DOCTOR OF PHILOSOPHY

Valuing the Child

A Person-centred Framework for Assistive Technologists Within a Special Education Setting

Norrie, Christopher Stephen

Award date:
2021

Valuing the Child: A Person-centred Framework for Assistive Technologists Within a Special Education Setting

Christopher Stephen Norrie

This thesis is submitted in partial fulfilment of the degree of *Doctor of Philosophy* at the University of Dundee

University of Dundee
May 2021

Declarations

Candidate's Declaration

I, Christopher Norrie, hereby declare that I am the author of this thesis; that I have consulted all references cited; that I have done all the work recorded by this thesis; and that it has not been previously accepted for a degree.

Supervisor's Declaration

I, Annalu Waller, hereby declare that I am the supervisor of the candidate, and that the conditions of the relevant Ordinance and Regulations have been fulfilled.

"A very little key will open a very heavy door."

Charles Dickens (7 February 1812 – 9 June 1870)

Abstract

We live in an era with decades of equality and diversity legislation in effect around the world. Bodies such as the World Health Organisation (WHO) are focused upon promoting sustainable and accessible development for all. In recent years, society has largely embraced the social model of disability, which characterises disability as a failure by society to accommodate diversity. Yet people with complex communication needs (CCN) - a growing demographic, thanks in part to welcome advances in medicine - typically struggle to achieve independence, and to utilise expressive language effectively. For children and young people just embarking upon this journey, there are the added barriers of vocabulary acquisition in an environment where their needs are not always understood or acted upon, and the negotiation of social and strategic competencies to overcome. Sadly, up to 90 per cent of those with congenital CCN fail to acquire functional literacy. This deficit has grave implications for their capacity to engage with key assets of modern society, including health services, education and employment. Many face a lifetime of passive dependency.

High tech Augmentative and Alternative Communication (AAC) solutions - assistive technologies designed to support people with little or absence of functional speech - may be able to help. However, uptake of these devices in special education (SE) institutions remains poor, and their use is often abandoned due to usability issues, the demands of gaining operational competencies, and other challenges such as matching physical access methods to emerging communicators' needs. Such obstacles demand a nuanced, bespoke approach to service provision and support, requiring significant expertise to organise and oversee effectively.

This research introduces a responsive, tech-savvy support infrastructure that will foster earlier, more purposeful interventions; and introduce a novel, evidence-based approach to the pedagogical support of young emerging communicators in SE. It promulgates and defines, via three qualitative studies, a practitioner new to the SE field: the Assistive Technologist (ATist) - a trained professional with a focus upon innovating and supporting advanced technology solutions for aided communicators. Over the course of this project, the researcher performed the role of the ATist, embedded in the classroom, and collaborating using hybrid ethnographic/action research methodologies with educators, other adult stakeholders in the community, and the pupils themselves to extend the mediated learning experience - a learner-centred intervention-based teaching method. In this way, common user-centred design principles of joint interaction were actuated in a population - children with CCN - traditionally challenging to access and engage.

The results provide compelling indicators of the ATist role's potential to act as a catalyst fomenting enhanced levels of holistic support, boosting pedagogical outcomes, and the adoption of high tech AAC solutions. It is argued that the large scale deployment of such a practitioner in the field could therefore be transformative. A key output from this work is a novel framework informed by these results, and designed to encourage and promote the instatement of ATists in SE institutions throughout the world.

Acknowledgements

Foremost thanks must go to my supervisors, Professor Annalu Waller, Dr Beth Hannah, and for the early stages of my research, Dr Jianguo Zhang. Your collective and erudite support, advice and encouragement is what has made the writing of these acknowledgements - the culmination of this research journey - possible. And on that topic, Professor Alan Newell also deserves recognition - a supervisor for me in all but name.

Also vital to the research described in this thesis, my thanks go out to the staff, parents and pupils of our partner school for allowing my long intrusion into their world. It has been a remarkable, eye-opening, and humbling experience that I will never forget. Similarly, the Assistive Technologists I worked with, without exception, were very enthusiastic and altruistic in their support for my investigation. Thank you. It is my fervent hope that, together, we can make the changes that I believe this research shows are necessary.

Members of the Dundee AAC Research Group, past and present, deserve particular thanks, but I know I benefited from my association with virtually every student and member of staff at the Queen Mother Building I came into contact with throughout my years of researching for this PhD (and indeed my Master's degree prior to that). Special mention (in no particular order) goes to:

Fellow PhD students: Garreth Tigwell, Thomas Hope, Ladan Safiee, Katerina Gorkovenko, Hasith Nandadasa, Conor McKillop.

Staff: Anne Millar, Kathleen Cummins, Mahamadou Niakaté, Norman Alm, Alan Mc-

Gregor, Rolf Black, Andy Cobley.

Further afield, on my academic travels, I have been helped or inspired by: Stijn Deckers, Mascha Legel, Nicola Grove, Hans van Balkom, Ronald Spanjers, Pam Enderby, Rohan Slaughter, Bronwyn Hemsley, Ben Smith.

Grateful acknowledgement must also go to the EPSRC, who funded this research.

Thanks to my viva committee for somehow making a daunting prospect ultimately both fun and constructive:

- Professor Juan Bornman, University of Pretora (External Examiner)
- Dr Rachel Menzies, University of Dundee (Internal Examiner)
- Dr Iain Murray, University of Dundee (Convener)

I would also like to thank my family, and friends outwith academia. Your support, your patience, and your understanding of my relative isolation as I focused on this work - even before SARS-CoV-2 hoved into view - has meant a lot.

For anyone I have inadvertently missed out - your help was gratefully received at the time. But, it would seem, not gratefully enough. Fear not: In due course I will be wracked with remorse.

Finally, thanks to this, my PhD research, for broadening my horizons with sojourns to Continental Europe, Australia, North America (and Sheffield!) as I travelled far and wide to conferences to present my research. I may never have got there without you. And also for encouraging me to forget about the mountaineering and become distinctly portly. Though I do have mixed feelings about that.

Associated Publications

Publications related to this thesis:

Christopher S. Norrie, Annalu Waller, and Elizabeth F. S. Hannah. 2021. Establishing Context: Augmentative and Alternative Communication Device Adoption and Support in a Special Education Setting. *ACM Transactions on Computer-Human Interaction* 28, 2, Article 13 (April 2021), 30 pages. DOI: `https://doi.org/10.1145/3446205`

Christopher S. Norrie, Annalu Waller, and Elizabeth F. S. Hannah. 2019. Exploring the Role of Assistive Technologist within a Special Education Setting. L. Desideri, L. de Witte, R. Chattat, E-J. Hoogerwerf (Eds.), In *Proceedings of the 15th International Conference of the Association for the Advancement of Assistive Technology in Europe (AAATE): Global Challenges in Assistive Technology: Research, Policy Practice* (Supp 1 ed., Vol. 31, pp. 48-49). Holland: IOS Press.

Christopher S. Norrie, Annalu Waller, and Jianguo Zhang. 2018. Developing a novel system to support language acquisition in children with CCN: An ethnographic study. In *Proceedings of the 18th Biennial Conference of the International Society for Augmentative and Alternative Communication (ISAAC)*, Gold Coast, Australia.

Christopher S. Norrie, Annalu Waller, and Jianguo Zhang. 2018. Developing a novel system to support language acquisition in children with CCN: an ethnographic study. *Communication Matters*, 32(2), 8–10.

Glossary of Common Acronyms

ACRONYM	EXPANSION	DESCRIPTION
AAC	Augmentative and Alternative Communication	*An area of clinical practice that attempts to compensate (either temporarily or permanently) for the impairment and disability patterns of individuals with severe expressive communication disorders.*
ALgS	Aided Language Stimulation	*An approach to teaching communication competencies where the communication partner both prompts responses via, and "models" the expressive use of, a learner's AAC device.*
AT	Assistive Technology	*Any product or device designed to assist, maintain or enhance functionality in people with disabilities.*
ATD	Assistive Technology Device	*See above.*
ATist	Assistive Technologist	*A trained professional with a focus upon innovating and supporting advanced technology solutions for aided communicators.*

ACRONYM	EXPANSION	DESCRIPTION
CCN	Complex Communication Needs	*Term referring to individuals who may experience difficulties in understanding or producing speech.*
CfE	Curriculum for Excellence	*The national curriculum for learners between 3yrs - 18yrs of age in Scotland.*
CP	Cerebral Palsy	*A group of lifelong, non-progressive movement disorders typically affecting movement, posture and communication from birth or early childhood.*
CYP	Children and Young People	*A collective term for the named demographic.*
DA	Dynamic Assessment	*A type of qualitative assessment, involving demonstrative interactions between educator and young emerging communicator to determine and extend the latter's communicative competencies.*
DLS	Derbyshire Language Scheme	*A language intervention system designed to support children who experience difficulties developing language skills.*
EBP	Evidence Based Practice	*An approach to occupational practices that promotes the use of empirical evidence in decision-making.*
EI	Early Intervention	*The provision of a service or support to very young children and their carers or family members*

ACRONYM	EXPANSION	DESCRIPTION
FE	Further Education	*In the UK, education undertaken beyond the years of secondary school, though typically distinct from university.*
HCI	Human-computer Interaction	*A discipline considering the design and use of computer technology, and the interfaces between users and their devices.*
ICF	International Classification of Functioning, Disability and Health	*A framework sponsored by the WHO that considers health and disability.*
ID	Intellectual Disability	*A neurodevelopmental disorder placing limitations on an individual's ability to learn and adapt.*
IDL	Interdisciplinary Learning	*One of four "contexts for learning" in the Curriculum for Excellence programme, aimed at boosting cognitive abilities.*
IPR	Intellectual Property Rights	*A legal concept that, for the purposes of exploitation, confers ownership of novel ideas or products upon their originators and/or commissioners.*
LCA	Learning and Care Assistant	*A classroom support member of staff, AKA as a classroom assistant (or education assistant in North America).*

ACRONYM	EXPANSION	DESCRIPTION
MKO	More Knowledgeable Other	*In Vygotsky's theory of child development, this refers to an individual such as a parent or teacher that a child is actively engaged in learning from.*
MDT	Multi-disciplinary Team	*A team of professionals who have differing but complementary competencies working together for a shared goal.*
MLE	Mediated Learning Experience	*Feuerstein's student-centred interaction paradigm, where the mediator - typically a teacher - focuses on the promotion and growth of transferable skills within the learner.*
NT	Neurotypical	*Refers to neurologically typical individuals i.e. those unaffected by a learning or developmental disorder.*
OT	Occupational Therapist	*A health care professional focused on promoting a client's ability to undertake daily routines effectively.*
PCS	Picture Communication Symbols	*Mayer-Johnson graphic symbols, designed as a gateway for emerging aided communicators to see and familiarise themselves with the written word.*
PD	Participatory Design	*A collaborative design approach aimed at integrating participants' perspectives into the end product.*

ACRONYM	EXPANSION	DESCRIPTION
PMLD	Profound and Multiple Learning Disabilities	*An umbrella term for individuals with profound intellectual impairment and restricted apparent understanding of verbal communication, often with accompanying physical impairments.*
SCTCI	Scottish Centre of Technology for the Communication Impaired	*Scottish assessment and advice service for people with severe communication impairments.*
SE	Special Education	*The practice of educating learners with special needs, typically those with learning and/or physical disabilities.*
SEN	Special Educational Needs	*See above.*
SGD	Speech Generating Device	*A high-tech AAC device that acts as the user's "voice" by generating digitised, synthesised or recorded speech in response to the operator's input. See also VOCA.*
SLT	Speech and Language Therapist	*A healthcare professional whose role is focused upon evaluating, diagnosing and treating communication disorders. Also known as a speech language pathologist.*

ACRONYM	EXPANSION	DESCRIPTION
SPT	Single Planning Tool	*A bespoke well-being indicator instrument linked to the Scottish Government's GIRFEC (Getting It Right For Every Child) initiative.*
TATC	Team Around The Child	*Collective term for the trans-disciplinary group of professionals and stakeholders supporting the learner.*
UCD	User Centred Design	*An iterative, problem-solving approach to designing products and systems with a focus on validation through testing and canvassing of end users' opinions.*
VOCA	Voice Output Communication Aid	*A high-tech AAC device that acts as the user's "voice" by generating digitised, synthesised or recorded speech in response to the operator's input. See also SGD.*
WHO	World Health Organisation	*An agency within the United Nations whose remit is to monitor and promote well-being in public health around the globe.*
ZPD	Zone of Proximal Development	*In Vygotsky's theory of child development, this refers to the zone an individual such as a parent or teacher guides the learner through by active engagement. See also MKO.*

Contents

List of Figures

List of Tables

Chapter 1

Introduction

This introductory chapter details the problem that this thesis aims to address and the rationale for undertaking this work. An overview of subsequent chapters is also provided to outline the scope and broad narrative of the pages that lie ahead.

1.1 Problem Space and Rationale

"Leaving no one behind" is a clarion call of the World Health Organisation (WHO), as it focuses upon promoting sustainable development for all. Good health and well-being are at the centre of the organisation's 2030 Agenda for Sustainable Development [57]. Yet in terms of assistive technology (AT[1]), their Global Cooperation on Assistive Technology (GATE) initiative estimates that of the one billion people world-wide who need access to such support, only one in ten currently receives it [130]. With demographics indicating an ageing population, projections for 2030 are that the numbers of people experiencing some form of disability and thereby requiring such support will more than double. In the UK, current government figures suggest that disabled people make up almost 21 percent of the population [150]. Research suggests that in a world of finite resources, providing the requisite resources for individuals to achieve or maintain their independence - not leaving them behind - will be cost effective [96].

[1]AT has been defined as "any item, piece of equipment, or product system... that is used to increase, maintain, or improve functional capabilities of (people) with disabilities" [117].

A particularly challenging subset area of AT is augmentative and alternative communication (AAC[2]). This thesis is primarily concerned with supporting children and young people (CYP) with severe speech, language and communication needs who require help in accessing an optimal means, through AAC, to interact effectively with others. In other words, the leveraging of aided communication technology to facilitate access for these individuals to the agency and power of language, and thereby enhancing their communication, which - according to Waller [179] - is the "essence of life". Currently, however, too many vulnerable young people with these types of developmental disabilities are missing out on vital support in this area in their formative years, with far-reaching ramifications for their progress and life opportunities [126].

Unfortunately, what we do know from decades of research that has taken place in this domain is that there is no single solution. The provision of AT generally has been identified as a "wicked problem" i.e one that is difficult or impossible to solve because of its complex, interrelated and exacting mix of often fluid parameters [73]. Since identifying eligibility, referral and provision of AAC solutions for emerging communicators are - or should be [115] - only the very start of a long and challenging journey on the road to achieving effective communication for recipients, these types of interventions may be among the most "wicked" AT problems of all.

In recent years, society has largely moved on from the medical model of disability (which views disability as a condition intrinsic to the individual, requiring a "cure"), to embrace the social ecological model (which views disability as a failure by society to accommodate diversity) [67]. This change is evidenced by inclusive design enterprises such as the Global Public Inclusive Infrastructure (GPII)[172] - or indeed the ICF's biopsychosocial model that integrates the two [70]. However, people with highly complex communication needs still face a battle to express themselves through the suffocating proxy of ponderous and imperfect technology. For CYP just embarking upon this battle, there are also the added barriers of language acquisition in an environment where their needs are not always understood, and the negotiation of social and strategic

[2]AAC is an area of clinical practice that attempts to compensate (either temporarily or permanently) for the impairment and disability patterns of individuals with severe expressive communication disorders (i.e. the severely speech-language and writing impaired)[103].

competencies to be overcome.

The advent of tablet computers and app stores over the past decade has seen a dramatic increase in the number of electronic AAC solutions reaching the marketplace, offered at significantly more affordable price points than the low production volume technical tools of old. Electronic AAC devices in general are acknowledged to have significant advantages over low or no tech alternatives [11, 146, 180]. Counterintuitively, however, current understanding of this problem identifies a deficit caused by low adoption and high abandonment of AAC devices in special education and mainstream schools alike [89, 180]. Yet early and effective intervention - perhaps commencing at preschool age - is identified as a vital means of enabling CYP with complex communication needs (CCN) to reach their full potential [19, 48, 141]. Casting the impact of these lapses into sharp relief, it has been calculated that up to 90 percent of those with congenital CCN fail to acquire functional literacy [54], with grave implications for their capacity to engage with key assets of modern society, including health services, education and employment [182]. The outcome for many is a life of passivity, poverty and dependence, which in turn has a cumulative cost beyond the individual concerned, extending to their family - aided communicators typically struggle to forge and sustain many external friendships - and to society at large. Contrary to the WHO's guidance, they are indeed being left behind.

The overarching problem space that this thesis recognises and explores one potential solution to may be summarised as: *People with CCN typically enter adult life as passive, dependent individuals with little or no functional literacy, and without the knowledge or enabling advantages of extended conversation potentially available to them through the adoption and enduring use of high tech aided communication solutions.*

A literature review demonstrates that substantive research in this domain has led to a large, and expanding, range of devices currently available, but there is considerably less evidence of research into the quality and impact of intervention provision. As the first stage of investigating the design requirements for a novel AAC device therefore, an exploratory ethnographic study was conducted. Based upon well-established participant observation methods and practices [6], it would focus on identifying the people, pro-

cedures and policies in place to support the provision of AAC devices within a special education environment. The study results showed that there were major challenges in the way that AAC devices were presented to their users[3], and the support being made available to them. These findings were supported in the literature in these and other educational environments. Based upon this evidence, it was decided to change the focus of the research from the development of a novel AAC device to an examination of how best to support the introduction of such devices within an educational setting.

