attend to when understanding and designing systems that aim to support students to self-advocate using digital media. This is considered in terms of the wide matrix of skills and opportunities required for children with special educational needs to self-advocate, the choices students make about how, when and where they are represented through digital media and the emotional blocks and pedagogical issues of risk and confidence that must be supported in order for students to *access education* that is suitable for their needs.

It then turns to *classroom practice* within the context of the mixed ability SEN classroom and considers how existing classroom practices can inform and in turn be informed by the design of novel interactive systems. This is considered in terms of:

- *The teacher's role* in introducing and using digital resources in a classroom
- *Classroom management* issues that must be addressed in our designs and research studies
- The importance of designing for *contingency* in the resources we create and the role of *narrative* as a form of structure in classroom sessions
- The role digital media can play in *narrative* formation.

In the final section *design processes*, I discuss the design processes that I and the wider interaction community need to engage with when designing novel interactive systems to support staff and students in mixed ability classrooms. This is considered in terms of how we design for the particular physical *environment* of a mixed ability SEN classroom, how we *design with teachers* in our development processes and finally how we can design novel digital resources that are *appealing* to both students and teachers.

The following insights and guidelines have been developed directly from the research conducted in the four main studies in this thesis. For each of the insights I link to the corresponding discussion and examples in the relevant studies.

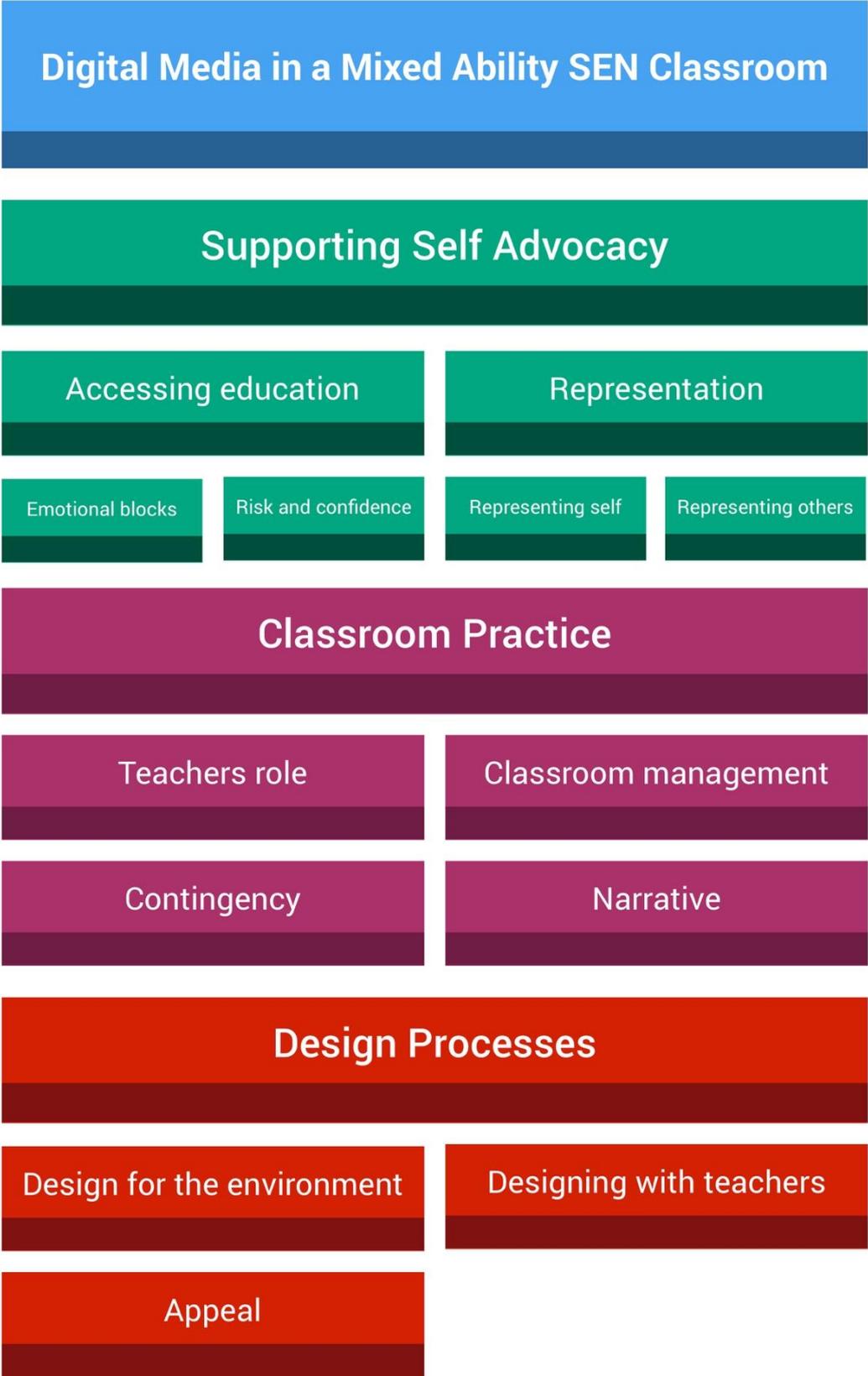
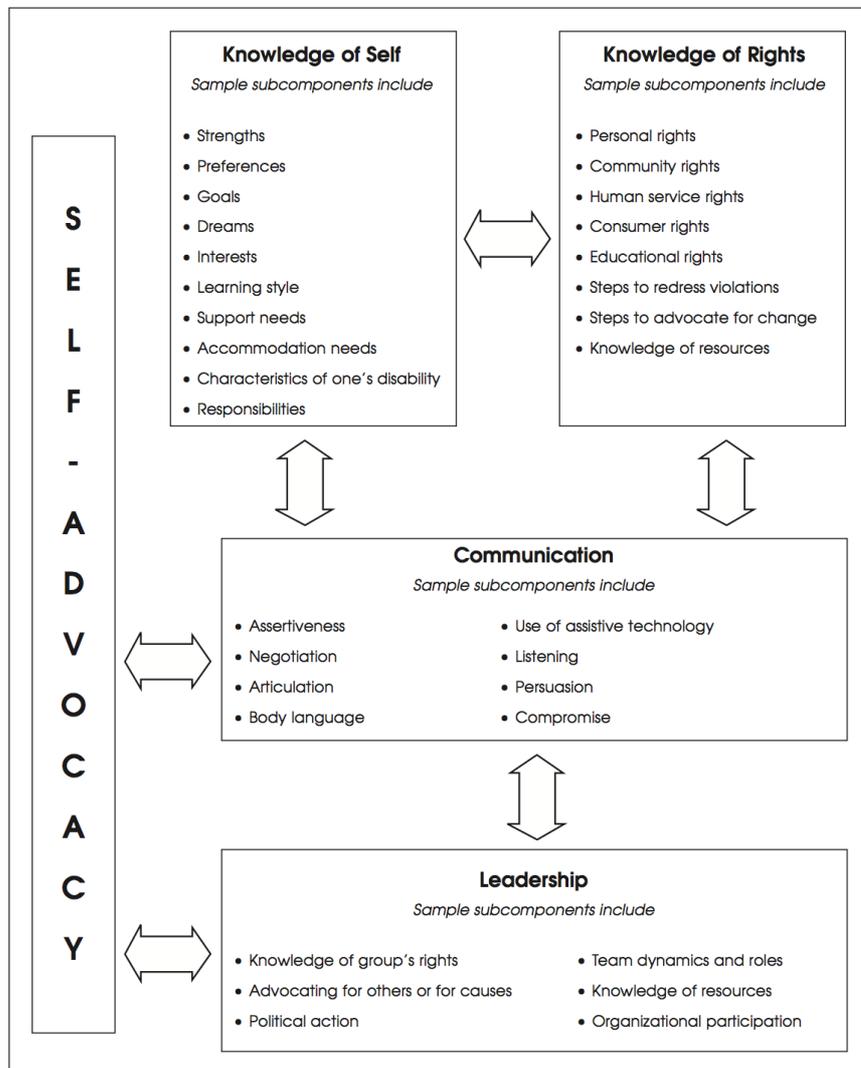