1.1.1 Thesis Research Goal

With the foregoing in mind, the focal problem to be addressed in this thesis is:

> *How can the special education environment be enhanced to promote the effective introduction and support of high tech AAC solutions into the lives of children and young people with complex communication needs?*

To date, the majority of research carried out in the SE domain has deployed data collection methods such as questionnaires and surveys, without any immersive element seeking to engage longitudinally with this difficult-to-access population. However, there is a clear and pressing need to gain a richer understanding of the range of factors influencing persistently disappointing pedagogical and communicative outcomes for this population of learners as they make their way through school, and into the adult world.

By developing greater understanding of behaviour patterns, policies, personnel, and other dynamics within SE environments affecting the support and provision of electronic AAC, an opportunity is provided to evaluate and improve upon current practices. It is essential to establish novel support solutions - be they organisational, technical, or pedagogical - to empower emerging communicators with CCN so that they may reap the full potential of current and future electronic AAC technologies.

[3] In this context, "users" refers to any stakeholder maintaining or operating the technology, be they carers, educational practitioners or the aided communicators themselves.

1.2 Motivation

The advantages of early intervention have been highlighted by the work of researchers such as Light, McNaughton and Drager [48] in particular as they pertain to instilling the proficiencies required for enriching and successful adoption of electronic AAC. However there is little evidence within the literature that this, and similar, evidence-based practice (EBP) has made a significant impact upon service provision and support of AAC in SE. In turn, this indicates an unnecessary but grave deficit in the approach of the educational community toward nurturing CYP to reach their full potential. Raising awareness of best practices, and encouraging service delivery in the field to reflect these strategies and solutions may prove instrumental in significantly increasing uptake and reducing abandonment of high tech AAC. This author's hypothesis is that such a successful adaptation will boost many CYP on their journey through school, furnishing them with the operational, social, strategic and linguistic competencies to facilitate much greater engagement with society as they enter adulthood. This will increase their autonomy and reduce their social isolation. They will stand a far better chance of not being left behind.

1.3 Solution

To address the problem stated in Section 1.1.1 above, this thesis outlines the underpinning investigation towards the development of a novel guide or framework for the cross-disciplinary role of Assistive Technologist (ATist) within special education identified during Phase I of this research. This is envisaged as a new post within the school ecosystem to be established as a coordinating solution to the chronic issues of erratic practitioner knowledge and restricted technical support for AAC-friendly pedagogy encountered during inaugural inquiries by this author within the field (and described in Chapter 3 of this thesis). In this context, an ATist represents a trained professional who will mitigate some of the issues identified above by innovating novel solutions, boosting awareness and delivery of evidence-based practice, and enhancing cooperation between other practitioners within the classroom environment. The outcome of such a practitioner's presence is anticipated to be the introduction of a more mindful and holistic - and thereby effective - support mechanism for both CYP with CCN, and

educators, support staff and family members alike.

1.4 Steps in the Solution

Three major phases were carried out in initiating, developing and evaluating the framework and recommendations presented in this work:

1. Phase I: Immersive Contextualisation - A 21.5 week ethnographic exploration was undertaken in a SE school to identify key factors - bolstered by a literature review - influencing the domain and to gain a richer understanding of the dynamics at work. The study documented artefacts and field notes, capturing important metrics that would inform the ongoing conduct of this research. Interviews were conducted with thirteen adult participants - comprising a mix of practitioners and parents - and a thematic analysis was undertaken of the collated dataset. This generated three major themes with implications for the conduct of pedagogical and technical support provided to emerging communicators with CCN. The cross-disciplinary role of the Assistive Technologist (ATist) was then posited as a potential solution. An ongoing review of prior research confirmed that to date there had been no formal attempt to understand or define the ATist role in a SE classroom.

2. Phase II: Targeted Research - Defining the role: In this phase, the primary aim was to explore the ATist's role as a precursor towards developing a definitive framework. A 19.5 week hybrid ethnographic/action research study was undertaken in a SE school, with the principal investigator (PI) embedded within a class of primary school-age children identified as having profound and multiple learning disabilities (PMLD). An exploratory mixed methods approach was adopted, with concurrent triangulation [88]: A qualitative single case study [66]; reinforced by end of study semi-structured interviews with adult stakeholder participants (n=6) comprising teachers, speech language therapists, classroom assistants and one parent/carer. During the study, the PI worked as part of the team, adopting the role of the ATist, and acting collaboratively and as a mediator between staff, AAC users and their assistive technology strategies and devices.

Content analysis was then undertaken of the collected data (field notes, surveys, artefacts, interview transcripts). Informed by this analysis, the development of a job description/framework guide for the role in SE was planned.

3. Phase III: Framework development and validation - Remote interviews were then undertaken with ATists from the FE sector, and related stakeholders[4] (n=10) - augmented by an expert panel review (n=4) - to assemble and validate the nascent guide, and to gain further insights into the role. Content analysis was undertaken of the interview transcripts, and the resulting themes and feedback applied to finalise the framework design. As a follow up, the updated design was then returned to Phase III participants for final triangulation.

1.4.1 Research Design

The research design for this project is illustrated in Figure 1.1 (below), representing an exploratory iterative approach with each phase being informed by the phase preceding it.

1.5 Contributions

The major contribution of this thesis to the body of knowledge is the development of a definitive, practical framework for the ATist role in SE. To date there had been no formal attempt to identify or define ATist duties and influence, nor the benefits that may accrue from their presence in the classroom. It is argued in this thesis that the large scale deployment of ATists within SE would be both transformational for the lives of thousands of CYP with CCN and their families, but also cost effective in the long term.

[4] Benneworth and Jongbloed define stakeholders as "actors — organizations, agencies, clubs, groups or individuals — who may gain or lose from an organization's activities." [16]

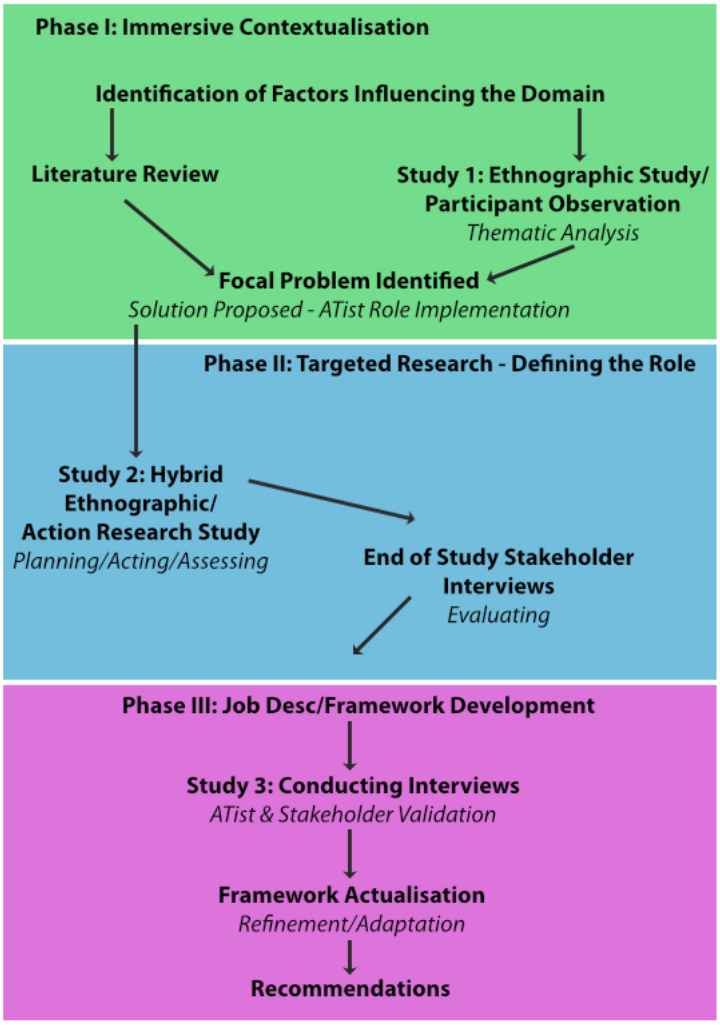


Figure 1.1: Research design summary for this thesis.

This work also delivers a number of secondary contributions, as follows:

1. The application of ethnographic methods and action research processes - across almost two years of immersive fieldwork - to deliver a unique insight into the *modus operandi* of a current SE school, including the strategies, assessment instruments, and multimodal mix of no and low through to high tech AAC solutions in use.

2. A contemporary focus on the demographic reality represented by an increasing prevalence of people in society with CCN, the scale and urgency of the problem - and the inadequacy of current policies, procedures and infrastructures in place to support CYP with additional support needs.

3. The presentation of novel interview data from a mix of 18 educational practitioners and parents operating in SE, and 10 ATists operating in the FE sector (or related stakeholders).

1.6 Images Used in this Work

Unattributed illustrative graphical elements or photographs within this thesis were created by the author.

1.7 Thesis Structure

The subsequent chapters of this thesis expand on the work outlined in this introduction as follows:

Chapter 2 - *Background and Related Work*: Describes dominant issues relating to the focus of this thesis as identified through a review of the literature. Prior research in key areas are discussed to build a solid narrative of the problem space to date. This represents the first half of Phase I of this project (see Figure 1.1 above).

Chapter 3 - *Understanding Context*: Presents the major element of Phase I of this thesis, an ethnographic study undertaken at an SE school to establish current practices in use to support CYP with CCN. The motivation, methods and findings are considered in detail.

Chapter 4 - *Supporting Learners and the Team Around The Child*: In this chapter - representing Phase II of the project - a second ethnographic study with action research elements is described, with the researcher embedded in a single classroom and adopting the role of Assistive Technologist. Again, the motivation, methods, and findings of this study are discussed.

Chapter 5 - *Framework Development and Validation*: Presents Phase III of this work, commencing with a series of interviews with ten current ATists from Further Education (FE), and related practitioners, aimed at validating the research described in previous chapters. A draft job description/framework for the role in a SE context is developed and validated.

Chapter 6 - *Discussion*: The main findings of the current research are summarised within this chapter, and implications and future research opportunities arising from this work are each discussed.

Chapter 7 - *Conclusion*: This chapter presents a final critical overview of the work undertaken.

Appendix A - *Pedagogical Tools*: This appendix contains a brief description of key pedagogical tools found to be in use at the partner school.

Appendix B - *Ethical Approval Forms*: This appendix contains the letters of approval from the University of Dundee Science and Engineering Research Ethics Committee, and the application for undertaking research from Dundee City Council.

Appendix C - *Study 1 Study Materials*: This appendix contains material generated during Study 1 (presented in Chapter 3).

Appendix D - *Study 2 Study Materials*: This appendix contains material generated during Study 2 (presented in Chapter 4).

Appendix E - *Study 3 Study Materials and Framework Actualisation*: This appendix contains material generated during Study 3, and the final framework development and validation process (presented in Chapter 5).

1.8 Global Overview of Research Project Participants

Across the three major phases of this research, contributions from the focal community, and from the wider related academic diaspora, have proven essential. To aid clarity, a table[5] is provided below broadly quantifying the scope of this input.

Table 1.1: Summary of participants across entire research project

		Adults		Children		
Study	**Context**	**Number**	**Occupation or Background**	**Number**	**Age Range (Years)**	**Clinical Profiles**
1	SE School (Field Study)	13	5 Teachers; 3 SLTs; 3 LCAs; 2 Parents/Carers. ID: P01 - P13.	(School Population) 180	5 - 18	Diverse Additional Support Needs
2	SE School - Single Classroom (Field Study)	9	3 Teachers; 1 SLT; 4 LCAs; 1 Parent/Carer. ID: P01 - P09.	7 ID: C01 - C07	5 -12	PMLD
3	Triangulation Interviews (Remote)	10	5 FE ATists; 2 SLTs; 1 OT; 1 Parent/Carer; 1 Phonetician. ID: P01 - P10.	-	-	-
3	Expert Review Panel (Remote)	4	HCI/AAC Researchers ID: E01 - E04	-	-	-
		***36 (35)**		***187 (180)**		

*Bracketed figures = numbers of unique participants. One adult participant (Teacher P06) identified during Study 1, played a key role in Study 2. In addition, the child participants of Study 2 had also been part of the cohort included in Study 1.

[5]Expanded acronyms for the table appear in the glossary list that begins on page ix of this thesis.

1.9 Essential Research Trajectory Milestones

Again for clarity, a list of milestones documenting the narrative arc of this research project is also provided (below).

- Initiate UCD process to develop novel technical tool for early intervention.
- Process finds AAC tech to be underperforming due to fragmented support.
- Focus switches to AAC service delivery - ATist embedded in SE classroom.
- Outcomes are positive - ATist enhances tech support as part of MDT.
- Practical framework for ATist role generated from collected data sets.
- Practical framework validated via contact with ATists in FE sector.

1.10 Summary

This chapter documented the problem statement and rationale for undertaking this research, highlighting challenges in current approaches to AAC provision for emerging communicators with CCN. It describes the sequence of steps undertaken to explore the problem space more comprehensively, and the perceived contributions to the body of knowledge that this work represents. It also includes an outline of the contents for each of the subsequent chapters included here, and a global overview of all research participants contributing to this thesis.

Chapter 2

Background and Related Work

2.1 Introduction

Communication is such an embedded and fundamental part of the human condition that it is recognised by the United Nations as a human right [168]. The dictionary [37] defines communication as "the imparting or interchange of thoughts, opinions, or information by speech, writing, or signs". As a race, this ability has empowered us to question, accumulate, synthesise, share, adapt, control and understand information to the point that modern physicists stand poised to reveal, perhaps, a Theory of Everything [121]. At the same time, communication is so integral to the fabric of humanity that it may be taken for granted yet so often it breaks down - with potentially catastrophic results [84].

In the struggle to express ourselves and be understood, individuals do not restrict themselves in their choices of communication strategies. As an indicator of the importance placed on effective communication by our species, communication partners will adopt any means at their disposal to express themselves, including any combination of the following (Table 2.1):

Table 2.1: Unaided communication modalities [19]

Unaided Communication Modalities		
Spoken Word	Vocalisation	Gesture
Body Language	Signing	Facial Expressions
Actions	Touching	Mime
Eye "Pointing"	Tone of Voice	Head Movements

These communication skills bestow upon their users the autonomy to express their feelings, preferences and personalities; to gather evidence and make informed decisions; to give or ask for assistance; to forge and nurture relationships; and to participate in and contribute to their community. In mastering some - or all - of them lies the key to vital life opportunities. An overarching goal of this thesis is to foster awareness of the indispensability of communication for every single stakeholder affected. According to the United Nations Population Fund, there are some 7.6 billion of these stakeholders now [169].

The aim of this chapter is to acquaint the reader with issues affecting those of us who - for one reason or another - struggle to acquire critical modalities and proficiencies of communication such as functional speech and literacy; and the current methods and prior related work that frame the backdrop for the research described in this doctoral thesis. It forms the initial part of Phase I of this project, as illustrated in Figure 2.1.

2.2 Search Strategy

The author has some experience of researching in this domain, and a significant number of key papers and academic books were already known to him. These were used as a “springboard” to expand upon for a fuller picture of AAC provision and support in education to emerge.

Consistent with the exploratory nature of qualitative research methodologies in general, a "snowballing" search strategy (following references of references, and serendipitous discovery) was adopted. This was intentionally distinct from a protocol-driven

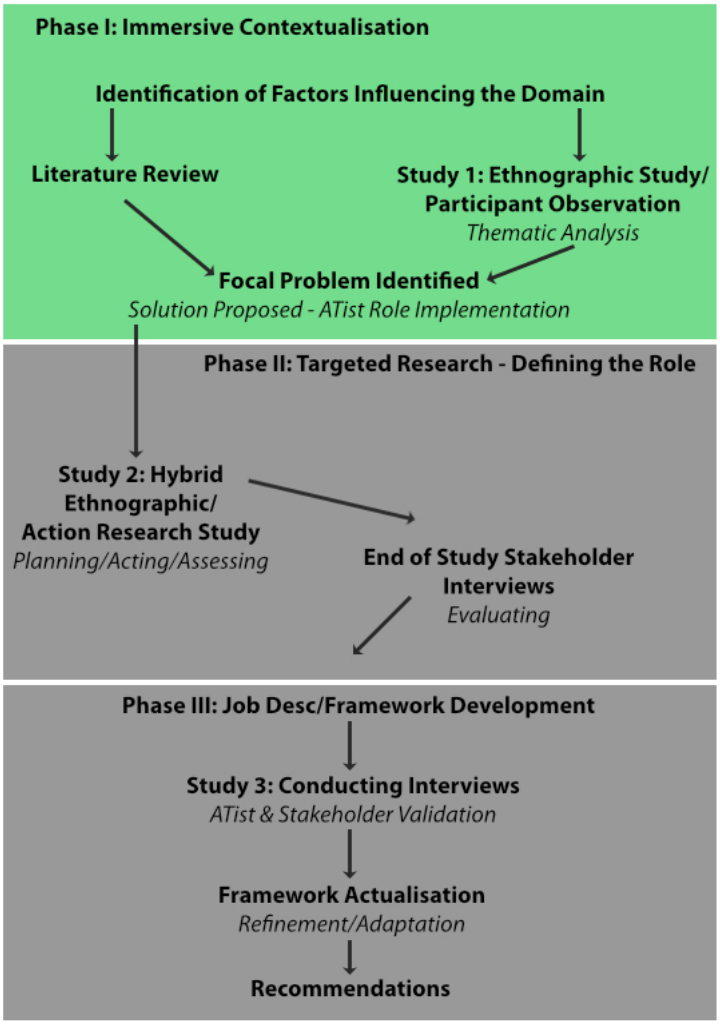


Figure 2.1: Research design for this project (with Phase I highlighted, and this chapter's literature review shown in context).

approach which may have missed important resources and therefore proved less efficient [63]. Initial search terms on databases such as Google Scholar included general AAC nomenclature (for example *high tech AAC*, *speech generating device*), terms relating to education (such as *early intervention*, *core vocabulary*) and clinical profile terms (such as *cerebral palsy*, *developmental delay*), or some combination of these.