Figure 50 – Digital Media in a mixed ability SEN classroom thematic map.

### 8.3.1 Supporting Self Advocacy

In *Chapter 3 - Background and literature review*, we have seen that children with SEN are often devalued and disempowered by the social attitudes and expectations of their abilities, which can lead to low self-esteem and learnt helplessness. Children with SEN are less likely than their typically developing peers to be consulted about changes that affect their lives which may include medical, educational and pastoral provision (D. Miller, 2002; 2003) (Lewis et al., 2008). The inherent power imbalance between children and adults is emphasized for children with SEN due to both socially constructed factors that disable them and the impairments that require support to mitigate (Alanen, 2001; Auslander, 2008; Sandahl & Auslander, 2005). **Link to position in the thesis: 3.2.4 - Challenges in special education research**



*Figure 51 Conceptual framework of self-advocacy (Test 2005 p. 49)*

There is a wide range of literature that calls for children with SEN to self-advocate in matters that concern their lives and those of other people with disabilities, 'nothing for us without us' (Department for Education Department of Health, 2015; Williams:1984wg in Test et al., 2005, p. 47). This call for self-advocacy can be found in the literature concerning the design of interactive technologies for children with SEN in the methodologies that are used to research and design new technologies (Benton, Vasalou, Khaled, Johnson, & Gooch, 2014a; Druin, 2002; Frauenberger et al., 2011; Guha et al., 2008) and the effects of using the technologies themselves (Liu et al., 2007).

If we consider the conceptual model of self-advocacy that is put forward by Test et al., (Test et al., 2005) we can see that there is a matrix of skills, tools and opportunities that must be developed in order for people with SEN to self-advocate. Self-advocacy is an important concept that we, as designers and researchers, should support children with SEN to achieve but it would be hard to claim that any research or technological design on its own can be said to enable students to self-advocate.

As Pia Christianson (Christensen, 2004) argues, children exist within complex social situations where disclosure and the power relationship between adults and children are of acute importance. Working to mitigate this when trying to enable students to express their needs will not be achieved through technology on its own but rather through wide ranging social pedagogical change on which new technologies may or may not have some affect.

#### *Accessing Education*

*Chapter 4 – The Scented School* showed that providing the tools, training and opportunities for students to share their preferences, interests and achievements with people of significance to them was a strategy used by the school to support students' emotional and educational development. This was considered through two conceptual categories, *emotional blocks* to learning that children with special educational needs face and the need as facilitators and designers to manage the *risk* of sharing ideas and achievements with the *confidence* it can bring. **Link to position in the thesis:** 4.6 - *Category 2: Accessing education*

This issue of *risk and confidence* was then further explored in *Chapter 5 – This year I have...* through a shared, meaningful experience of developing an audio annotated slide show with students to share their opinions and achievements in a 'real world' context.