2.3 Disability

The International Classification of Functioning, Disability and Health (ICF) is a framework sponsored by the WHO that considers health and disability. It defines disability as:

> "...a complex phenomena that is both a problem at the level of a person's body, and a complex and primarily social phenomena. Disability is always an interaction between features of the person and features of the overall context in which the person lives, but some aspects of disability are almost entirely internal to the person, while another aspect is almost entirely external." [128]

The WHO describes disability as "an umbrella term, covering impairments, activity limitations, and participation restrictions" [131]. Disabilities may be present in an affected individual from birth (congenital), or acquired later in life through, for example, accident or disease.

Chapter One noted the societal movement towards the social ecological model of support for people living with disabilities, and it is generally recognised that demographic trends[1] resulting from medical advances in disciplines such as neonatal and geriatric care will exacerbate the need for increasingly seamless support strategies for our communities in the future [130, 129]. This recognition led to the first United Nations human rights treaty of the 21st century - the Convention on the Rights of Persons with Disabilities - with signatories committed to promoting inclusion and the removal of any discriminatory barriers - environmental or social - that people with disabilities might currently face [168].

2.3.1 Communication Disabilities

From our earliest days in infancy, we begin communicating to express our wants, our needs, our ideas, to bond with those around us, and to attempt to exercise influence

[1] Of particular relevance for this research project, the number of CYP in England alone with life-limiting conditions are recorded as rising from 32,975 in 2001/2002 to 86,625 in 2017/2018 [55], an increase of over 262 percent in 16 years.

over our surroundings [154]. Such conventional paths of development and social interaction may not be routinely accessible, however, for some disabled individuals with impairments affecting their ability to engage in or understand speech - cognitive, lingual, dexterity, sensory or any combination of these [153].

As with other forms of disability, expressive impairments may be congenital (e.g., cerebral palsy, autism spectrum disorder, Rett syndrome) or acquired in later life (e.g., traumatic brain injury, neurodegenerative conditions such as motor neuron disease). In some conditions seen in children with developmental delay, the causes are indeterminable or remain the focus of much debate [108]. Communication disabilities are debilitating at any age, but for young, emergent communicators with complex communication needs (CCN), the repercussions are particularly acute [164] - with ensuing implications for language development and literacy, access to social, learning, fiscal and health resources and opportunities; and engendering potentially harmful passivity and lifelong disconnection from their communities impacting severely on quality of life.

Consider these words from one individual with CCN:

> "If you want to know what it is like to be unable to speak, there is a way. Go to a party and don't talk... Here is what you will find: people talking; talking behind, beside, around, over, under, through and even for you. But never with you. You are ignored... ."
>
> p.59 [19]

Prentice writes:

> "Deny a person the ability to articulate intelligibly, and that person is sentenced to live in social, intellectual, and emotional isolation."
>
> p.213 [137]

It is apparent from these testimonies - and the introduction to this chapter (Section 2.1) - that a communication disability is potentially a very damaging deficit that im-

pacts on what it means for us, as profoundly social creatures, to be human. Yet there are ways and means of reducing this impact, and the proportion of children and adults who potentially may benefit from support in this area is recognised to be expanding as a consequence of improving survival rates and life expectancies across the population. Related to this trend, the number of people with complex and severe disabilities is also increasing [39, 104, 139]. The next two sections will consider, respectively, the expanding prevalence of assistive technologies in society; and the development and application of augmentative and alternative communication (AAC) solutions - a particular focus of this research.

2.4 Assistive Technology (AT)

As discussed in Section 1.1, the demographics indicate increasing pressure for disability support services in the coming decades worldwide. Assistive technologies are recognised as an important facet of the response to this challenge, as evidenced by the WHO's Global Cooperation on Assistive Technology (GATE) initiative [130]. Within the context of this study, AT may be defined as: "any item, piece of equipment or product system, whether acquired commercially off the shelf, modified, or customised, that is used to increase, maintain or improve the functional capabilities of a child with a disability" [99]. The number and diversity of such supports reflect the heterogeneous essence of the growing population they are designed to assist. These tools are also in a state of persistent evolution. For example, traditionally AT has been associated with devices aimed at helping individuals with visual, hearing or motor impairments. However, technologies that offer support to people with cognitive disabilities, for example those designed to aid practical, conceptual and/or social skills - while less well-known - are gaining in prevalence and utility [50]. Table 2.2 below provides a broad outline of the diversity of ways in which technology is being used to promote independence, and support activities of daily living, for people living with a disability.

The table is not intended to be exhaustive; but rather a simplified exemplar of the breadth of the domain. The severity of visual impairments, for example, range from those fixable by prescription glasses, through colour blindness, to complete vision loss. Wheelchairs may be manually, or motor, propelled. Their control mechanisms may

Table 2.2: Examples of assistive technology solutions in current use

AT Support Examples					
Mobility	**Hearing**	**Visual**	**Cognitive**	**Eating**	**Communication**
Wheelchairs	Hearing Aids	Braille	Word Prediction Software	Assistive Utensils	See Section 2.5 below
Walking Frames	Amplified Telephones	Screen Reader Software	Mind Mapping Software	Adaptive Tableware	
Adaptive Positioning/ Seating	Visual Alerting Devices	Screen Magnification Software	Digital Pens	Powered/ Manual Feeding Devices	
Prostheses	Real Time Captioning	Smart Glasses	Digital Voice Recorders	Drinking Straws	
Exoskeletons	Smart Glasses	Tactile Keyboards	Memory Aids	3D Food Printing	

be accessed by head switch, joystick, sip-and-puff[2], or other input method, contingent upon the needs and functional attributes of their owner. The purpose of Table 2.2. is to demonstrate the multiplicity of assistive technologies, potentially influencing any and all areas of their users' activities of daily living to enhance and sustain their personal independence.

It is recognised that in limiting the impacts of a disability, and facilitating enhanced participation in society, AT enriches and improves the quality of the lives of users [134]. An important issue appears to be delivering the optimal arrangement of resources tailored for the needs of the individual. To best meet their needs, many users require a person-centred selection of services and products from the complex mix available [160], broadly illustrated above. As the range of assistive technology devices continues to expand and diversify - responding to the relatively rapid demographic adjustments described above - a consensus is emerging that this can only be achieved effectively by close collaboration between agencies and across disciplines [144].

[2]A tube responsive to air pressure often used by people who do not have the use of their hands.

2.5 AAC Research and Practice

A subset of AT, AAC is a term that encapsulates the diverse range of strategies and technologies adopted by people living with communication disabilities to support (augment) or replace (alternative) spoken communication and promote enduring independence. Modern AAC began in the 1950s, with electronic devices beginning to emerge from the 1960s onwards, increasing in sophistication and availability as technology has evolved in the decades since [173]. Post 2010 this trend has gained exponential momentum with the advent of comparatively affordable, and portable, consumer touchscreen devices and Apple and Google Play app stores[3] (although advancing digital AAC is not to dismiss or denigrate the efficacy of simple and intuitive communication modalities such as natural gesture and signing, which for many remain situationally relevant and often indispensable).

AAC has great potential value, delivering positive outcomes for young children with CCN which cannot be overstated - these include improved communicative interactions, amelioration of challenging behaviours, facilitation of social relationships and enhancing of educational opportunities [90, 107]. In addition to promoting expressive communication in its users, it is also a possible pathway towards building their understanding of the fundamental mechanisms of communication such as personal narrative, turn taking and conversation repair [40, 142]. However, despite the increasing number of AAC solutions entering production, the actual impact of these communication aids as a means of developing communication competencies within their users remains disappointing [180]. The attrition rate through abandonment of assistive technologies remains unacceptably high, and appears - historically and to date - bound in the complex nature of these devices, their usability, candidate match, and the availability of support [89, 91, 119]. There are some indications of a technology-centric approach dominating the field [105], which is potentially at odds with an empathic focus on the nurture and modelling of communication itself [72, 80]. Understanding the dynamics here more fully was a part of the motivation for undertaking Study 1 (described in Chapter 3 of this thesis). The following section briefly summarises the array of devices and access methods commonly available that we might expect to encounter in SE.

[3]Over 130 billion apps have been downloaded onto Apple devices alone since July 2008 [135].

2.5.1 AAC Modalities

AAC supports or strategies are commonly divided into unaided and aided modalities. Unaided modalities include gestures, pointing, vocalisations, body language, eye contact, facial expressions, and sign language, and have the benefit of being highly portable (nothing to carry); are unburdened by risks of technical failure; and are often intuitive [136]. Manual and on-body signing have been shown to be effective and feasible modalities for people with CCN and severe intellectual disabilities (ID), but this assumes that the individual concerned has adequate motor control to articulate their message, and requires a suitably experienced communication partner [149, 156].

Aided modalities are those communication strategies that involve external components, and are divided into two categories:

- Low technology aided AAC.
  - Physical apparatus that supports communication but does not require a battery or mains power supply to operate.
  - Examples include: objects of reference[4]; communication boards; schedules; picture exchange communication systems (PECS[5]); photographs; communication passports; Etran boards[6].
  - Low-tech aided strategies are generally less portable than unaided AAC, but also less prone to failure than high tech AAC
- High technology aided AAC.
  - These are powered devices, either from battery or mains electricity. They are typically computer-based solutions (dedicated standalone or consumer

[4] A physical object used to physically represent a person, action or concept e.g., using a wooden spoon to represent cooking or a paintbrush to signify an art lesson.

[5] Mayer-Johnson Boardmaker PECS [38] is a low tech aided AAC system that utilises pictures to encourage communication via a transactional mechanism.

[6] A low tech means of attaching letters or symbols to a board so that a communication partner can track where an aided communicator is looking.

devices such as iPads utilising specialist AAC apps) that act as the user's "voice" by generating digitised, synthesised or recorded speech in response to the operator's input. Access to their vocabulary is generally achieved via a graphic symbol- or text-based interface [19].

– Devices that specifically replace the user's voice such as these are often described as voice output communication aids (VOCAs), or speech generating devices (SGDs)[7]. An example is shown in Figure 2.2 below. Access methods in common use include touchscreen, eyetracking, switch, auditory scanning, visual scanning, keyboard, mouse, or some combination of these - with brain computer interfaces (BCIs) becoming increasingly feasible [4].

– SGDs have the advantage of their output being more intuitive to understand by a wider range of communication partners, but are less portable than non-technical devices, often require significant operational competence, and are susceptible to technical failure. They also tend to be more demanding and labour-intensive to maintain, and - for emerging communicators - to keep up-to-date with pedagogical needs [19]. Nevertheless there is some evidence that high-tech AAC could be particularly beneficial in enhancing and supporting communication for people with expressive impairments [11].

In many cases a mix of these modalities might fittingly be adopted by the individual using AAC in order to accommodate capricious circumstances encountered such as situational impairment [152], technology malfunction or communication partner diversity.

Finally, some simple powered devices, including single or sequential message communicators such as the Ablenet BIGmack or Step by Step[8] [1], occupy a grey area that

[7] The author has elected to deploy the term speech generating device (SGD) for the remainder of this thesis.

[8] A device which allows audio to be recorded, stored digitally and played back by the operation of a simple switch mechanism.

Figure 2.2: Tobii Dynavox SGD featuring Communicator 5 software with eye tracking access, photographed during Study 1 of this project.

might best be categorised as "light" tech, with a slightly different profile of pros and cons to those described above. Together, such a diversity of tools in practitioners' hands increases the opportunities for sensitively matching solutions to the needs of individual users.

2.5.2 AAC System Customisation and Personalisation

Huijbregts and Wallace (2015) described the importance of customisation and personalisation of AAC devices since the advancement of "interactive surfaces as pervasive, rich, and developed ecosystems" [78]. It should be recognised that people with communication disabilities represent a diverse array of individuals. It follows that the tools they use for communication should reflect that diversity by affording appropriate adaptation to meet their specific needs.

The manner in which language is presented to the user through an interface, for example, will vary depending upon the requirements of the intended user. A person with aphasia through traumatic brain injury who retains their literacy and vocabulary has very different support and communication needs in comparison to a young emerging communicator with a congenital communication disability. Similarly, people who use AAC find their devices more useful to them if they or their helpers can populate it with

content - such as captured photographs and other media - that reflects their interests and personal circumstances [3]. For these reasons, modern AAC devices will typically engineer options for customising and personalisation into their products.

2.5.3 User-focused System Design for CYP with CCN

For any high tech AAC system or technical tool, there may be multiple end-users - from the children receiving the support, to the parents, educators and clinicians who must maintain, update and, indeed, oversee learning/instruction via these devices. Each of these users may have different requirements in terms of how they interact with the technology, and thus efforts should be made to include them in any user-centred product or service design process.

Williams, Krezman and McNaughton identified five principles for AAC, to guide all aspects of service procurement, design and delivery [182]. The fifth, "nothing about me without me", is a term that appears to have attached itself to disability activism in the 1990s (although it has historically also been adopted by other marginalised groups), and is defined as the "right to be meaningfully involved in every aspect of AAC research, development, and intervention".

This is supported by well established design principles that advocate an early and ongoing focus on users - highlighted by Gould and Lewis [60] - in order to achieve "good" (usable) design for products demonstrating "affordance" [122]; and standardised in the domain of human-computer interaction (HCI) by International Standards document ISO 9241 [82] (Figure 2.3).

In designing AAC systems we are confronted with a multiplicity of approaches in this respect, starting with user centred design (UCD) [123] - an iterative, problem-solving process with a focus on validation through testing and canvassing end users' opinions - through participatory design (PD) [140] - similar to UCD, but where the user becomes a part of the team and makes design decisions, rather than simply providing feedback. Empathic design [58], action research [31], and human centred design [59] are other similar terms, and precise definitions may vary dependent upon the source. However, at the core of these allied methodologies is the integration of the participant's

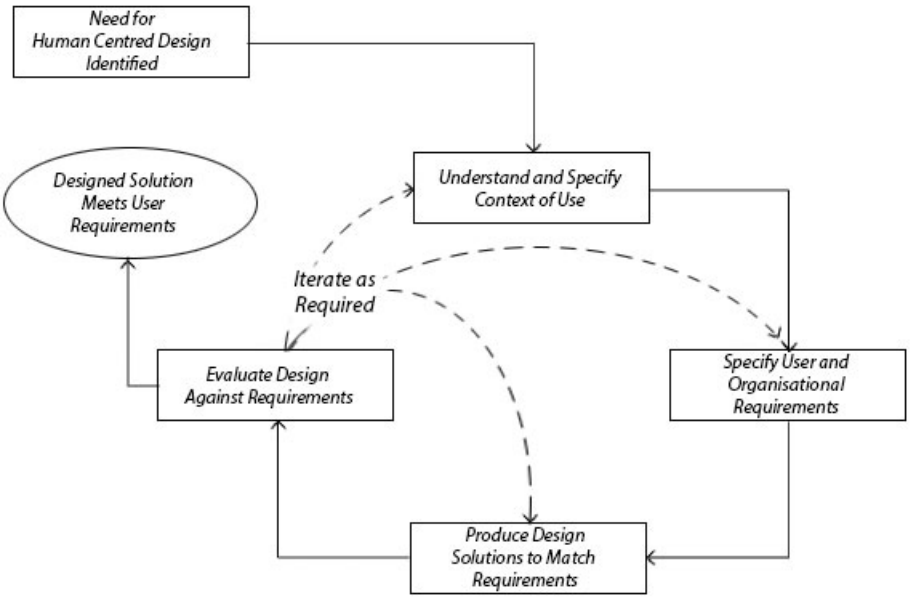


Figure 2.3: ISO 9241-210:2019 Workflow diagram.

perspective into the end product. When that participant has a communication impairment, where feedback or collaboration may be more time consuming [77] or otherwise problematic, the approach encounters additional complexity. The assumption that a non-speaking person has the capacity to learn, to participate, to understand is described as the "least dangerous assumption" [51, 8]. It thus remains incumbent upon designers to find the most empathic way of eliciting constructive feedback from this population.

Mankoff, Hayes and Kasnitz [111] advocate PD as a solution in assistive technology design, but they cite its effective application with disabled adults. CYP with CCN, who have yet to acquire sophisticated communicative or linguistic skills, or access to appropriate AAC support, represent a particular obstacle. Many experienced and respected researchers in the field have circumvented this issue by working with naturally speaking children or other surrogate participants [49], citing "behaviour, attention, seating challenges" [30], communication difficulties and potential "fatigue" [181] in their target user audience. This factor may be exacerbated by demanding research schedules, tight budgets and the consequent pressure for timely results.

Using their Inclusionary Model, however, Guha et al. [65] report significant successes, and indeed highlight some advantages[9] in working with children with complex needs as design partners - given adequate levels of support.

Benton and Johnson [17] identify informant design, and experience-centred design (ECD) as participatory approaches that attempt to keep this group of vulnerable end-users involved in the technology design process, aiming to foster "empathy and aesthetic engagement" while reducing the demands of traditional UCD placed upon them. This is largely achieved through allowing adult designers to take decisions where deemed necessary, but ensuring that the children contribute meaningfully where possible and appropriate.

The Children in the Centre (CIC) Framework [92] recommends a number of practical approaches to working successfully with children with CCN, including expanding the range of semiotic resources used to stimulate engagement.

Numerous researchers [77, 92] recommend designers increase investment in time to achieve fruitful outcomes with SEN participants. Hornof [77] also warns of systemic obstacles to collaborative design that may further complicate matters, often unrelated to a child's disability - "structural, institutional, social, geographical, financial, legal, and attitudinal".

Despite the successes and approaches highlighted here, truly collaborative research with emerging communicators remains relatively limited to date. Writing in 2007, Light and Drager [103] observed that assistive technologies continued "to reflect the conceptual models and priorities of nondisabled adults". This issue remains largely unaddressed in 2020, raising important questions about the lack of true UCD engagement with this population.

It would seem reasonable to suppose that, with some of the challenges described in this section influencing the reduction or non-existence of user involvement, usability of products aimed at this community continues to suffer. This in turn may be one

[9] They enthusiastically cite lateral thinking advantages emerging from cooperative inquiry with children - who are often creatively unconstrained by norms or conventions.

explanation for the chronic abandonment of technical tools we see in this sector.

2.6 AAC in Education

The problem posited in Chapter One - *How can the special education environment be enhanced to promote the effective introduction and support of high tech AAC solutions into the lives of children and young people with complex communication needs?* - identifies the focal population and environment for this research to be special education (SE). SE, or rather the schools that provide it, and the pupils, educators and other stakeholders who represent their populations, is an environment where CYP identified as having special needs (e.g., through developmental disability) may be supported with adapted physical settings and teaching methods to enhance access and therefore meet their individual requirements[10].

The aim of these schools is - or should be - providing children with highly complex needs outcomes and opportunities that may not be afforded them in a mainstream classroom setting. SE schools support CYP with a diverse range of physical, intellectual and behavioural disorders and disabilities, but for this study there is a particular focus upon those identified as having some level of communicative impairment.

2.6.1 Language Acquisition in AAC Users

However advanced an AAC device may be, sensitive implementation should be recognised as an indispensable element of service delivery [124]. In this section we consider the considerable challenges that young emerging communicators with CCN must overcome in contrast to their non-disabled peers.

The term communication impairment can be used to refer to difficulties with any or all of the following linguistic competencies: language comprehension, understanding or expression of vocabulary, and understanding of sound structure (phonological awareness [97]). Neaum claims that spoken language is instrumental in underpinning all

[10]Mainstream education, reflecting the trend towards the social ecological model mentioned in Chapter One, is increasingly improving support and integration for children with special needs ("inclusionary" schooling [35]).

teaching and learning, with children requiring "rich language experiences that include adults who say more than is necessary... and interaction that enables them to engage in talk" [120]. According to von Tetzchner et al., these interactions institute a "communicatively accessible environment" affording the use of language, and thereby establishing it as a route to agency in the perception of the emerging communicator [175]. Such joint engagement or attention is identified as a key mechanism in language acquisition for young emerging communicators i.e. the partnership action of sharing an instructive attentional focus with others [15].

This is congruent with the work of Vygotsky and his socio-cultural theory of child development [100] and the idea that a child learns actively, relying on a more knowledgeable other (MKO) such as a parent or teacher to guide them through a critical zone of proximal development (ZPD). The child develops with the support of scaffolding, recasting, and in a formal setting assessment-derived insights from their skilled communication partner, this assisted performance pushing the boundaries until knowledge is internalised. This can constitute a form of dynamic assessment (DA), where adult mediation is key [162] - see Section 2.7.

This relationship between the MKO and the child learner may also be mirrored in Feuerstein's student-centred mediated learning experience (MLE) [53] where the author refers to "human interactions that generate the capacity of individuals to change, to modify themselves in the direction of greater adaptability and toward the use of higher mental processes" [163]. In other words, to enhance a learner's cognitive functioning. Here, the mediator seeks to go beyond instilling meaning from stimuli in the mind of the learner, towards the promotion and growth of transferable skills. Childhood has been described as the developmental stage when the "advantages of MLE have the greatest impact on cognitive development" [151]. Deutsch illustrates the MLE interaction in the following way (Figure 2.4):

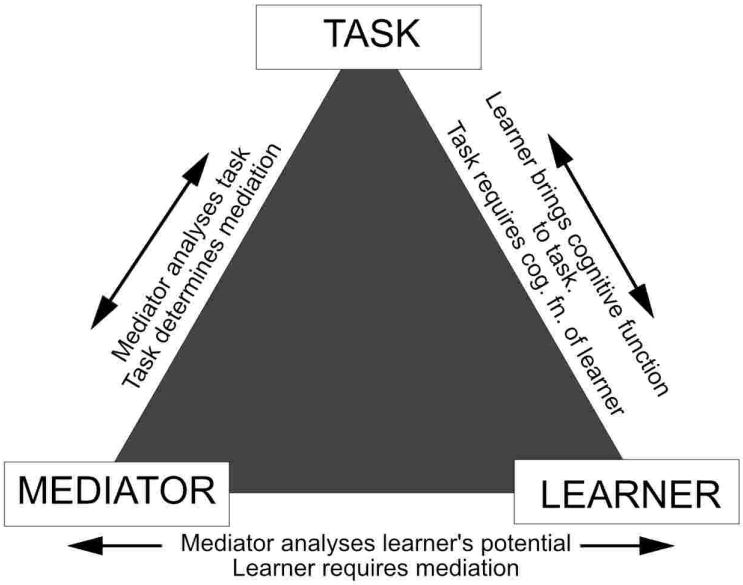


Figure 2.4: The mediated learning experience [Adapted from Deutsch, R. M.]

The goal is to attain a clear understanding of the child's competencies and be able to use that understanding to formulate an approach to assist the child's learning. When a child is presented with a particular task or activity in the classroom, the teacher will have an idea of what they are intending the child will learn; in doing so they need to take account of the child's starting point. The teacher also needs to carry out an analysis of the activity in terms of knowledge, understanding, and skills needed to carry out the task.

The teacher observes how the child approaches the task without intervention in the first instance. The teacher then adopts a range of graduated prompts to mediate the child's learning - these prompts can range from repeating instructions, providing non-verbal cues such as pointing, through to carrying out the task jointly with the child. The teacher carefully observes how the child responds to the prompts provided. According to Deutsch and Reynolds (2000), such interventions are "highly responsive to individual needs and lead to diagnostic and prescriptive insights that are uniquely relevant to a particular child" [45].

For naturally speaking children these interactions with adult mentors typically occur

quite seamlessly in an iterative process manifesting throughout childhood and early adolescence [153, 167]. However, there are critical differences in the early experiences of language acquisition for children with CCN, and their skills must be built within the context of their accompanying "physical, sensory, or cognitive constraints" [19]. Aided language development is the emergence of language constructed via the use of some form of AAC solution. Benigno and McCarthy (2012) describe this complicating interaction shift as being “from triadic (child–communication partner–referent) to quadratic (child–AAC system–communication partner–referent)”[15].

Assuming an adequate level of service provision and co-ordinated support - which is vital but by no means guaranteed [72] - the child will ideally therefore have access to an AAC device [182] such as a SGD to assist them in their learning, comprehension and expression of language. Historically, however, these devices have been difficult to learn, and limited in their use by a multiplicity of factors [10, 72, 119, 156]. Common barriers for adoption often cited include operational and programming demands, speed of use, heterogeneity of client base, situational and ergonomic restrictions, and inadequate support or training leading to abandonment [119].

Young emergent communicators rarely observe adults modelling the use of their technology expressively [153], and their opportunities to interact using their devices is significantly, and damagingly, curtailed in comparison to the dynamic learning experiences of their speaking peers [85]. This deficit has been described by Smith and Grove (2003) as “asymmetry between the modalities of input to output" [161]. Sennott, Light and McNaughton [153] report that the amount and frequency of words children with CCN are hearing contrasts starkly with those encountered by verbal children - 1,600 to 24,000 words per week for the former as compared with 125,000 words per week for the latter. This is generally discordant with further evidence indicating that children who are nonverbal need to be presented with a minimum of 200 opportunities per day to interact via aided language stimulation [7].

2.6.2 Impact Upon Literacy

Being unable to speak has a detrimental impact upon the development of literacy [41, 174]. It has been suggested that up to 90 percent of individuals with congenital

CCN reach adulthood without functional literacy [54]. There is evidence of a causal dynamic between vocabulary acquisition and reading comprehension and the building of cognitive and linguistic skills.

Van Balkom and Verhoeven refer to a "Matthew Effect" (an accumulating advantage in literacy) and state:

> "It can be assumed that children with greater lexical knowledge and better comprehension strategies learn to read more quickly and effectively, and consequently may read more and experience reciprocal growth in cognitive and linguistic skills. It can also be assumed that the gap between better readers and poorer readers widens rapidly through the school years."
>
> p.150 [170]

This mechanism is inevitably exacerbated in children with CCN. There is, however, a growing corpus of evidence that AAC interventions, sensitively applied, can successfully equip even pre-school children with basic literacy skills [75], and access to the benefits of phatic[11], rather than solely transactional, communication.

2.7 AAC Assessment - Intervention

In assessing people with communication disabilities, practitioners aim to accurately gauge each individual's communication potential and match them to the most suitable AAC solution for meeting their needs [145]. Beukelman and Mirenda assert that, for emerging communicators, "norm-referenced assessment tools cannot accurately and meaningfully" be used [19], underlining the need for adopting tailored and responsive strategies to support the population in question. Such adaptive, ongoing and individualised assessment - often termed dynamic assessment (DA)[12], identified in Section 2.6.1 as a means of navigating the child's "Vygotskian" zone of proximal development - appears essential if the most effective constellation of AAC supports is to be achieved.

[11] Expressions that engender social cohesion [32].

[12] A type of qualitative assessment, involving demonstrative interactions between educator and young emerging communicator to determine and extend the latter's communicative competencies [162].

Prior research in this area has been substantive, with some well established frameworks proposed and in use, but there are no generally agreed standards.

Scherer et al. provide the following insight:

> "When we think of the ultimate outcome of the ATD (*Assistive Technology Device*) service delivery process, we think of a consumer satisfied with the use of a recommended device and who… is performing needed and desired activities, and is able to participate in a variety of roles and events in varied settings where the lack of an appropriate device was a critical limiting factor for performance and participation."
>
> p.6 [144]

However, the fast pace of technological change is a complicating factor that cannot be ignored - and is highlighted by numerous studies [110, 10] - adding to a sense of flux and the requirement for ongoing review [101]. Lund and Light [109] highlight the need to document long-term outcomes to "ensure accountability, justify costs, guide clinical interventions and establish best practices to improve services to individuals with complex communication needs". Yet beyond academia, it appears that there has been little research undertaken in the field as to how coordinated practitioners are in making clinical decisions [147] and where it exists, indicators are that time constraints, workload and skill levels all impact on the ability of practitioners to pursue evidence based practices [79].

In this context, one group of practitioners, speech and language therapists, are a key stakeholder and gatekeeper in AAC provision and evaluation, yet we know that - in the UK at least - they are few in number (as a ratio), serving large populations peripatetically, and fewer still have the requisite technological expertise [46, 72, 74]. Combined with over-burdened local authorities, and associated intensifying demands on teaching and other support staff, here there is an increasing pressure to save time or cut corners that potentially may result in conflict with, or hinder application of, international and domestic frameworks, codes and legislative Acts by bodies such as the World Health Organisation, and the United Nations [168] aimed at supporting inclusion and

enabling organised assessment and intervention in AAC [157].

Beukelman and Mirenda used the metaphor of mastering a musical instrument to illustrate the folly of superficial assessments oriented towards provision of a device or solution without accommodating ongoing support and evaluation ("...a piano alone doesn't make a pianist") [19].

Janice Light employs a similar metaphor - that of balance and harmony in a musical score - to explain her *Framework of Communicative Competence* [101] which has been recognised as a useful mechanism for measuring outcomes in AAC implementation, taking into account the four interrelated communication competency domains she defines as:

1. Linguistic: mastery of the language used in the individual's respective community.

2. Operational: sufficient proficiency in operating the AAC system in question to allow adequate focus upon the message being constructed.

3. Social: sufficient skill in the use of pragmatic language, and understanding of the mores of social communication to engage in discourse effectively.

4. Strategic: the knowledge to adopt effective compensatory/repair strategies where communication difficulties are encountered.

Adapted from [101]

Light argues that lacking any one of these skills will impact on the ability of an individual to become a skilled communicator[13].

Beukelman and Mirenda's 1988 Participation Model [19] remains a popular framework that provides a systematic and responsive approach to AAC assessment and intervention. It enables an evaluation to take place contextually, and identifies opportunity and access barriers via an inventory tool that deploys charts and a flowchart paradigm.

[13]Note that this preliminary model of communication competence has been expanded by Light and others in the years since [106, 23] to include, among others, *Policy and Practice Barriers and Supports* - of particular pertinence to this thesis and further discussed in Section 2.7.3 below.

However, in terms of intervention it is also clear - and related to the issue raised above regarding the pressure experienced by practitioners - that an holistic approach is essential, and this has long been recognised in the literature: Pre-empting Light, Savignon [143] insisted that communicative competence is an interpersonal, as much as an intrapersonal trait. That is, opportunities must be made available for the AAC user to communicate. If communication partners, friends, family are not engaged and supportive in this activity then the effect on an individual's capacity to learn may be detrimental - and the intervention's success may be severely impacted [72].

Appendix A.1 is a reference document providing descriptions of a selection of instruments, tools and strategies available or currently in use for teaching and assessing CYP with CCN.

2.7.1 Early Intervention

Early intervention (EI) may be summarised as the provision of a service or support to very young children and their guardians or family members [125]. Typically this is implemented to address an identified adverse developmental trajectory. In the context of AAC, too often intervention has been treated as a last resort; yet according to Romski and Sevcik [141] "it is never too early to incorporate AAC into language and communication intervention for the young child with a significant communication disability". Indeed it appears likely that it is the routine delay of access to appropriate AAC support in infancy that often abandons these children, and the adults that they will become, to a potentially avoidable, or at the very least mitigable, life of forever playing catch up in the widening gap between themselves and their naturally speaking peers [48].

Beukelman and Mirenda [19] note that "it is well established that focused educational and related interventions from an early age can make a real difference with regard to outcome". This is because the nature of developmental sequencing means that there is a window of opportunity when all children are neurologically primed for rapid learning, between the ages of one and three[14], and where AAC intervention has been shown to

[14]For example, the evolution from single- to multi-word utterances, around the age of 18 months in NT children, appears to herald understanding of syntax and the beginning of generative language [133].

be particularly beneficial [103]. When that window closes, it may be closed for good. If this is the case then it is critical that AAC services, and the communication aids they promote, are cognisant of, and geared towards, this reality.

One recurring concern for parents and practitioners in this context - often described as a "myth" - is the impact that high tech AAC may have upon natural speech development i.e. that it may represent a hindrance. Schlosser and Wendt [148] and Blischak, Lombardino and Dyson [25] are among those who have carried out oft-cited studies that seem to allay such concerns. However, these pre-date the launch of the Apple iPad in April 2010 and the subsequent ubiquity and escalating popularity of AAC solutions with touchscreen access which differ, and we can only speculate how significantly, from the technologies those studies scrutinised.

More recently, Oommen and McCarthy [127] have suggested targeting AAC and speech in a "dual paradigm approach" although they too continue to cite the same earlier studies. That discrepancy (with implications for future research) aside, a robust case for early intervention can - and has - surely been made, and developing apposite tools and support strategies to optimally facilitate this is an ongoing challenge that this research seeks to contribute solutions towards.

2.7.2 Modelling Interventions

In Section 2.6.1 above, it was noted that the number of opportunities for children with CCN to interact using their devices was typically inadequate, and damagingly so in contrast to their speaking peers. Aided language stimulation (ALgS) or modelling[15] is an intervention method for communication partners to encourage interaction with a child using their AAC system [2] in order to mitigate an input/output modality "asymmetry" [161, 183]. Broadly, this refers to providing linguistic input both via natural speech and through the AAC device that the child uses to communicate simultaneously [22]. For example, if a child indicates that they are thirsty - perhaps by pointing at their cup - their communication partner will say "More to drink" while se-

[15] In fact, Sennott et al. [153] identify five similar but differently labelled techniques: "aided language stimulation", "aided language modelling", "augmented input", "natural aided language" and "aided AAC modelling".

lecting the symbols for MORE and DRINK on their device. By multimodal, observable action, the aided communicator is exposed both to the operational mechanism of their device, and to the symbolic referents mirrored by the spoken vocabulary to which they relate.

This process, iterative and cumulative, and with adequate dosage [2, 7] may more closely resemble the learning experiences of NT children. It seems clear that such a process has the potential to inform and reinforce at least two of Light's four interrelated communicative competency domains (linguistic and operational) described in Section 2.7 above. This is important, and may be supported by subsequent research which demonstrates ALgS to be effective in rapidly expanding symbol comprehension for children with learning disabilities [68]. Its impact was also found to promote enduring multi-symbol message production in populations as diverse as pre-school children with CCN [22]; and adults with developmental disabilities [13].

An alternative - but related - strategy of modelling intervention for communication partners to adopt utilises the AAC device as a prompt for direct responses from the emerging communicator [20]. Evidence suggests that combining these approaches may strengthen outcomes further [21], but with the caveat that effective training is paramount [161].

Modelling techniques are clearly an important body of intervention methods that can deliver tangible, perhaps life-changing, outcomes for people with communication disabilities. However, as the foregoing papers also document, they require a knowledgeable, and well-trained communication partner with a consistent and thoughtful approach.