It reinforced the need for designers and researchers to take into consideration how we *balance risk*, develop *platforms* for children to advocate, create *safe spaces* in which to do it by providing *reliable tools* and *positive reinforcement* for the achievements they share. **Link to position in the thesis:** 6.12.1 - Risk and Confidence

### *Representation*

This conceptual category of *accessing education* and *risk and confidence* then informed the next two research studies presented in *Chapter 5 – My photos, your photos* and *Chapter 6 – This year I have...* which focused on designing a console to support students to use digital media as a form of communication and more specifically to share their interests, preferences and achievements. If we return to Test et al.'s model of self-advocacy we can see that this speaks to two of the main categories *Communication* and *Knowledge of Self*.

*Chapter 5 – My photos, your photos* demonstrated that digital media in the form of photographs and short videos were used by students to *represent the self* by talking about sharing their personal achievements and activities in school with people of significance to them through the use of wall displays, photo books and screen based slideshows. It also found that students were rarely consulted regarding which media was selected to represent them and how it was shared by teaching staff. This was found to stem from a need by teachers to arbitrate in the process due to legitimate issues of child protection and pastoral care by teachers. However, it also became clear that this was also due to a lack of available tools and strategies to enable students to engage in the process of choosing and sharing digital media. **Link to position in the thesis:** 5.7.1 - *Digital Media and Representation*.

In *Chapter 6 - This year I have...* I showed that there are a number of *structures* that need to be developed and considered when creating systems to support children to make choices and share their achievements and opinions through digital media. This includes the use of *narrative* to structure children's ideas, addressing the *existing goals* of students and those that teach them, the need to design for *contingent* strategies in our interaction design. **Link to position in the thesis:** 6.12.1 - *Structures*

### ***8.3.2 Guidelines for designing to support self-advocacy for children with special educational needs using digital media..***

Empirical evidence was gathered, analysed and discussed in detail in the individual studies that make up this thesis. The conceptual categories that resulted, which are summarised in each of the category discussions in this section, have led to a series of guidelines for those in the interaction design and educational community concerned with developing digital interventions to support the use of digital media in mixed ability classroom contexts. The guidelines concerned with the development of systems to support self-advocacy through the use of digital media are set out below:

- 1. Support students to become confident and competent learners:** An important area for interaction designers to focus on in future research in the context of special education is to support children with special educational needs' social and educational development by helping them to become confident and competent learners. There is no single strategy, tool or solution to do this. It is a matrix of skills, opportunities, social attitudes and tools that must be changed and developed. As designers and researchers we can contribute to this matrix by creating supportive and accessible environments and tools with which students can develop their communication and creative skills and demonstrate those abilities to others. Students must be able to access appropriate learning activities, be supported to take risks and have people that are willing to listen and appreciate their achievements. As a designer then we must see where we can support, mitigate or offer alternatives to the tools and strategies that are used by teachers and the students themselves to support and demonstrate student's confidence and abilities.
- 2. Support student's self-advocacy through active engagement with digital media:** This work in this thesis has shown the social value of using a design-led research approach and creative design process to support students to actively engage in the representation of their ideas and achievements using digital media. If we consider Test et al.'s conceptual model of self-advocacy, (Test et al., 2005) we can see how the photo-sharing consoles in *Chapter 5 – My photos your photos*, and *Chapter 6 – This year I have...* used ICT and digital media to support interpersonal communication and expression. This fits with the matrix of skills, tools and opportunities for supporting students with SEN to self-advocate. The photo-sharing tools supported students to *articulate* their *strengths* and *interests* by

enabling them to express their *preference* about how they were represented to others.

For researchers and designers then this demonstrates that we can support students with special educational and those that work with them to self-advocate through the development of systems that actively engage them in creating, choosing and sharing digital media that represents them and that this is an important and fertile area for future interaction design research. We must ground our design processes in the social and pragmatic complexities of a mixed ability special needs classroom through design-led, cooperative research approaches.

- 3. Support students' and teachers' voice:** Designers and researchers must balance the right of children to use and have their voice heard in the research and design process within the institutional and management requirements of the school and teacher. Whilst there has been a focus in literature on the promotion of the child's voice through interactive systems, the work in this thesis demonstrates the challenge for developing interactive systems in a SEN classroom that incorporates the negotiation of both the student and teacher's voices in the design process.

The photo-sharing console in *Chapter 5 – My photos your photos*, and the insights that informed its design demonstrate the effectiveness, in supporting students with SEN to self-advocate, of designing a tool that enables them to be actively engaged in decisions about how images representing them are to be shared, stored or deleted. The triaging technique used should be considered by other designers working to develop digital media tools and practices to enable expressive and creative communication for children with SEN and speaks directly to the research that seeks to understand the role of children's voice in the interaction design processes (Druin, 2010; Frauenberger, Good, & Alcorn, 2012a; Iversen & Smith, 2012; Read et al., 2002; 2014).

- 4. Attend to existing and potential structures for supporting self-advocacy:** As researchers and designers working in this context we must consider not only the functionality and user experience between student and system but also the social and learning structures that our systems will sit within and create. By tackling both the pragmatic 'situationally constrained choices' that teachers, designers and researchers must make in the day-to-day interactions with children (Cuban, 1986) in a classroom environment and the structures we use to develop shared

experiences (Wright & McCarthy, 2008) we can develop digital tools and approaches that are not only useful but are also used in a mixed ability SEN classroom context.