2.7.3 The Assistive Technologist

The complexity of some assistive technology devices (ATDs) noted in Section 2.5 above has been highlighted as an issue that may be at the root of poor uptake and high abandonment rates for these devices. Section 2.5.3 identified evidence of limited end-user engagement by developers of these tools as one explanation. Yet another factor may be the level and quality of support available to users - and the expertise required to deliver

it (Section 2.6.1). The Bercow Report [18] and the Scottish Government's *A Right to Speak* [61] both emphasised the gulf apparent between the operational demands of high tech AAC, and the skillsets of those - practitioners, clinicians, family members - inevitably charged with supporting aided emerging communicators in their use of these technologies. Shire and Jones note that it is "essential to secure opportunities for children to engage with competent communication partners" [155]. On the topic of *Policy and Practice Barriers and Supports* - noting the impact of such extrinsic factors - Light and McNaughton state "intervention to enhance communicative competence necessitates intervention with not only the individual with complex communication needs but also partners in the environment, in order to reduce barriers and ensure appropriate supports as required" [106].

What form might such multi-faceted support constitute in practical terms? In the UK's further education (FE) sector, NatSpec - a body that promotes advances in the education and training of young people with learning disabilities - have tried to address such recommendations for improvements in the training of those working with people who use ATDs. Their DART Project (Disseminating Assistive Roles and Technology) produced a paper outlining the role of Assistive Technologist (ATist) [159]. This they envisioned as a novel "hybrid" role fusing education, technical and therapeutic elements, and working to provide support across disciplines to ensure a holistic service was provided to students in FE. This was illustrated as shown in Figure 2.5 (below).

The ATist model as described by the DART paper occupies a unique coordinating position, potentially bridging any gap between students and practitioners in the overarching organisational structure. This innovation acknowledges the reality of the federation of specialised roles that comprise an educational environment, in particular, an environment supporting disabled students, and the complexities - and importance - of fostering cohesion among and between those roles.

The existence of the ATist's role in the FE sector, although not universal, is highly significant - and on the evidence of the literature was without a current counterpart in SE.

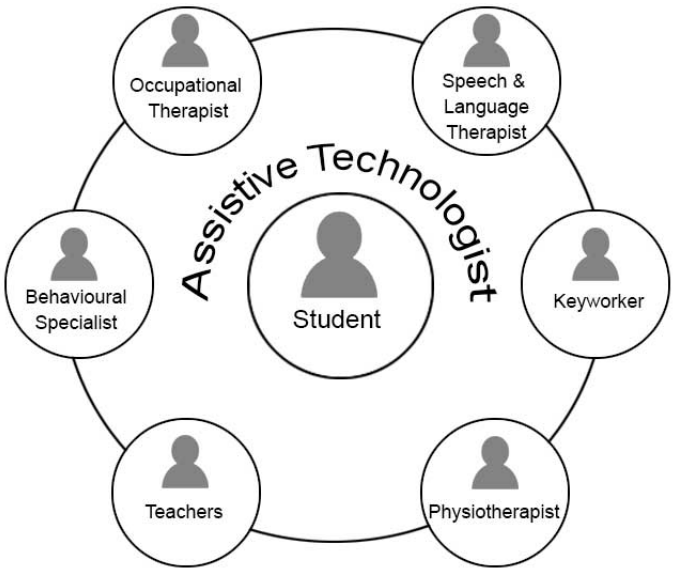


Figure 2.5: The ATist's collaborative role in FE supporting staff and students (adapted from R Slaughter/DART).

2.8 Summary

In this chapter, the current research relating to development, adoption and support of AT and AAC in the education sector was explored - with a particular focus on strategies and interventions aimed at young emerging communicators. Understanding the broad context of the domain under investigation is an essential first step towards innovating solutions. The following two paragraphs are a summary of the relevant findings.

Communication is a human right, recognised in law, and supporting those individuals with communication disabilities to reach their full potential is an obligation for governments around the world. However, the incidences of people experiencing some form of communicative impairment during their lifetimes is increasing, and with potentially severe impact upon the opportunities and outcomes available for affected individuals, and those around them. Young emergent communicators with developmental delays are particularly vulnerable, with up to 90 per cent reaching adulthood without acquiring functional literacy [54]. AAC strategies and devices exist in many forms, with varying levels of sophistication, to support this diverse population. Tech-

nical tools appear potentially beneficial, and are being developed in increasing numbers, particularly since the advent of touchscreen equipped mobile technology platforms and their accompanying commercial app stores. Persistent device or app abandonment rates, however, remain unsatisfactory and these could indicate that conventional UCD techniques are poorly implemented for this population, requiring improved access and more time to implement effectively i.e. the problem may not be the design of the device or the design methodology, but the supporting infrastructure when such a device is introduced.

Whichever device is deployed, the appropriate level, and manner, of pedagogical support could be essential. Although in the SE community numerous assessment frameworks are in use, these must be tailored to meet the needs of vulnerable emerging communicators, and be suitably supported by practitioners in the field. Early intervention may be key, and intervention methods that have been shown to be effective across a diverse population of recipients are available. Such methods, however, require a skilled communication partner, and there is a clear need for well-trained and supported professionals in the field. In the FE sector, the transdisciplinary role of the ATist has been suggested as a possible way forward.

2.9 Conclusion

Although the foregoing review revealed much about the context of this complex and challenging area of research, the most significant discoveries arising from this exercise are deemed by the author to be:

- A very high proportion (up to 90 per cent) of CYP with congenital CCN fail to acquire functional literacy [54]. This is a reliable indicator that major issues remain to be addressed in this problem space.

- A recognition that very few - if any - datasets had been captured through empirical ethnographic research in this domain.

The latter issue may be explained by restrictions inherent in arranging access to this vulnerable population. Yet it is acknowledged that ethnographic field work has ad-

vantages over other methods of research, the proximity of the researcher often gleaning novel insights from informants that may not otherwise be forthcoming.

On this basis, it was decided that an important contribution, in the first instance, would be to undertake an ethnographic study in a SE school to gain a deeper understanding of the domain.

Chapter 3

Understanding Context

3.1 Introduction

Chapter Two's literature review yielded useful insights into the range of factors affecting access to communication for those emerging communicators within our communities who have CCN. However, what also emerged from the review was a potential gap in the knowledge base - one possibly emblematic of the difficulties often assumed in working with this population, and surely an egregious detail in the wicked problem narrative cited in Chapter One. Few - if any - significant studies have adopted an immersive research paradigm to engage this ostensibly difficult to reach population of learners. Recognising that this deficit of context could be significant, an ethnographic study was initiated within a SE school to capture data *in situ*.

In the context of the problem this thesis aims to address, issues of particular interest arising from the earlier research were:

1. The importance of early intervention [154];
2. the benefits of access to high tech AAC for young aided communicators [11, 103];
3. and the disappointing prevalence of device abandonment [89].

Assistive technology devices (ATDs) and software packages to support this population have massive potential, and appear to be abundant, so why are so many CYP with CCN leaving school bereft of functional literacy? This mystery focused the author's attention upon establishing a deeper insight into the means and efficacy by which such technologies are adopted by emerging communicators within SE, and the levels of support made available to them.

The following chapter - Part 2 of Phase I of this project (as illustrated in Figure 2.1 earlier) - describes this work in detail.

3.2 Aims of the Study

The study aimed to answer the following research questions:

1. What are the facilitators and barriers for educators currently using technology to stimulate functional communication and language acquisition in children with CCN?

2. How is the technology procured, implemented and monitored?

3. Which tools or strategies are currently in use?

3.3 Methodology

3.3.1 A Qualitative Approach

The complexity of this domain makes a compelling argument for a qualitative study design. Qualitative methods are increasingly popular as a means of directly accessing the perspectives of participants, and as such have been recognised as effective in investigating clinical practice [6]. The following section describes the approach in undertaking an ethnographic study at a SE school to gather data, the hypothesis being that the immersive nature of such an approach could yield novel insights that prior research had overlooked. The opportunities for empathic interrogation that ethnography represents distinguishes it as a uniquely apt means of eliciting information from a diverse

and sensitive population of communicators.

3.3.2 Context and Recruitment Strategy

The Dundee AAC Research Group - based in Computing at the University of Dundee's School of Science and Engineering - maintains links with special educational needs schools throughout the country, and a suitable partner school was approached during spring 2017 to collaborate in this study. The chosen school occupies a modern building, and has approximately 180 pupils aged from five to 18 years of age with additional support needs. This number includes a diverse range of young emerging communicators, many with physical, developmental and/or communicative disabilities.

Following an exploratory meeting[1], the Headteacher agreed in principle to the study. Approval was then sought and received from both the relevant city council's education department, and the University Research Ethics Committee (see Appendices B.2 and B.3). The former required the completion of an application form requesting permission to undertake research in a school under their jurisdiction; the latter procedure involved the preparation of information sheets and consent forms tailored for all participants - parents, educators, and children (the form targeting pupils was designed to support Mayer-Johnson Boardmaker PECS [114] - thus providing an accessible solution to the acquisition of meaningful consent).

The author also applied for and received confirmation of enhanced disclosure from the Protecting Vulnerable Groups (PVG) Scheme, and engaged in a short programme of acclimatisation by attending a local nursery school to mitigate his limited experience of a school-age pedagogical environment. Three pilot attendance days were also organised at the end of June 2017 for basic introductions to the discrete departments within the partner school (primary, secondary, enhanced support area (ESA)) before the summer break commenced. This allowed work in the autumn to launch seamlessly, and was also a pragmatic compromise to accommodate the school's timetable as efficiently as possible. As well as precipitating familiarisation from both the researcher's and the School's perspective, this time also enabled the PI to compile a formative list

[1]This meeting outlined the aims of the research, and paid particular heed to field study ethics involving vulnerable groups e.g., informed consent, user self-esteem, and preservation of anonymity [116].

of candidate interviewees.

3.3.3 Participants

Child Participants

The pool of children in the study (n=180) - in common with other SE schools [9] - represented a heterogeneous range of ages, genders, and developmental disabilities. An original goal of the overarching project was to involve these children in participatory design at a later stage. In the current ethnographic study, therefore, there was a particular focus on identifying suitable candidate children to work with.

It has been said that there is no typical disabled person [177], that they are "consistently inconsistent" [71] and that, for example, if you have met one person with autism, then you have simply met one person with autism. Possessing little or no functional speech may in fact be a rare defining trait many children with CCN share, irrespective of precise clinical profiling. This common attribute was a persuasive factor in favour of justifying observational fieldwork as a method for identifying patterns of engagement in this heterogeneous group, recording their chosen mix of modalities and strategies for communication in a day-to-day, real world context - and how they were supported in those.

Almost all of the children attending the school were at risk of experiencing the social isolation, the passivity, the impacted quality of life described earlier in this thesis. This study was intended to examine the wider environment they inhabit, and to understand the interactions between pupils and the adult stakeholders implementing policies and practices on their behalf.

Adult Participants

Adults in the study were selected from the cross-disciplinary mix of staff, and parents with children in attendance at the school.

Criteria for Selection

Resonant with Morrow et al.'s assertions on the inherent value of the contributions of a range of roles as informants [118], it was recognised as important in this study to ensure the canvassing of a full and representative range of adult protagonists in the complex setting under investigation. Criteria for selection evolved with the study as work progressed, with the author monitoring outstanding requirements in the collected data - e.g., accruing awareness of the structure and organisation of the school - and adjusting identified candidate interviewees responsively to target gaps. (Caveat: this was also partially dictated by availability and willingness of individuals to participate. Any reluctance was heeded sensitively and acknowledged politely without resistance - in this way it was hoped to avoid any danger of managerial delegation of unwilling or overtly defensive collaborators.)

Adult stakeholders were typically identified in the school, and invited to participate on the basis that:

- they had experience of working with children with CCN either as a practitioner or as a parent;
- they had at least one year of association and/or familiarity with the partner school either in a pedagogical, support, or parental context;
- they were personally comfortable to commit to one interview session of circa 60 minutes, with a possibility of a follow up member check contact at a later date [52].

The peripatetic nature of some of the professionals working within the school also provided a window into practices further afield.

Characteristics

Four distinct adult stakeholder groups were identified, with subdividing characteristics based upon specialisms where applicable. **Table 3.1** details these, and records some demographic characteristics of the participants.

Table 3.1: Study 1 adult participant characteristics

ID	Age	Education	Role	Years Experience	Specialism	Tech Comfort Rating[+]
P01	45-54	Postgrad	SLT*	11	PMLD	Very
P02	18-24	Undergrad	SLT	3	N/A	Moderate
P03	45-54	Undergrad	SLT	25	High Tech AAC	Very
P04	35-44	Postgrad	Teacher	5	Art Therapy	Moderate
P05	55-64	Undergrad	Teacher	41	ASD	Nil Response
P06	45-54	Postgrad	Teacher	7	PMLD	Moderate
P07	25-34	Other	Teacher	10	ASD	Moderate
P08	35-44	Undergrad	Teacher	7	Primary	Nil Response
P09	35-44	N/A	Parent	N/A	N/A	Minimal
P10	45-54	N/A	Parent	N/A	N/A	Very
P11	55-64	Other	LCA**	20	Early Years	Nil Response
P12	45-54	Other	LCA	27	Makaton Mentor[++]	Moderate
P13	35-44	Other	LCA	15	N/A	Very

∗ Speech and Language Therapist | ∗∗ Learning and Care Assistant | [+] Data for this column captured from member-check survey | [++] Makaton is a simple language programme mixing signing and symbols.

Thirteen adult participants were selected in total for supplemental interview - Speech and Language Therapists (n=3), teachers (n=5), Learning and Care Assistants (n=3), parents (n=2). Each was assigned a number (Px) to preserve anonymity. Participants ranged in age from 24 to 62 years of age (M=44); and the professionals ranged in experience from three to 41 years (M=15.5) although these figures may include years in mainstream education in addition to SE. All were native English speakers. All formal interviewees were female: This was a result of the asymmetric gender balance within the school, a recognised phenomena [166].

On the foregoing evidence, there is a diverse mix of adult stakeholders on the ground in such an organisation, and each - individually and as a collective representative of a particular role - has a contribution to make in revealing insights into the day-to-day operation of the school, and the support of children with diverse and complex needs.

3.3.4 Data Collection

Materials

A Panasonic Lumix digital still camera was used for capturing artefacts; a notepad and pen were used to document field notes; an interview guide (see Appendix C.4) was used for the semi-structured interviews, along with a digital audio recorder to capture informant responses for transcription.

Method for Classroom Observation

A hallmark of the ethnographic study is researcher immersion in the mores of the group(s) under scrutiny. Naturalistic observation in a setting familiar to the subject(s) is understood to reduce the likelihood of deviation from typical behaviour in response to the presence of a researcher. A major strand of this investigation was to participate in individual classes with return visits to especially productive or challenging cohorts where required. Excluding the June pilot study, a total of 21 separate classes, across a mix of primary (n=8), secondary (n=5) and autism spectrum disorder (ASD) (n=8) departments, were visited. Six were selected for at least one return visit (with the most visited class receiving four half day visits in total). This encapsulated 77.78 percent of the total school population (27 classes).

Work continued throughout the autumn and early winter of 2017 encompassing 21.5 weeks in total (inclusive of seasonal holiday breaks), with 18 full day visits. The duration of the study - initially scheduled for four to six three-day weeks - was extended responsively partially as a result of accommodating the partner school's timetable and circumstances, and partially in response to the complexity of the story gradually unveiling as data collection advanced.

Attendance typically involved full mornings and afternoons shadowing different classes for observation[2], informal canvassing, note-taking, and artefact collection.

[2]This was a mixture of non-participant and participant observation. The former was intended, but the latter inevitably occurred as a natural consequence of immersion in a busy classroom environment with inquisitive occupants. This is consistent with current thinking on the practicality of true neutrality in a research setting [34]. On balance, data collection was perceived to be enhanced by the interactions that did take place.

Weekdays away from the school were an opportunity for the researcher to write up notes and prepare for future visits.

Written field notes carefully documented metrics of scheduling and activities undertaken, assistive technologies observed in use, and informal interactions between and with staff and pupils. As a formative exploration of the problem area, this observational approach allowed the children to make a positive contribution to the study while relieving them of any particular pressure to perform or divulge specific feedback.

Physical artefacts such as relevant documents and objects of reference examples were gathered where permission could be obtained, and photography was used extensively to capture items that could not be collected (see Figure 3.1 below). Typical subjects for photography were SGDs, BIGmack communicators, single switches, tactile props, interactive boards, soft play and classroom settings (such as positioning of student tables, decorations).

Video and audio recordings were not captured due to privacy concerns expressed by the participating school's senior management team.

Figure 3.1: Artefacts, including (clockwise from top left, not to scale) Canaan-Barrie signs, BIGmack communicator, Object of Reference, Boardmaker PCS visual schedule, interactive LCD screen, SGD with eyegaze, documents.

Spreadsheets recording all assistive technologies, computer software programs, devices

and assessment/teaching tools and strategies encountered or described were set up and maintained.

Interviews

Individual, face-to-face interviews with key adult stakeholders were conducted between late August and late November 2017, taking place over lunch or post-school hours. These were semi-structured, and adjusted iteratively throughout the data collection phase as a comprehensive picture began to emerge. Each participant was given time to read a (role) contextual information sheet and each completed an informed consent and audio/image release form (see Appendices C.5 - C.10) at the commencement of the interview, in line with ethical commitments. The interviews themselves were audio recorded, with a total extent of ten hours and 22 minutes (M = 47 mins 51 secs). The shortest interview duration was 30.21, the longest 52.36.