### **8.3.3 Classroom Practice**

Cuban, Buckingham and Selwyn (Buckingham, 2007; Cuban, 1986; Selwyn, 2009) have all argued that it is not the technology that brings about change in itself but that any changes occur within the social interactions in the classroom that accompany its use. In order, then to ground interaction design processes in the 'social reality' of a school environment (Selwyn, 2011), the existing teaching practices being used (Buckingham, 2007) and the 'situationally constrained choices' of teachers (Cuban, 1986) we must actively acknowledge existing classroom practices and consider how our interventions will compliment, mitigate or interfere with those practices. This is in opposition to the techno-determinist position typified by Prensky in his call for teachers to get out of the way of the innate pedagogic qualities of new technologies.

If we can agree that the role of technology in our classrooms is to support the "new" pedagogy of kids teaching themselves, then we can all move much more quickly down the road of reaching that goal. (Prensky, 2008b, p. 3)

The work in this thesis has shown that it is vital that we consider not only the functions and user experience that occurs between student and system but also the social and learning structures that our systems will sit within and create. By attending to both the pragmatic 'situationally constrained choices' that teachers, designers and researchers must make in the day-to-day interactions with children (Cuban, 1986) in a classroom environment and the structures we use to develop shared, meaningful research experiences with our participants (Wright & McCarthy, 2008) we can develop digital tools and approaches that are not only *useful* but are also *used* in a mixed ability SEN classroom context.

The participatory approach taken in this thesis has allowed us to develop an understanding of the social context and social effects of digital media in a mixed ability classroom. This understanding directly contributes to the wider interaction design community by providing, at the end of this section, guidelines about how to deal with the social complexities that affect and must be considered in our design processes when working in a mixed ability special educational needs classroom.

### *Teacher's Role*

The work in this thesis and in particular the findings in *Chapter 4- The Scented School* and *Chapter 7 – Sounds and stories*, has highlighted the important role of the teacher in choosing, using and modifying digital resources to suit their professional and 'situationally constrained choices' as a means to support their students. It is not an innate quality of the technology that enables students to learn. It is how the technology is used as a tool and the suitability of that tool for the situation that matters. As interaction designers our design processes must address how teachers can and will use our interactive resources with their students. **Link to position in the thesis:** 7.11.1 - *The Role of the Teacher*

The personas presented in *Chapter 4 – The Scented School* are useful guides for designers, researchers and educators as to the role that teachers and other staff in SEN schools can have in an interaction design process. **Link to position in the thesis:** 4.5 - *Personas*

### *Classroom Management*

The studies carried out in *Chapter 4 - The Scented School* and *Chapter 5 – My photos, your photos*, led to a discussion of the importance of supporting active classroom management when designing and conducting research in the context of a mixed ability SEN classroom. A central theme that arose from both studies was how teachers and staff use existing strategies and practices in the classroom to manage and include all students in learning activities, and how students respond to those strategies and practices with the teacher and other students.

These discussions identified three important categories of classroom management that are pertinent to the design and understanding of the social role of digital media: *individual achievement, adapting activities, a group of individuals*.

Jane, the class teacher in *Chapter 5 – My photos, your photos*, discussed the challenges of managing 'a group of individuals'. That is ensuring that the shared teaching resources and activities are suitable for the range of needs and abilities presented by her students. She went on to say that as every student in the school has an individual learning and care plan 'designing for a particular student's special educational need is a moot point.', that is when designing for a mixed ability classroom context we must tailor resources and activities for the needs of individuals whilst still considering the group context in which they work. This is also reflected in the insights of Rosa, the

Delmore school's curriculum access coordinator, that whilst a teaching approach that supports and is accessible to every child is desirable it must be tempered within the needs of the class as a group. **Link to position in the thesis:** 5.7.2 - *Classroom Management*.

In *Chapter 4 – The Scented School* I identified two strategies that Rosa and the schools' teaching staff use to manage 'a group of individuals': *adapting activities* and *individual achievement*. When a teacher is attempting to address the individual needs of a student in the class, they are encouraged to consider how a particular lesson, resource or activity will fit within the wider educational and care plan for the pupil. It is then up to the teacher and other supporting staff to continually assess the suitability and accessibility of resources and lessons for a particular student. They must *adapt their approach* in the planning and delivery of activities in response to the plurality of needs within a class. As interaction designers and researchers we must then turn our attention to the importance of creating systems and devices that support both the individual needs of students and at the same time work for groups of students with mixed cognitive and physical needs. **Link to position in the thesis:** 4.6.2 - *Classroom Management*.

### *Contingency*

The conceptual categories arising from a grounded analysis of the empirical evidence in *Chapter 6 – This year I have...* and *Chapter 7 – Sounds and stories*, led to a discussion of the importance of *contingency* as a strategy used in the classroom by teachers and therefore an essential approach to consider in our research and design.

The term contingency relates to classroom management issues around the planning and structure of sessions in terms of student behaviour and the fluid nature of timings in a classroom context. Teachers must adapt and change activities, approaches and the resources they use with students in response to the ever changing social complexities of a classroom context. Ensuring they can use and create contingent strategies whilst teaching is an integral part of a teacher's professional practice. **Link to position in the thesis:** 7.11.1 - *Contingency*.

As a researcher and designer in this context we must also be prepared to make changes to our plans, approaches and resources in response to the demands of our participants and the environment in which we work and design, to support contingent strategies in

the resources we create for teachers and students. **Link to position in the thesis:** 6.12.1- *Structures*.

#### *Narrative*

The work in *Chapter 6 – This year I have...* and *Chapter 7 – Sounds and stories*, demonstrate that narrative and thematic structure provide context and meaning to the technologies that were introduced. Conversely the introduction of resources to use digital media has been shown to help students handle *high* and *low order* literary concerns (Keh, 1990). The design interventions introduced in both chapters offered participants a form of scaffolding for storytelling and narrative construction. This use of narrative and thematic structure was derived from the observed practice of the class teacher and teaching assistants in using narrative in their teaching.