A brief discussion guide was prepared. At this early stage of the overall project - with the researcher still engaged in an exercise to prepare for the user-driven development of an innovative AAC device supporting autonomous vocabulary acquisition - the questions aimed to gather data that would enhance a UCD process. The author felt that observations alone had not yet furnished sufficient data to reliably answer the stated aims of the study (Section 3.2), and therefore the discussion guide was designed to be both exploratory and corroborative of the data gathered heretofore (both through the study and the earlier literature review). Cognisant of this situation, a total of six questions guided the interview structure:

1. Which AAC strategies or resources, unaided, aided, low- or high tech, do you use/are you aware of being used within the SE context?

2. How are communication aids and support strategies administered/maintained within the school?

3. Which instruments or tools do you use/are you aware of being used to assess vocabulary/language acquisition with these children?

4. Do you think the aided vocabulary acquisition device under consideration would

be beneficial for your children?

5. Do you have any practical advice for how to elicit feedback from your children/the children that you work with effectively?

6. From the children you are familiar with, can you identify suitable candidate participant(s) for the engineering phase of this research?

By adopting an in-depth, semi-structured approach, it was hoped that probing questions within a conversational setting would shed light on wider policy issues - thus identifying barriers and facilitators to vocabulary acquisition at a more systemic level.

The interviewer aimed to establish respective backgrounds, attitudes, competencies and approaches towards working within the school in concert to deliver effective educational outcomes for pupils; and also to gather comprehensive information about AAC *in situ*, and early responses to a description of the proposed device. Where bandwidth and network access allowed, the interviewer took the opportunity to demonstrate a mobile app that replicated a part of the envisioned functionality [24] - i.e. a device applying intelligent image processing to afford autonomous vocabulary acquisition - to illustrate the concept more clearly.

The documented question framework of topics to be explored acted as a guide throughout the interviews. The breadth and complexity of the environment meant that the interviewer consciously encouraged participants to elaborate in order to explore and unveil novel issues, and to validate responses. A strategy of recasting was employed to prompt clarification, and further explication e.g., "So you are saying that…?", "Why do you think that…?". Key topic questions were predominantly open-ended e.g., "Could you describe your familiarity with assistive tech in your school?", with supporting follow-up questions such as "Do you support any high tech AAC in the classroom at the moment?". Efforts were made to explore the participant's attitudes and accounts of their practice objectively and empathically by allowing them time to speak, and by avoiding leading prompts or questions. The risk of guarded responses to an "outsider" perceived as scrutinising their practices was mitigated by repeated reassurances of anonymity, and emphasis of a collaborative focus on improving service provision for

children in SE.

Later interviews were characterised by their infrequency and increasing difficulty to arrange, perhaps symptomatic of a time-poor population. Encountering novel data also became increasingly rare, indicating saturation may have been met and that the sample size was adequate, when balanced against other factors such as time constraints.

Member Check

In qualitative studies capturing data from human participants, a member check refers to a means of confirming narrative or interpretive accuracy [28]. For the current research, member checking was an iterative process, encompassing classroom discussions and during the formal interviews themselves. Follow-up contact via email, a Survey Monkey [165] online questionnaire targeted at interviewees (and a scheduled meeting with the Assistant Headteacher) continued this process beyond the conclusion of the main study in order to bolster the overall rigour of the work (Appendix C.11). The online survey, predominantly consisting of open questions, was to ensure consistency of data - and helped to mitigate weaknesses recognised in the conduct of the earlier interviews as the study refined and progressed. This included demographic information such as educational level, years of experience in SE, specialisms, and technology comfort level. Data in the final column of Table 3.1 were collected in this way - although respondents were answering a closed question in this example, the Nil responses may be significant i.e. open to a deeper interpretation such as discomfort or avoidance [87].

3.4 Analysis of Data

Audio recordings of the interviews were transcribed using open source transcription software[3] [171], with diligence paid to accuracy - for example, by recording any filler or "buffering" words and sounds uttered, careful attention to punctuation, and by multiple passes to verify verbatim reproduction and to mitigate against any errors. This process generated 130 pages of single-spaced textual data (formatted in Arial font size 12), extended a further 30 pages by the inclusion of the information-rich bulleted field notes log.

[3]Non-automated i.e. not speech-to-text.

Conformant to ethical requirements, access to these data were limited to the researchers (the author and his supervisors) and steps were taken to ensure anonymity was preserved, such as the use of pseudonyms to replace real identities.

Both data sets, along with captured digital (photographic) artefacts, were then imported into QSR NVivo, a qualitative data analysis software designed for the analysis of unstructured data [138]. This tool was used to work through the significant volumes of data collected to perform an inductive thematic analysis (TA) for the study.

The overarching goal of any TA is to forge understanding and meaning from measurement via constructive interpretation [87]. Broadly following the influential phased approach described by Braun and Clarke [26], the author commenced the extensive process of data coding and identifying themes, actively engaging with the data, with the aim of extracting meaningful insights from the subjective viewpoints and activities of the target population, and thereby going some way towards meeting the research goals.

Braun and Clarke [26] provide a "step-by-step" guide to their procedure for TA, but this is in fact a pragmatic expression of what is to some degree a non-linear, cyclical and reflexive procedure. They describe six "phases":

1. Familiarisation with the data.
2. Generation of initial codes.
3. Searching for themes.[4]
4. Reviewing themes.
5. Defining and naming themes.
6. Producing a report.

Adapted from [26]

[4] In fact Braun and Clarke now talk about "generating" themes, asserting that "searching" reduces the emphasis on active engagement with the data by the researcher [27].

They support this with a 15-point checklist of criteria for good TA, which was also referenced during the execution of this analysis. Note that assessing inter-rater reliability is not a feature of this checklist, and that questions remain as to the applicability of this method in a qualitative research analysis [5]. For these reasons no inter-rater reliability check was undertaken for this study.

3.4.1 Materials for the Thematic Analysis

An Apple Macbook Air running macOS 10.13 High Sierra and NVivo 12.5.0 (qualitative data analysis software) was utilised in analysing data for the thematic analysis.

3.4.2 Phase 1 Familiarisation with the Data

Phase one - becoming familiar with the collected data - is a concurrent, and natural result of active data collection and curation, assuming these tasks are being implemented by the same researchers. Conducting and then transcribing interviews, for example, develops a close familiarity with the information. Braun and Clarke describe transcription as an interpretive act, thus placing the researcher in an active role synthesising meaning almost from the moment data collection commences. For the current project, the author/researcher had a central role throughout, which accelerated progress towards the next phase.

3.4.3 Phase 2 Generation of Initial Codes

With all relevant data imported into NVivo, Phase 2 was focused on generating initial codes i.e. identifying features that appear interesting or significant to the inquiry, and tagging and labelling respective passages of text or images to begin organising the data into meaningful categories. Sixty-five initial codes were generated from the raw data following this recursive procedure, with 852 respectively linked data extracts.

3.4.4 Phase 3 Searching for Themes

Having developed a long list of codes, these would now be a source of candidate themes - summative categories that might collate a number of codes to convey a broader, overarching message.

The outcome of this phase was seven candidates themes, with a number of ancillary sub-themes. These were then generated graphically as an initial thematic map within the software (see Figure 3.2 below).

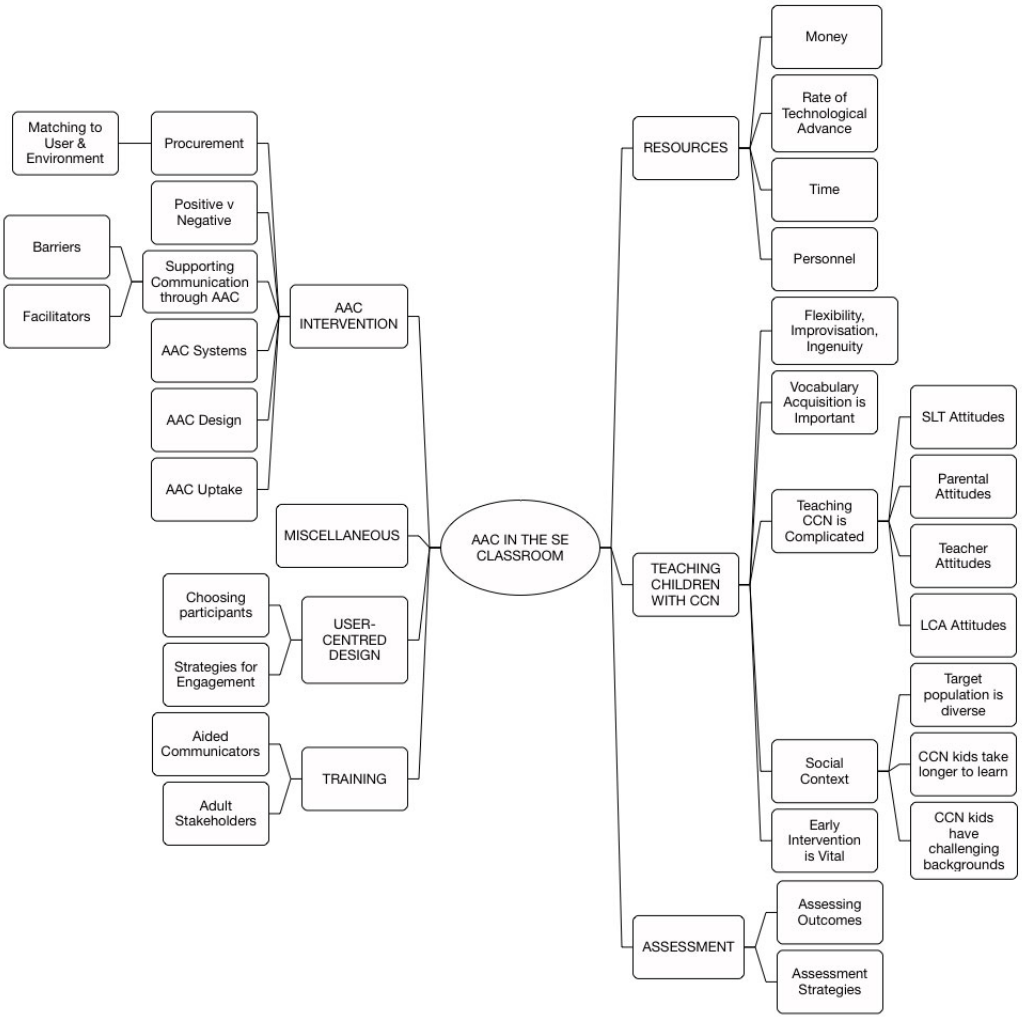


Figure 3.2: Initial thematic map

3.4.5 Phase 4 Reviewing Themes

With candidate themes now in place, a process of refinement commenced. Braun and Clarke [26] describe a two tier approach, with the first level reviewing the coded data extracts against their associated theme to gauge coherence, and the second level reviewing the themes themselves against the context of the entire data set.

The analysis was undertaken recursively - there being no substitute for systematically reading and re-reading data items to ascertain contextual and holistic accuracy and consistency. Significant amendments were made to the structure of the analysis, consolidating, merging and/or jettisoning a number of themes that either did not map to the explicit aims of the study, or that upon reflection lacked adequately distinctive distinguishing traits. Where necessary, each theme was assigned a new, appropriately descriptive, title. The output was an updated thematic map with three main themes, optimised for the purposes of the current investigation (Figure 3.3).

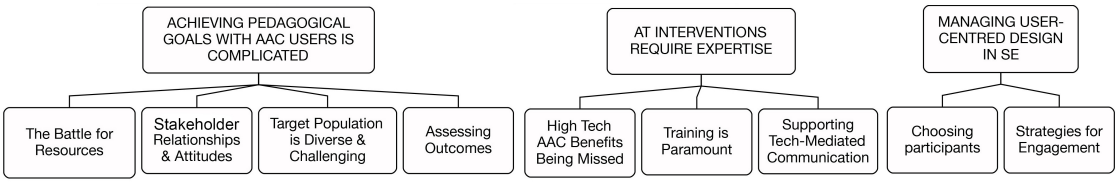


Figure 3.3: Final thematic map

3.4.6 Phase 5 Defining and Naming Themes

The final stage of the reflexive TA before writing up the results was to continue a responsive refinement of the generated, finalised themes, to describe each one's core essence. The focus of this exercise was to establish each theme as a tangible, discrete semantic unit yet occupying a coherent space within the unfolding narrative of the wider data set. This was done with close attention to the coded extracts applied earlier to each theme, interrogating for consistency, including - where applicable - within supporting sub-themes. The summative results of this, and all the preceding phases of this analysis, are presented in the following section.

3.5 Results

The decision to adopt a qualitative study design, and specifically a TA, proved fruitful in delivering a convincing series of interpretive insights into this intricate and dynamic domain. One characteristic of the topic is its breadth and complexity. The systematic

nature of Braun and Clarke's [26] approach enabled the author to propagate meaning from within this complexity in a manageable way. The data set analysed included the author's field notes, and this data item - a log composed of personal observations, and accounts of short, informal conversations in situ - proved valuable, often acting to affirm phenomena described by formal interviewees as well as delivering valuable insights of its own.

Three major themes were generated: 1)*Achieving Pedagogical Goals with AAC Users is Complicated*; 2)*Assistive Technology Interventions Require Expertise*; and 3)*Managing User-Centred Design in Special Education*. Each will now be considered in turn.

3.5.1 Main Theme 1: Achieving Pedagogical Goals with AAC Users is Complicated

A special education school is a unique and complicated mix of disciplines - pedagogy, therapy and technology - which requires careful management of responsibility and co-ordinated routines. All adult participants had some role or input into the teaching of the children in their care. They came from a variety of backgrounds, and occasionally expressed contrasting views even within their respective areas of responsibility.

> P03 (SLT) - "It's about knowing and understanding what makes them tick and what strategies are being used in the class to get them to do adult-directed stuff. So sometimes it takes me a while to master that and you do get it wrong, you think oh dear."

> P05 (Teacher) - "You can't judge a book by its cover, and it's a case of us meeting, going to their world, and understanding where they're at rather than constantly flash carding them and the poor kids expecting them to make a leap when they haven't got the building blocks behind them."

> P12 (LCA) - "Yes, sometimes it's trial and error, mix and match. Our kids didn't come in a formula, it's not like... one size fits this kinda criteria. Our kids don't function like that."

> P09 (Parent) - "I am the type of parent that I do my research, I go to

> training days, I like to know what's happening. I have my meetings with the teachers, with SLTs, if something needs changed we all work together. We've got the deputy headteacher involved as well, so it is very extensive that we know where we're going with [my child] and that everybody is on the same page."

As an environment conducive to learning, the study found evidence of both harmony and disagreement, as one might encounter in any real world organisation. As hinted at by P09 above, the author observed a strong culture of camaraderie within the school - but he also saw disputes over roles and responsibilities; noted challenges wrought by the necessary demands of accommodating diversity; and listened to accounts detailing the impact of resource scarcity - all of which potentially affect the core purpose of the school i.e. giving pupils with highly complex needs a life-enhancing pedagogical experience with proficient support. Four important sub-themes follow to illustrate these issues in more detail.

Sub-Theme: Target Population is Diverse and Challenging

At the centre of the parent theme's complexity are the unique individuals - the young people - who attend the school and are the focus of the combined support and pedagogical efforts. Classes are small (mean=6), with approximately 2:1 child/adult ratio, although this will vary depending upon circumstances. The school attracts a wide and, as we will see, shifting demographic of children of mixed ages, sizes, developmental stages, clinical profiles and family backgrounds, all with individual and particular pedagogical requirements.

As time has passed, fewer are arriving with language skills. What has caused that change?

> P11 (LCA) - "Mainstream. They're more able [to support disabled children now]. We're finding we're getting less language. We're getting the more impaired children, the more challenging. That's the truth. We had more able kids (in the past), and they were doing GCSEs[5]."

[5]General Certificate of Secondary Education.

Acquiring language - or other - skills will tend to take longer with these learners, with an accompanying requirement for more patience, more support, and more accommodation for setbacks.

> P08 (Teacher) - "Our children don't really acquire vocabulary through their environment. Most of it has to be taught. Everything has to be taught."
> Interviewer - "When you say through their environment...?"
> P08 (Teacher) - "Oh just absorbing things and picking things up in conversation. A lot of kids will not have that skill where they can listen to what you're saying and link it to what they already know."

Attempts are made to support and moderate any negative effects of developmental diversity by placing children in classes with approximately similar need, rather than, as traditionally, by chronological age - and therefore beyond the basic divisions of the three departments described earlier (primary, secondary, ESA (ASD)). However this approach is sometimes further complicated by resourcing restrictions (see *The Battle for Resources* below).

> P11 (LCA) - "You do things very gradually, especially with autistic children. Well we don't group our classes like that as such... (w)e group our kids mainly by ability rather than by age because our kids are all at a different stage in development."

> Interviewer - "The children in the department that you work in, they're a mixture of ages and conditions, and verbal and nonverbal?"
> P12 (LCA) - "Yes."
> Interviewer - "There are children with ASD in the Primary?"
> P12 (LCA) - "Yes."
> Interviewer - "Am I right in thinking that they don't really respond to Makaton[6] so much or...?"
> P12 (LCA) - "Well I don't know, it varies! It's like everything else, it varies from child to child."

[6]Makaton is a multimodal, speech and simplified signing programme commonly used in SE.