The student presentations in *Chapter 6 – This year I have...* used narrative as a means to structure and reflect on the achievements that each student had made that year. The photo-sorting console supported higher-level literary concerns by enabling students not only to reflect on and make decisions about how the photos that they were in or had taken would be used, but also to reflect on the aspects of their life that the story represented. The image sorting and audio annotation functions of the story-sorting consoles also enabled students with cognitive and physical impairments to mitigate issues around the mechanics of writing by offering two modes; using images and voice recordings, to tell stories that did not require the literacy and fine motor skills needed for handwriting or typing. **Link to position in the thesis:** 6.12.1- *Structures*.

The range of prototypes introduced in *Chapter 7 - Stories and sounds* also addressed low and high level concerns for writing and story composition. The video mixing workshops and storytelling workshops all used narrative as a basis for the classroom activities. The phonics and sorting boards enabled students to develop an understanding of the phonetics of letters in much the same way as the 'phonic dice' on which the interface was based but with the added motivation of having a projected image and ability to self-check the sound of individual letters. **Link to position in the thesis:** 7.11.1 -

*Narrative and thematic structures.*

#### **8.3.4 Guidelines for attending to existing classroom practices in interaction design processes.**

- 1. Design for active classroom management:** As designers and researchers we must take into consideration the social and pragmatic issues of managing a class that consists of students with multiple abilities and needs within the institutional restraints of a SEN school. Any interactive systems that we introduce must become a tool within that active management process. This means developing tools that are adaptable, robust and accessible to students and teachers who have a range of abilities and needs. As designers and researchers concerned with the design of interactive systems to support social inclusion in SEN contexts, we must not only design for social interaction but understand how interactive systems disrupt and complement existing classroom practices.
- 2. Support contingency and spontaneity in the classroom:** Creating discrete digital tools with clear functions that can become part of a wider constellation of resources and strategies allows teachers to use and adapt them to their teaching practice. A teacher needs to be able to understand the basic functionality and constraints of a device or system so that they can make a professional and creative decision about how the device or system can be used given a set of particular factors. We can also support contingency by creating resources that can still be used without the digital element of them working.
- 3. Acknowledge and support the use of multi-model narrative construction using digital media:** Interfaces that enable students with special educational needs to work with digital media help them to take ownership of their learning, story composition and modes of expression by offering modalities in addition to those offered by text. For this to happen the tools that the technology provide need to be used by skilled and engaged facilitators to ensure that students are using tools that support their individual needs whilst at the same time functioning within mixed ability groups.

#### **8.3.5 Design Processes**

This third category considers the design processes that I and the wider interaction community need to engage with when designing novel interactive systems to support staff and students in mixed ability classrooms. It covers the importance of *designing with teachers* to ensure both the interaction designer and participants are attuned to the needs of one another. It continues by highlighting the need for interaction designers

to consider the physical aspects of their design and the environment in which they work to ensure that the tools are suitable and *appealing* for the users they are created for.

#### *Designing with teachers*

The work in *Chapter 4 – The Scented School*, showed the importance of developing dialogues and meaningful, emotional encounters between interaction designers and teaching staff as a means to enable each side to consider the needs of the other. As interaction designers we need to be aware of the social complexities and professional practice of teaching staff in our designs and not simply expect teachers to conform to our design requirements. Teaching staff need to have the time and training to consider the potential use of the digital designs we introduce but more importantly must be able to contribute as an informed participant from the beginning of the design process. **Link to position in the thesis:** 4.4.2- *Designing with teachers*.

If our aim as designers and researchers is to develop systems that are not only *useful* but are also *used* in the environment they are intended for then we must find ways to understand the needs of our users and enable them to make informed decisions about what they require of our work. The 4.5 - *Personas* section in *Chapter 4 – The Scented School* provides a detailed set of personas of three key members of staff in a UK based SEN school. This is presented to support those in the interaction design community working in this context by providing an overview of staff roles that designers and researchers are likely to encounter in this context. **Link to position in the thesis:** 4.5 - *Personas*.

#### *Designing for the environment*

*Chapter 6 – This year I have...* demonstrated the need as interaction designers to tackle several important *design concerns* relating to the specific attributes of the mixed ability classroom context. In particular, it considered the role of tangible user interfaces for working with digital media to provide multi-modal tools for communication and as points of reference and meaning for constructing narratives. **Link to position in the thesis:** 6.4 - *Design rationale*, 6.12.2 - *Category 2 – Design Concerns*.

*Chapter 6- This year I have...* and *Chapter 7 – Sounds and stories* also showed the importance of considering design elements such as material, colour, shape and texture as a means to support the range of accessibility needs found in a mixed ability SEN classroom. **Link to position in the thesis:** 7.3 - *Design rationale*.

## *Appeal*

Much of the work in this thesis has considered how to design systems that support and engage with teachers' professional practice. If our goal is to make systems that are *useful* and *used* by children as well as teachers, then we must consider how to make our system appealing to them. *Chapter 6 - This year I have...* and *Chapter 7- Sounds and stories* both carefully considered the use of colour, material, fonts and shape as a means to make the prototypes appealing to students. **Link to position in the thesis:** 6.4 - *Design rationale*, 6.12.2 - *Category 2 – Design Concerns*, 7.3 - *Design rational*.

### ***8.3.6 Guidelines for conducting interaction design in a mixed ability special needs classroom context.***

**1. Design with teaching staff to promote more effective design:** As an interaction designer working in the context of a special educational needs school we must develop a mutually understandable dialogue between designer and teacher. We must work with teaching staff to ensure we understand the needs of the teachers and their students and conversely that teachers understand the abilities and needs of the designer and their work. In order to do this, we must incorporate what Wright and McCarthy call 'emotional and meaningful' encounters (Wright & McCarthy, 2010) between designers and participants. This results in a mutual understanding that grounds designs in the lived experiences of both designers and participants and was enabled through the use of an intermediary; the curriculum access coordinator in the work described in this thesis. The 4.5 - *Personas* section provides interaction designs and researchers with useful insights into how particular members of staff might help support their work and the priorities they have for interactive technologies in their teaching.

The work in this thesis has shown that another strategy for developing useful design is providing training for teachers. **Link to position in this thesis:** 4.4.2 *Training teachers*. By incorporating training for teachers into our design strategies we can ensure that those designs will compliment and extend teachers' practices. As seen in the Scandinavian inception of participatory design (Asaro, 2000; Bjercknes & Ehn, 1987) teachers need to not only learn how to use the functions of a particular artefact but also how to express themselves publicly, to evaluate their own and other's decisions, and to absorb information as a means to develop strong participatory structures. This results in technologies that are not only *useful* but are also *used* by teachers in their everyday practice.

2. **Attend to the multi-modal qualities of your designs to promote appeal and reduce learning demands for students:** Students with special educational needs require teachers to use a range of multisensory modes of communication in order to engage with the differing needs and learning styles of students. Using digital media in the special educational needs classrooms offers the potential to use audio, olfactory, tactile, audio and visual modes of expression in teaching and to re-appropriate media that represents pre-existing meanings. As designers and researchers working in this context we must pay attention to the aesthetics and material choices we make to ensure that the children we design for are willing and eager to use the systems we create.

## 8.4 Reflections on Approach

In *Chapter 2 –Position*, I started from first principles to explain my research approach as being both empirical and phenomenological; an inductive approach that starts from phenomena, which then builds knowledge and understanding through interpretation, analysis and explanation. I have been concerned in this thesis with the consequences, intended and unintended, *of* and *for* the use of digital media as a form of social action and interaction within the institutional space of a UK special education school.

The epistemology, methodology and methods of inquiry used in this thesis are not put forward as a general method of sociological enquiry for design research but were chosen for and were appropriate for the studies in this thesis. The methodological approach adopted in this thesis has not strictly followed any one formal methodology but rather has used the appropriate tools and ways of thinking about the phenomena under study offered by grounded theory and the range of participatory design methods to build a coherent and useful account.

Not all the methods used in this thesis have been appropriate or successful. Over the duration of the research, different methods have been used, adjusted, abandoned and rediscovered as new insights, lines of enquiry and practicalities of using those methods in a real world context become clear. The social interactions within the schools I have studied are contingent on the interaction of multiple processes over time. By constantly evaluating and being flexible in my methods of enquiry, I was able to learn from and adapt those methods in response to my understanding of those processes over time.

In *Chapter 2 - Position* I put forward an approach, following from Neil Selwyn (Selwyn, 2011), to researching and designing technology in schools that engages with the school

context as it is, rather than as we would like it to be. In order to do this, I took an embedded, longitudinal approach to conducting my research. This enabled me to gain a deep understanding of the relevant parts of the school context in which the design interventions I created were situated over time and in response to my experiences of interacting within the social contexts of the schools.

In the following section I will reflect on my approach to research and design in this thesis using both the accounts set out in my studies and relevant arguments within the wider literature.

#### **8.4.1 Methods**

The embedded, longitudinal approach taken during this research borrowed methods from grounded theory and different forms of participatory design. Grounded theory was the principal method used to collect and analyse data about the context of this research. It provided a rich and detailed understanding of the context through a combined analysis of participant's views, observations and video data. By using grounded analysis throughout the research I was able to compare results from my different studies to further refine the categories and themes for each study. This detailed understanding of the context did not develop into a full grounded theory, as this would require a significant amount of work and resources that is beyond the scope of this research project.

I devoted a large amount of time to collecting and analysing my data in order to follow the reciprocal, grounded analysis approach. The amount of time this took went far beyond what I had planned for in my research schedule. Learning the skills to gather and analyse my data as a post-graduate student took time. Over the duration of the research project I learnt techniques and methods of evidence gathering that sped up the analysis process. The coding, analysis and iterative gathering of information for analysis is however innately time consuming, particularly when the data is gathered over a significant amount of time and when working without a wider research team (Charmaz, 2006).

A criticism that can be levelled against the methods used in this research project was that student views were only elicited briefly in some of the studies. Ann Lewis would describe this as a *weak* position (Lewis et al., 2008) as the participants were involved in the research but not as equal partners in the process. Lewis says that we must adjust our research in order to take into account the context and abilities of participants to

engage with the research process. Larsen and Hedvall (Larsen & Hedvall, 2012) argue that researchers start from children's capabilities rather than compensating for their impairments and advocate for the use of observation, design intervention and discussion with adult participants as a form of participation which they call *voice by proxy*.