Each child has an individual customised learning plan, but a common trait is for frequent setbacks in their learning to occur, and often unconnected with their situation at school:

> P05 (Teacher) - "Out of five I have (three children) regressed so I need to move back a bit and replan... None of these things would be the fault of myself, the child or anything - just the environment can change so quickly here... a child here can regress, it can be health, it can be change of circumstances to a carer, from the parent - there are many things... I just want you to bear that in mind that these things do happen in the school more than any place else."

It is not uncommon for pupils to come from challenging backgrounds, which means that support from home may prove inadequate. Some children attending the school are themselves the children of former pupils, who may struggle to provide optimum parental support despite their best intentions. This is important because children with CCN benefit from modelling and reinforcement, and consequently active engagement and the exchange of information between school and home - for example in the shape of day book diaries, and BIGmack switches - is often a pivotal element of the attempted pedagogical approach.

One should avoid drawing conclusions about the intellectual abilities of children at the school based upon superficial assessments. Some of the older children, mostly in Secondary, appeared ostensibly to have neurotypical verbal skills:

> P12 (LCA) - "See people fall into that trap. Because kids are very good verbally they think they must be very good cognitively and it's not necessarily the case. Some kids could yap for Scotland but ask them a question about what you've just said and boof! They can't answer... Good at this doesn't mean good at that."

The preponderance of older children in the school able to demonstrate verbal acuity seems at least partially linked to the recent demographic pivot towards attending mainstream schools for more able children (identified above by P11), rather than be-

ing entirely the fruits of current pedagogical practices. In contrast to when these older children commenced their education, fewer young children with the potential to speak may now be attending the school.

Conversely:

> P02 (SLT) - "And I think some of our kids might not be verbal but actually how do we find out what they're understanding - so just because the child doesn't speak doesn't mean, they might not be as cognitively challenged as they actually appear. I'd say they've either no interest in speaking with someone or they haven't got a way. We have these assessments like Derbyshire [44] but it's looking at other ways to assess them because some of our kids would not sit for them."

Sub-Theme: The Battle for Resources

A key message from many participants in the study related to pressure exerted on their work by the scarcity of resources, be they human, temporal, material or - intrinsic to these first three - economic. This factor is not unique to SE, but its effects on ease of access to expensive AAC technology and its support may be particularly acute. Anecdotal evidence from participation in the classroom echoed and supports the interviewees comments below:

> P05 (Teacher) - "I think we struggle with technology in here and I find it amazing that we have one computer and one whiteboard and then I'm told we're lucky that we've got it, ok? I constantly say, we do workstations individually. And I don't know how much these things cost but I'd love to see iPads within the rooms, I don't see tablets, I don't see things the children will need in life. So there are ways that things can change in here, without being too difficult but it's a cost - and I understand that, it's all about cost. My children need money, and they need time."

In an attempt to offset these restrictions, both individual staff members and parents will occasionally make significant personal contributions towards meeting pedagogical goals:

> P05 (Teacher) - "Then wait for the next bit, get all the velcro, put that there so we can stick that on and it is laborious to the ridiculous. That is what every child coming in here has to move from a photograph into symbols and then we go from symbols into words. Simple steps. And then you get moaned at because you use too much velcro... Then you buy it yourself."
> Interviewer - "No!"
> P05 - "Yeah I do! Cause you can't do anything without your velcro, you need it!"

> P09 (Parent) - "Like what I said about Gemini. A lot of the parents are wanting to try it but it's expensive because the app people, I know [Child X] in [Child Y's] class, his mum and dad have had it a wee while now and [Child X] has progressively said more words since using it."

(Note that P09 is referring to parents financing the purchase of commercial AT software themselves (Gemini), and note also that the software in question is not in fact recommended nor supported by the school since it "does not encourage functional use of words". These details are included for objective accuracy and should not be interpreted as a criticism of either party in any way.)

Numerous participants note the need for more access to high tech AAC:

> P07 (Teacher) - "Ideally we could probably use a more GoTalk system, em, unfortunately they're not available really."

> Interviewer - "So are resources an issue then?"
> P11 (LCA) - "For iPads? For these kinds of things? Huge issue!"

But - again to underline complexity in the real world - it is not necessarily the case that throwing money at the problem would be a panacea, and opinions are occasionally divided here:

> P10 (Teacher) - "Technology changes so quickly that we can't keep up. We'll spend months and months fundraising for something [only for it to

become obsolete]."

> P01 (SLT) - "So sometimes high tech does not help communication… I can have a hard time convincing parents of this because high tech is seen as sexy and bits of paper are not. And the reason you are telling me I'm not going to get an aid for my child is because resources, in my point of view it's not about resourcing, it's about what's best for the child. But it's difficult to convince parents of that."

The issue raised by P01 is looked at in more detail in *AT Interventions Require Expertise* below.

Achieving pedagogical goals is undoubtedly more difficult - and the lives of those delivering and receiving services more stressful - when working and balancing significant resource constraints. Participants alluded to a first come, first served distribution mechanism:

> P05 (Teacher) - "Some classes have two computers, some have got one, some have whiteboards, some don't."

A better coordinated control and distribution of resources could ease some of these pressures, and ensure a more equitable division of assets.

Sub-Theme: Stakeholder Relationships and Attitudes

The differences in attitudes of the respective stakeholders could be quite stark; and the tangible impacts of these factors - positive and negative - on achieving pedagogical goals are significant. An extreme example that demonstrates a poor level of awareness of inclusivity in society even today:

> P10 (Parent) - "Yeah, my gran was wondering why I hadn't put her[7] in a home… ."

Earlier, we highlighted the potential ramifications for emerging communicators with CCN who have challenging backgrounds. There can be little doubt that there can be

[7]That is, the informant's child (and by extrapolation the grandmother's own great-grandchild).

significant implications:

> P09 (Parent) - "I wasn't aware of any of [these AAC approaches] before the SLT had obviously noticed how [my child] was able to use them, I never pushed for it - because I had never even heard of them before."

P09 had two children attending the school with CCN, and in this case was referring to the younger one who - after a successful trial and subsequent hunt for funding - had been offered a SGD. Both children had already been using low tech aided communication for a number of years. At home P09 also indicated prior satisfaction with the status quo, redolent of earlier research in this area [119].

Contrast this against the following:

> P10 (Parent) - "I just think I'm the type of person that sits and researches and if I feel that there's gonna be some benefit then I like to give it a go or discuss it or find out if that is an opportunity for [my child] and take it from there."

This would seem to make a compelling argument in favour of increased efforts to raise awareness, and encourage, wherever possible, more engagement with family members by any means they find accessible - a position strongly supported within the literature [89].

In terms of co-ordinating the different strands of professional support within the school:

The dichotomy - or contrasting levels of engagement - demonstrated by the two parents P09 and P10 might cause the observer to assume that the more engaged of the two would be welcomed by the professional educators who encountered her. This was largely true, yet occasionally there was scepticism, rightly or wrongly, in evidence about the level of optimism and presumed competence she displayed.

Tension could also exist between teaching staff and LCAs. Unquestionably there was a great deal of respect between the two groups, who must both work closely together towards delivering pedagogical outcomes. Regarding, and in recognition of, this issue:

> P05 (Teacher) - "I go straight in there and say... pleased to meet you, I know you know the class and I'm depending on you for the first couple of weeks. Thereafter I'll take control but I'm really looking forward to working with you, I've heard lots of nice things about you, I know you're a great team *CLAPS HANDS* Straight in there! I'm the teacher but I want you here on my side."

From the LCA perspective:

> Interviewer - "What about, again, I'm interested in vocabulary acquisition. What's your take on that? Maybe that's a bit pedagogical and is that maybe more of the teacher's remit?"
> P13 (LCA) - "Em in here? No we all do it together. So [the teacher] will maybe say what she'd like done, what she'd like them to learn - and then we all work on the same page so that we all know what they are learning from the language. Things like that."

SLTs are the healthcare professionals working most closely, perhaps, with the pedagogy-focused teaching and support staff, and also with the parents themselves. They are gate-keepers to AAC and allied assistive technologies that might be deployed in assessing and intervening in cognitive-communicative impairments displayed by the children at the school. They also have a responsibility for training staff and parents in their re-commended solutions. As such they have a uniquely influential role for the focus of this study.

> Interviewer - "So you go and do what I do, you're ...sitting there observing and..."
> P01 (SLT) - "Yeah, in conjunction, in partnership, I'm trying to make lan-guage acquisition functional, real life in real time. And not isolated and segregated and separate."

Straddling the fence between the assistive technology, the therapy, the parents, and other staff appears to be uncomfortable at times. Like most of the adult stakeholders who participated in the study, they are passionate about their role and appear commit-

ted to enabling their colleagues to reach their pedagogical targets with the children. However there are indicators that the role is not an easy one - being responsive to the child's, their parents', and their teacher's needs; yet with their agency perhaps only extending as far as an advisory role by definition can:

> P01 (SLT) - "Sometimes it cannot be fixed! You know and if a parent hears 'Oh all you needed to have done is X and it would have been fine', how does it make that parent feel? You know they have tried their level best for years, they've read to their child, loved their child, sat with their child... and we've got to be careful that we... you see in newspapers you know 'This is the fix' and the parents will be banging your door down to get this fix..."

> P03 (SLT) - "Again, in primary we have children that are right at the very beginning of using objects of reference, again it's the consistency of that approach that is kind of my bugbear - people don't stick with it long enough in order to learn cause and effect. You know they're at object level for a reason of cognitive development and therefore their, em, processing takes much longer so people often give up with that type of system much quicker than... I'd be saying if that challenges that then you'd continue to keep going with it. Whether they demonstrate anticipation or not but staff do often give up."

It would, however, be a mistake to consider all of the practitioners of a certain role as sharing equivalence. Like the children, and the parents discussed above, they naturally display intra-individual and indeed role specific variability (specialisms in the latter case):

> P02 (SLT) - "I'm a bit rubbish at the more high tech things... ."

This is likely a modest appraisal, and contrasts with P02's later member check response that she was moderately comfortable with high tech AAC, but is illustrative that individual team members have correspondingly individual strengths and weaknesses, and that this sensibly may dictate their respective contributions.

It is clear that for the best potential outcomes, all participants need to assent and understand their roles and relative capacities, and work together to meet agreed pedagogical goals. Yet in a domain with this level of complexity, there are clearly many potential pitfalls in doing so, and a great need for cross-disciplinary co-ordination.

Sub-Theme: Assessing Outcomes

Clearly for any researcher engaged in developing a tool for enhancing vocabulary acquisition in children with CCN, an important step might be to make a baseline measurement, perform an intervention and then measure again to determine any tangible effect. However, the level of development that many of the children in the school present appears to make such evaluations less of a priority:

> P06 (Teacher) - "I couldn't put my hand up and say this is this vocabulary size and this is this vocabulary size. Somebody like (Child A) who is very early communication level, you wouldn't be looking particularly at vocabulary... I suppose (Child B) with her eyegaze you could look at her device and count the number of words that are on it, couldn't you? But actually how many of them does she use meaningfully - that's a different question. From the point of progression, and this is interesting with the communication books - that would be a concrete thing to actually say last year we had five pages in the book and were using them well, this year we've now got ten pages that they are now using well - and that would be a tangible way of measuring progress."

Resonating with prior research (discussed in Section 2.7), participants talked about the inadequacies of standard assessment tools for measuring outcomes in their students:

> P03 (SLT) - "The hard bit for us here, a lot of the pupils here if you're doing standardised assessments, they don't fit in with the standardisation - they won't fit with this population."

> P02 (SLT) - "We have these assessments like Derbyshire but it's looking at other ways to assess them because some of our kids would not sit for them... ."

Complications in this area are not simply down to the learning capacity of a particular child, but also reflect the barriers of any physical impairments they may be living with. So regarding the Derbyshire Language Scheme:

> P01 (SLT) - "Em you need vision and you need hearing and you need motor skills to do that though we can adapt it a little bit. If somebody's not got vision but they've got decent motor skills and can scan then you might be able to do it that way (*demonstrates something not captured*)."

The message appears to be that approaches to assessment are adaptive, perhaps unstructured, and framed within the context of the individual child in question.

3.5.2 Main Theme 2: Assistive Technology Interventions Require Expertise

It is very important to match the optimum AT/AAC solution to the specific requirements of the individual concerned. Failure to do so effectively can have far-reaching implications both in terms of resources (ill-matched devices often resulting in abandonment [119, 89]) and the long-term prospects for the young person with CCN being offered support. Unfortunately, a hallmark of this complex technology remains the challenging level of expertise often required to operate it, which also places significant demands on the competencies of any adult stakeholder involved in a support programme.

Sub-Theme: High Tech Benefits Being Missed

The literature highlights the potential benefits represented by high tech AAC, but also documents the twin issues of low adoption and high abandonment. In our study, there were six active users from a population of approximately 180 pupils with CCN. This amounts to only 3.3 per cent of the total. This concurs with prior research, but on a scale that the author did not anticipate. Against a backdrop of massively increased app development, awareness and availability, this appears to underline a crisis in service delivery supporting children with communication disabilities in SE. To describe this level of uptake as "low" or "poor" is to understate a situation that demands to be

addressed. Significantly, the scale of it may not have been appreciated without the embedded element of Study 1's approach. The data was generated by the author's presence and participation in classes within the school, rather than via interview. Practitioners were not generally aware of this overview statistic and it did not appear to be a significant issue for them. This may indicate that, at the time of the study, there was no coordinated strategy, or no recognition of a need, to increase high tech AAC uptake to leverage its potential benefits for fitting candidate pupils; or it may be symptomatic of a pragmatic acceptance within the school that the support infrastructure for such upscaling is simply not in place.

Some adult stakeholders with a longstanding relationship with the school (e.g., P09 above) remain unaware of the existence of high tech AAC, far less its potential benefits. But teachers such as P05 and P07, and LCAs (e.g., P11) animatedly discussed their wish for more technology to be utilised (in Section 3.5.1, *The Battle for Resources*). Clearly some staff would champion far more high tech AAC in the classroom.

In those cases where the technology had been provided, some serious issues were observed:

> Study field notes: "iPad size and weight is an issue (full size model), small child cannot hold it with one hand and operate it, too bulky - needs to be seated (why not iPad mini? Casing with handles? iPhone? [Child] observed struggling to carry the device around, what about some sort of velcro support strapping that allows the device to hang from shoulder/be dropped?)."

The child in question was being offered a very inconvenient and uncomfortable relationship with his "voice" that was clearly incompatible with a user-centred approach.

In interviews, teachers also reported failure (abandonment) in their efforts to integrate high tech AAC into their supporting pedagogical approach:

> P06 (Teacher) - "I have a pupil who used to use GoTalk app on an iPad... it's not been hugely successful - partly because he thinks his iPad means playing games and it hasn't worked hugely successfully as a communication

device so we're actually going to look down a different route for a change."

P06 was abandoning high tech AAC to return to a paper-based communication book support solution for the young person in question. There is a disconnect apparent between this teacher's experiences and the successes and potential benefits of high tech AAC as documented in the literature of evidence-based practice [30, 75, 153]. The extremely limited number of children with CCN using high tech AAC to communicate in the school was a revelation warranting further, urgent, investigation.

Sub-Theme: Training is Paramount

To develop competency in operating any complex technology, a system of adequate training should be provided as a support. However, comments from interviewees, and observations recorded in the study field notes suggest that some adult stakeholders are struggling to develop the necessary skills as afforded by current policies and practices.

> Field notes: "P09 (Parent) received brief familiarisation training (Assistiveware Proloquo2Go) of around an hour from SLT; wants Makaton training to fill gaps (e.g., when (Child Y) in shower or out and about): Problem is (Child Y) has some motor skill impairment and struggles with Makaton. Their teacher received similar level of training. LCAs receive no such training".

The training in question was intended to furnish the adults with the knowledge to operate the device, and maintain and update it for the benefit of the child both at home and in the classroom. Significantly, there appears to be little time or focus on the particular requirements for modelling and encouraging interaction consistently recommended by EBP [153, 147].

Where training had been provided it was reported that it can lack the necessary depth or context. One teacher recalled attending PECS training to support secondary department children, then moving classes to the enhanced support area - where PECS is much more intensive - with no supplementary training forthcoming, and found the experience very difficult:

P04 (Teacher) - "Most of the time I laugh rather than cry."

P04 may have been tongue in cheek with that remark, but she was implicitly referring to potentially very serious deficits in training provision, as demonstrated by the possible impact on an emerging communicator described in the following exchange:

P13 (LCA) - "They don't use Makaton when they leave school!"
Interviewer - "No?"
P13 (LCA) - "One (child) came here from a mainstream school, used BSL (British Sign Language), came in here and had to learn Makaton. So...you know. And I think when they go to college it's BSL."
Interviewer - "My understanding is that Makaton is easier to learn."
P13 (LCA) - "Yes but the big world out there don't... it's all BSL."
Interviewer - "So is there anyone in here that does BSL?"
P13 (LCA) - "I don't think there's anyone."

This particular example - apparently wrought by a lack of trained staff - could have implications with regards to meeting the requirements of the UN Convention on the Rights of Persons with Disabilities [168]. However, upon further investigation, this may have been partly a misapprehension by the participant. Makaton uses signs from BSL in a key word system [98]. Because of Scottish sign language dialect there may have been vocabulary clashes, but the child in question was probably not using BSL (typically only used with deaf children). What the LCA may have meant is that the lexicon was BSL, which is functionally equivalent to Makaton.

LCAs reported no access to training with high tech AAC - although training for low-tech and unaided is provided and, indeed, the LCAs appear to be a mainstay and source of mentoring and expertise in this regard. They describe learning *in situ* as being commonplace, and often to the benefit of the population as a whole:

P12 (LCA) - "You learn on the job here, and you learn as an adult from the others around you. And it's just something you learn over time, how to talk to our children, and how to extract information from them... You have to learn from other people. It doesn't matter what it says in that book

> because wee Jimmy in the corner's never read that book... I've learnt from some of the best LCAs and teachers that this place has ever had."