Why then did I choose not to include the views of participants through formal interviews or other PD workshop methods? The participants in this study presented a wide range of communication abilities and many students required support from staff in order to understand or communicate even simple ideas and needs. Other students were capable of understanding and communicating their views but this range of abilities over the different classes of students I worked with left me with a difficult choice regarding balance. I decided that instead of partially representing the views of students whom I could interview directly, as seen in (Garzotto & Bordogna, 2010) where typically developing children were used as proxy voices for children with SEN, I would rely on the observations, design interventions and experience of embedding myself within the classrooms as a form of voice by proxy described by Larson and Haedvall. (Larsen & Hedvall, 2012).

Though I did not use formal interviews with children throughout the research project I did build strong relationships of mutual trust and understanding with many of the participants. Christensen (Christensen, 2004) argues that we can never fully understand or be part of a child's world as an adult and so must take time to negotiate and mitigate some of the inherent imbalances in the adult/child relationship whilst understanding our limitations. During the project I spent a long time with students and dealt with issues as a teaching assistant and lead artist that included peer relationships, bullying, and the other day-to-day concerns of children in a school. Building these relationships with children meant that I was able to meet parents and siblings and get to know about their outside interests and aspirations for work and life outside of school.

Developing trust and taking time to get to know children is, I argue, as important as using more formal participatory methods as a means to illicit the views of children. The methods I used are in line with the qualities that Wright et al. contend are essential when conducting design research:

The development of a relationship between the participant and designer that enables both parties to be attuned to one another's needs.

A focus on the emotional qualities and effects of both the participant's and researcher's experiences.

A compassionate approach to the users.

(Wright & McCarthy, 2010)

These qualities as Lindsay et al. (Lindsay et al., 2012) contend, help the researcher and participants bridge the gap between their day-to-day experiences to work towards a form of shared understanding.

An issue with using a proxy-user method was the over-representation of some adult participant's views. In order to address this, I would share my observations and insights and interviews with other adult participants (with permission from the interviewee) and discuss my interpretations after and during my sessions in the school. Balancing the voices of young people with special needs, their carers and teachers with my own observations is a difficult and nuanced task that required me to be open with participants and to rely on a balanced analysis using multiple points of evidence.

Buckingham, Cuban and Williams et al. amongst others have called for research in educational technology to consider the low level of the interactions within classrooms and schools within which this research study is concerned but also higher level socio-political processes such as the local authority, government initiatives and wider political and industrial processes (Buckingham, 2007; Cuban, 1986; P. Williams et al., 2006). Research on literature concerned with these high-level factors helped to shape the methods and approach to research in this project but was not the focus of the applied research. These levels are beyond the scope of the research project itself but are germane to developing a fuller understanding of the role of interactive technology in special needs schools.

The inductive methods of empirical data collection and analysis used in this research project, combined with taking an extended amount of time working and researching in schools, resulted in a complex body of information and experiences that proved very hard for me to articulate clearly and in a way that is fair to the participants involved. Qualitative research is inherently subjective and relies on the researcher's experience and knowledge and awareness of their own subjective view in order to present an

accurate account of their research. Working with children with special needs is a privilege and places a great responsibility on the researcher to convey their findings in a manner that not only includes their successes but also their failures and problems so that others can learn from and develop the work that has been done. Working closely with adult and child participants and other experts in the field and having adult participants check and discuss my insights has helped to define and validate the outcomes of the research present in this thesis.

#### ***8.4.2 Methodological approach***

As I have made clear previously, whilst this research project made use of participatory methods and principles, I do not claim that this project has taken a Participatory Design (PD) approach. I align the approach taken in this thesis to the work of Guha et al.'s 'inclusionary model' (Guha et al., 2008) (itself based on the seminal work of (Druin, 2002)) for designing interactive technology with and for children with special educational needs. The children participants in my studies had the role of 'informants' in the design process. This was due to the wide range of abilities, age and communication difficulties among the participants I worked with. There was a possibility that some could become design partners but as not all the students could I decided that it would be unfair to exclude others and this would be against the schools directive of providing education and access for all.

The design-led, longitudinal and embedded approach I took in this research project aligns with research projects such as (Avramides et al., 2010; Guha et al., 2008; Key-Bright & Gethin-Lewis, 2011), all of which are considered in the literature and background chapter of this thesis, but differs in some important aspects. Whilst these projects place an emphasis on the importance of rapid development and short participatory workshops my research approach was concerned with a more involved long ranging engagement with participants and context. There is an implied hierarchy of participation that can be found in many research projects concerned with the design of interactive technology for children (Yarosh et al., 2011). This hierarchy places full participation or children as co-designers as being best practice for design with and for children. The issue this raises is that researchers can approach their research and subsequent dissemination with an emphasis on what (Heeks, 1999) describes as the 'indicators of participation', to the detriment of the project's resulting designs and insights (Iversen & Smith, 2012; Yarosh et al., 2011).

I argue that making claims that children can become co-designers and full participants in the design process and removing adult/child power imbalances is unfair to both the research and participants. As Christianson has argued, we cannot fully mitigate the power imbalance between children and adults. These claims of equality in the design process result in the interesting position that children have the same design, creative and research skills as a highly trained adult. It airbrushes out students' impairments and conversely does not give enough consideration to the valuable contribution that students can make through direct participation and the observations of their actions by the research and adult participants. I would align myself in this regard with Armagno and Benton et al. (Armagno, 2012) (Benton, Vasalou, Khaled, Johnson, & Gooch, 2014b) who call for the researcher to start from more progressive constructions of disability, such as the social model (Sandahl & Auslander, 2005; Swain, 2004; Worthen, 1998), that considers the strengths of participants and how to mitigate the socially constructed disabling issues that prevent them from participating. This means thinking about how participants might contribute to research beyond directly giving opinions, rather than compensating for their failures to contribute as a typically developing child might.

The approach I have taken has allowed me to gather a detailed and rich understanding of the context within which I have been situated. It has been participatory and inclusionary in that I have spent an extended time working with and understanding the social interactions of the participants that make up this research project. Heeks, Yarosh, and Iverson et al all contend that researchers must share their values and aims in using participatory design methods so that the readers can evaluate the research in light of this (Heeks, 1999; Iversen & Smith, 2012; Yarosh et al., 2011). My aims in pursuing a participatory approach were twofold: to develop suitable and usable designs for special educational needs classrooms and to understand through an inductive method the context I worked within and where and how I might introduce design interventions. I do not claim that my methodology was emancipatory in line with the democratic principles of PD but it did benefit both the participants' and my work through a reciprocal approach based on building trust and delivering positive outcomes for staff and students in my partner schools.

I was able to gather close observations, interpretations of children and adult participant's actions which resulted in a set of insights that were then used to develop design interventions which in turn informed further insights in a grounded and iterative manner. The design interventions I developed were in line with (Larsen &

Hedvall, 2012) in being propositions or questions that were explored through the use of the artefacts in the school.

The artefacts can be seen as basic questions as well as materialized hunches and understandings relating to the design program. They are continuously being reshaped and reinserted and in a sense giving form to designerly dialogues (Larsen & Hedvall, 2012, p. 39).

Two important reflections about my longitudinal, embedded approach emerged from conducting the studies in this thesis; time and the roles that I played as a researcher. Gathering, collating and analysing all the different evidence in my studies took a large amount of time. Whilst it resulted in a rich body of information and insights the time needed to conduct it may be unfeasible for many other researchers.

During the project I had to take on a wide range of roles: researcher, lead artist, teaching assistant, designer, classroom facilitator, technician and workshop leader. These roles both benefited the research by providing a means to build relationships and be exposed to experiences and skills that I might otherwise have missed. It also meant however that I struggled at times to maintain both my research and my responsibilities to the schools that I worked within. An important example was the issues around negotiating my role and the expectations of staff during the first study. Beyond the insights and accounts that I have set out in this thesis I have learnt a range of skills in managing my roles, developing positive relationships with partner institutes and resource management that will enable me to continue my work in this challenging and exciting field.

## **8.5 Contributions of this thesis**

This thesis makes three main contributions to the community of researchers, designers and educational practitioners who are concerned with the use of digital technology with children and more specifically working within the field of interaction design for children with special educational needs. These contributions are:

1. A set of key insights and guidelines for the interaction design community on the design and use of digital media to support students and teachers in a mixed ability special needs educational context. The guidelines were developed through an iterative, grounded analysis of the empirical evidence gathered and analysed in the four studies

of this thesis. **The key insights and guidelines are presented in 8.3 - *Digital media in a mixed ability SEN classroom: key concepts and guidelines.***

2. A discussion of the research approaches taken in the four studies in this thesis: **This discussion is presented in: 8.4 - *Reflections on Approach.***

3. A set of design personas, developed in *Chapter 4 – The Scented School*, for three key members of staff who interaction designers are likely to encounter when working in a UK special needs school and set out: their role in the school, their priorities for the use of interactive technologies in their work, their role in the interaction design process and the challenges for designers and researchers in this context. **These personas can be found in: 4.5 - *Personas.***

## **8.6 Future Work**

This thesis has provided detailed accounts of four major studies in special educational needs schools in the UK. There are several avenues that could be pursued in my and other's future work on the design and use of tools to work with digital media in a mixed ability SEN school environment. The work conducted in this thesis provides a foundation for conducting interaction design research in this context. The qualitative methods used have provided an understanding and guidelines for design processes that take into consideration the social complexities and social impact of digital systems in a SEN school in the UK.

A subsequent stage in this research will be to develop design interventions, using the guidelines that arose from this thesis, which can be handed over to teaching staff for long term use and evaluation in multiple contexts. It is at this stage that a combination of qualitative observational work and quantitative methodological approaches can be used to evaluate the impact of interventions on the teaching practice of staff and the learning and social development of children with special educational needs.

An example of how you might use one of the guidelines in this thesis for future work might be to start from the guideline: *Support student's self-advocacy through active engagement with digital media.* This could be used as the basis of a longitudinal research project with a single group of children with special educational needs, that supported the participants to create a range of novel digital systems for them to use to self-advocate. These could be developed through a co-operative design practice in order to provide feedback and make changes to how they access a particular institution

or service, for example, a museum, play centre or theatre. This would then allow the research to consider and discuss the effectiveness of the research and design processes used, provide a real world platform for children to self-advocate and result in a set of novel digital interfaces for use in other contexts.

Another fertile area of investigation will be to develop guidelines and techniques for carrying out co-operative and participatory design processes with a group of children with mixed cognitive and physical abilities based on the social model of disability and the emancipatory approach of the Scandinavian inception of Participatory Design. This needs to be investigated through practical research with children with special educational needs and the adults who support them in the play and learning contexts in which they work.

## **8.7 Closing Remarks**

This thesis has demonstrated the role that digital media can have in supporting students with special educational needs to learn, build self-confidence and to share their achievements with people of significance to them. It has been a pleasure and honour to work with the children and adults in the participant schools and has led not only to the experiences and insights detailed in the thesis but also moments of happiness, delight, humour and sadness that I will never be able to convey in writing. I have been humbled by the patience, strength and integrity of the children and adults that I have worked with. We as researchers and designer must continue to focus on research that enriches the lives of children with special educational needs, the people that support them and the contexts in which they learn, love and play.