One observation however exposed a flaw in restricting LCA training in high tech, whether as a strategy or due to budgetary constraints. The practitioners were ill-prepared to assist a child using eyegaze (eye tracking) technology when the device developed an access malfunction, and all appeared unaware of the calibration procedure, rendering their problem-solving efforts completely ineffective.

There can be strength in *ad hoc* training practices, at least as far as unaided or low tech AAC is concerned. But the complexity of high tech systems, their maintenance requirements and diverse access methods, pose a challenge to current training and support models in SE.

Sub-Theme: Supporting Technology-Mediated Communication

This sub-theme considers the ways participants described or were observed supporting communication in their classrooms. Due to the paucity of high tech adoption observed, some of the examples relate to low-tech or unaided AAC, but insights are relevant.

Table 3.2 below summarises the mix of technologies, alongside other strategies, the author found to be in use at the time of the study.

There is evidence that training children to use their high tech device may be more seamless than that of the adults. In this example, a parent describes the joy her child with ASD experiences upon receiving a funded speech generating device (SGD) that he had previously trialled for six weeks:

> P09 (Parent) - "Yes and now that he's got it back he just flips through the menu to get to what he needs, it's come back, it must be like someone taking something so much from you that you need! Yeah, he's really good on it - you have to go in and see him on it!"

This is a good example of the success of early intervention (triangulating work by researchers such as Janice Light [102]), in this case for a child with ASD who values the

Table 3.2: AAC technologies/strategies recorded in use Study 1

Unaided*	Aided Low Tech	Aided High Tech	Access Methods**	Assessment
Canaan Barrie	PODD/ Communication Books	Single or Sequential Message Communicators (BIGmack, Smooth Talker, Jellybean, Talking Tiles)	Touchscreen	Routes for Learning
Makaton	Objects of Reference	iPad with Apps (Assistiveware Proloquo2go)	Eyetracker	Derbyshire Language Scheme
Intensive Interaction	Visual Schedules	Tobii Dynavox I series 12+ SGD with Communicator 5	Headswitch	CODES Framework
Total Communication	Home-School Books	Tobii Dynavox Indi SGD with Snap + Core First	Auditory Scanning	TEACCH Autism Programme
	Etran Frame	Liberator GoTalk 9+	Simple Binary Switch	Pre-verbal Communication Schedule
	Communication Passports		Keyboard	SMART/ SCRUFFY Targets
	True Object Based Icons (TOBIs)		Mouse	Observation
	Picture Exchange Communication Symbols (PECS)		Device Mounts	

∗ Or perhaps more accurately, "no tech" | ∗∗ Access methods might apply to almost any high or low tech aid

precision and predictability of computer-based interactions.

> P13 (LCA) - "Well kids have got technology as soon as they are born, they see mum and dad on it, they know what to do. If it was there and available to them to use, it probably would be a good thing, yeah."

Supporting communication - technology-mediated or otherwise - requires knowledge, skill, and flexibility. Participants described what appears to be a culture of make do and mend, adaptive, borne perhaps of resource constraints and the motivation to meet the contrasting needs of their heterogeneous audience with ingenuity and improvisation:

> P04 (Teacher) - "So we were making a polar bear one day - and I knew the (Makaton) sign for bear but not polar bear. And we discovered that there wasn't one so we kind of made one up - and just went with ice bear."

P04 refers to a common occurrence apparently, so much so that the Makaton key word signing programme common within SE had been wittily nicknamed "Makie-Up-A-Ton".

All of the children who used high tech AAC had low-tech or unaided alternatives available, in other words a multiple modality approach, to their planned intervention strategies.

> P02 (SLT) - "So some teachers have that as a backup for more high tech because you can't rely on technology all the time *laughs*."

Where adverse conditions hold sway, innovation can still engender improvements to support for technology-mediated communication that are cost effective - yet such improvisation is unlikely to represent a secure pathway towards organisational best practice.

3.5.3 Main Theme 3: Managing User-centred Design in Special Education

There is convincing evidence of the essential contribution early intervention can make to language acquisition, and fuller participation in society [178], but the literature documenting UCD processes involving children with CCN is sparse, predominantly due to problems eliciting feedback [181, 77].

Sub-Theme: Strategies for Engagement

Setting children at ease, reducing anxiety levels was quickly identified as important for successful collaboration with them. For example, SLTs may work in familiar surroundings such as the child's own classroom, or may co-opt LCAs to spend significantly more time with a child - to maintain the child's comfort zone.

> P05 (Teacher) - "It takes you about six weeks of constantly being here to get that rapport with that child, that closeness, that bond. You need to know what they are doing when you are not part of that."

From an LCA:

> P12 (LCA) - "Be patient, and just think about what it is you're trying to get from them. Because you've got to know how to ask these kids a question. You've got to know how to kind of break it down, and that isn't learnt in a day... [You need] the relationship with that child to understand and interpret what that child is trying to tell you."

They may engage these children, making the interaction fun - one participant adopting the terminology of a performance:

> Interviewer - "How do I walk this minefield between making a really entertaining session for them that keeps their imagination... versus a genuine critique of the tool and how useful it is for them?"
> P05 (Teacher) - "Difficult! I sit on the stage here every day trying to make everything I say and do as exciting as you can possibly imagine... There's

no simple answer to that!"

There is evidence of significant advantage to be gained from applying UCD processes with children in this user group, despite the obvious, and pervasive, complexity of working with them. For some children, acquiescence bias may not exist:

> Interviewer - "I'm trying to work out how I get an accurate result because the other thing is… they may also want to please me. This is a common phenomenon in user testing."
> P11 (LCA) - "The autistic children who are probably more able to use it, they don't have emotion, so you're ok with that. They'll just be wanting that implement. That iPad. They don't care about emotions so you're ok with that. You'll be fine. Please you? What's that all about?"

Yet, as noted in Section 2.5.3, evidence suggests that this population remains chronically unengaged by developers.

Sub-Theme: Choosing Participants

An initial goal of this study was to identify candidate participants from the pupil population for subsequent user-testing of a prototype technical tool as part of its development life cycle. Each interviewee contributed their suggestions, and the output - also informed by observations in the classroom - was a compiled list of candidates for future use.

Most participants had strong opinions about which children would be most suitable for user-testing. In the context of receptive and expressive language skills, some advocated working with their most able pupils, others that this would negate the purpose of the research. A balanced mix, it was decided, would be the most rigorous scientific approach. An ostensibly throwaway remark by one teacher working with children with PMLD succinctly captured the approach decided upon thus:

> P06 (Teacher) - "I think you need to look at choosing children who you can get feedback from in a useful way… You're at the stage of developing the product, aren't you? So you need to work with children who are able

to give you that feedback."
Interviewer - "I need children who are..."
P06 (Teacher) - "[Children] with complex needs but not that complex! *Laughs*."

3.6 Discussion

The problem presented in this thesis is: *How can the special education environment be enhanced to promote the effective introduction and support of high tech AAC solutions into the lives of children and young people with complex communication needs?* In Chapter 2, a variety of causal factors were implicated in this problem, or identified as requiring further investigation.

There is an ongoing squeeze on public finances around the world, exacerbated by demographic trends increasing pressure on disability services. Rapid advances in AAC technologies - exemplified by more affordable touchscreen tablets and apps - do not appear to have translated into significant gains. These factors demanded a fresh look at how well matched current systems and policies are to meeting the evolving needs of people with communication disabilities. The narrative, however, is a complicated one, with many moving parts and protagonists. The literature indicated that early intervention was an important strategy for enhancing outcomes for young emerging communicators. By furnishing them with the most timely and apposite mix of resources and training, they may be empowered to cross that bridge to independence, and to not be left behind. Yet the evidence provided in this study indicates that in the field, these objectives are not being fulfilled.

Some of the issues encountered in this research are well known - for example, low adoption and high abandonment of AT and AAC technologies have been identified in numerous studies [89]. However, most, if not all, prior work had been restricted to discrete surveys or interview methodologies. To address this potential deficit, an ethnographic, grounded theory approach was adopted. By embedding within the classrooms and corridors of SE, the author set out to accumulate a richer understanding of the SE ecosystem within which educators and children operate. Having originally intended

the user centred development of a novel AAC device, immersion in an actual educational environment revealed that there were far more important issues to address - significant enough to switch the focus of the project away from product development, to service provision.

3.6.1 RQ1: What are the barriers and facilitators for educators currently using technology to stimulate functional communication and language acquisition in children with CCN?

Key barriers identified were:

- Critically low uptake of high tech AAC.
- Complexity of the technology.
- Resource scarcity, and *ad hoc* approach to distribution.
- Insufficient cross-disciplinary co-ordination.
- Insufficient training opportunities for staff.
- Paucity of professional expertise and uptake of evidence-based practice (EBP) in class.
- Pace of technological change (practitioners keeping up-to-date) and rapid device obsolescence.

Key facilitators identified were:

- Enhanced access opportunities to technology through apps and mass produced (lower cost) hardware solutions.
- Advancing evidence-based practice (where disseminated).
- A motivated community of adult stakeholders.

These insights validate prior research gathered using less immersive methodologies.

Importantly, however, they also suggest a far greater scale of deficit, or missed opportunity, in the sector. Individually these barriers are debilitating, but in combination they may create an impact that is much more damaging than their individual parts.

3.6.2 RQ2: How is the technology procured, implemented and monitored?

In an environment where resources are sparse, those making decisions about procurement, delivery and support need to strive for the most effective solutions possible. The reasons for failure of strategies or abandonment of devices must be understood, and efforts made to ensure high tech AAC is matched appropriately to individual users, and suitably supported. During the study, sharply contrasting views were observed or expressed on the support and distribution of high tech AAC. Practitioners and parents alike navigate this complex topic quite idiosyncratically, based upon personal experiences, respective roles and understanding. High tech is not always best but questions remain over how well-informed and supported respective protagonists in pivotal roles are - and the impact on resource allocation and coherent service delivery between disciplines also plays a significant role.

While best practice suggests a sensitive and responsive matching of AAC to any candidate user's needs [145], the author observed a number of shortcomings over the course of Study 1. For example, weaknesses were noted in the system of procurement (assessment of AAC solutions and features matching) that echoed the literature, such as the challenge of "gatekeeper" practitioners maintaining topical knowledge of the latest tech [110]. Stretched SLTs were not in a position to undertake horizon scanning - and nor did adequate emphasis appear placed upon this vital activity - to identify the most fitting high tech solutions. Identifying candidates for high tech AAC support also appeared *ad hoc*, possibly depending upon a particularly engaged teacher or parent initiating an assessment.

In implementation (adoption and use) the author observed devices being delivered into the hands of children attending classes where their teachers had minimal or no training in best practice to support a high tech AAC user [105]. This is particularly important

because - supported by the literature [7] - aided language stimulation, and providing opportunities for children who use high tech AAC to communicate with their devices, are essential to promote language acquisition. This factor could make the difference between success and failure in the brief window of opportunity that is available for trialling a device with a candidate child.

AAC services must be responsive to the fact that developing skills to master these devices requires a range of physical and cognitive competencies [106]. These may take years to acquire, resulting in an inevitable educational focus on managing access rather than using technology to achieve pedagogical goals. Significantly, this deficit may have profound implications for the functional stability of joint engagement interaction models such as the mediated learning experience identified in Chapter 2, Section 2.6.1. While there is little doubt that AAC technology improves the quality of life for individuals with severe disabilities, this study indicates that when someone has a severe communication disability, there are too few people in education sufficiently familiar with the technology to support them in their learning [61, 18].

During this collaboration with a SE school, data collected highlighted the extraordinary rarity of successful high tech AAC adoption. One barrier for this was resource scarcity; but there were also incidents of device abandonment (e.g., P06 and the GoTalk app in sub-theme *High Tech Benefits Being Missed*), ineffective (possibly non-existent) support of both aided and unaided AAC (e.g., P13's anecdote about BSL support in sub-theme *Training is Paramount*), and ergonomically inappropriate device allocation (e.g., small child matched with full size iPad seriously impacting upon usability in sub-theme *High Tech Benefits Being Missed*). These phenomena do not occur in a vacuum. Extensive knowledge and expertise is required to curate these complex technologies, and while it may be unreasonable to expect flawless service delivery this study spotlights the many interconnections which demand a coordinated solution. The embedded element of Study 1 enabled the rich complexity of this environment and its implications relating to this aim to be realised.

3.6.3 RQ3: Which tools or strategies are currently in use?

In the sub-theme *Supporting Technology-Mediated Communication*, Table 3.2 summarised the tools and strategies found or described as being in use over the course of Study 1. Within it are documented a diverse range of strategies, tools, and access methods available within the School. At a glance, there are no glaring omissions - what we see is a wide range of instruments as one might expect in an environment geared to support an heterogeneous population of young emerging communicators with CCN.

More critically, however, the frequency, distribution and nature of that use, with implications for practice, are discussed in the sub-theme *High Tech Benefits Being Missed* (Section 3.5.2). It is reasonable to conclude, with the restricted uptake and support for some of these potentially life-changing solutions highlighted over the course of this ethnographic study, that greater and more effective engagement is desirable.

3.6.4 Limitations of the Study

The data collection and analysis for Study 1 - e.g., the coding and theme generation - was undertaken by one individual (the author). This imparted consistency to the approach but, however diligently executed, removed the perspective of others, which may be an important mechanism for identifying latent, or implicit, codes [26]. This may have impacted upon the richness of the extrapolated data.

As a small scale study, the diversity of views available was curtailed - most notable is the absence of formal male interviewees, a recognised phenomenon, and one that the sector seeks to address by adopting strategies offering greater support for trainee male teachers [166]. The ethnicity of adult participants was also uniform. Gender and cultural differences therefore may not be well represented here, although the latter disadvantage may be offset to some degree by the absence of any language barriers. The restriction of the study to one school may also negate the transferability of the results - although again, the itinerant SLTs allowed some insights from further afield.

3.7 Conclusion

The outcomes of Study 1 support mounting evidence that current organisational systems are not adequately geared towards high tech AAC adoption. As discussed in Section 3.6 above, for that reason, developing a new technical tool for this population becomes less attractive as a goal. This study highlighted a crucial gap between the skills of the practitioners and their ability to harness and realise the true potential of these high tech devices for CYP with CCN, with implications for the integrity of the mediated learning experience. A possible solution is access to more focused and comprehensive training, or to third party sources of expertise. Greater emphasis needs to be placed upon bridging this gap by integrating richer, more sustained support for AAC users and practitioners alike.

This study also highlights the organisational complexity of orchestrating teaching of children with CCN; and the accompanying need for pedagogical and technical expertise as an integral, enduring presence. Building upon insights gathered in the literature review (Section 2.7.3), it is thus proposed that the systemic missing link may be found in the role of the Assistive Technologist (ATist). That is, a professional trained to innovate high technology solutions that are trans-disciplinary. Guidelines for the training of ATists have been developed e.g., Natspec's (further education-focused) DART Project in the UK [113], but to date there had been no formal attempt to understand or define their role in the SE classroom.

An ATist could be a skilled mediator within the learning environment, working closely with teachers and other staff, as well as supporting children, in the use of AAC technologies. Such a role could contribute towards eroding many of the barriers identified in this study, and provide support for Light's four competencies [101]. For example, taking "ownership" of the tech could assist coordination and horizon scanning; and on-hand expertise could provide a source of *ad hoc* or formal training for other staff members. Assessing and supporting higher numbers of high tech AAC users would be more feasible with a dedicated expert *in situ* and the low uptake/high abandonment challenges the sector faces could be reduced. Extended access to modelling could elevate support for children with language comprehension deficits, as well as improving express-

ive communication where more focus has traditionally been placed [2]. The presence of such a practitioner could create a stable mediated learning experience where educators can focus on their students' current abilities and future potential rather than only on "access to technology" as is currently most often the case [180].

These insights - as part of an exploratory iterative design - drew Phase I of this research project to a close. Chapter 4 describes Phase II - a study conducted to further evaluate the ATist role concept, and exploring how it might be implemented effectively within a real world SE school setting.

Chapter 4

Supporting Learners and the Team Around The Child

4.1 Introduction

The preceding two chapters, encapsulating Phase I of this research, yielded important insights into the distribution and support of AAC technologies within SE gathered through an ethnographic investigation of a naturalistic setting. The immersive nature - involving prolonged engagement with informants and their environment - of this approach proved instrumental in revealing a scale of deficit that may not have been apparent using other, less persistent investigative methods. Both uptake and abandonment of high tech AAC were found to be at levels incompatible with the achievement of satisfactory outcomes for this population if the recommendations of EBP are to be accepted as accurate.

One factor that cannot be dismissed as a contributor to this predicament is the degree of usability achieved by designers for consumers of their products. It is generally acknowledged that children with CCN are difficult to access as a population and perceived as challenging to work with collaboratively in any UCD process. This explains why such approaches are underutilised with this group, which in turn - if we accept UCD as having any positive impact - must equate to poorer usability for end-users.

This is an issue that demands further investigation, but - guided by harvested data as a consequence of the exploratory iterative design approach adopted - it is not the major focus of this thesis.

The other factor affecting uptake and abandonment identified in Study 1 was the level of support available to staff and pupils in coordinating best evidence-based practice (EBP) in the distribution and use of high tech AAC technologies - where the embedding of an ATist in the team around the child (TATC) was proposed as a possible solution. This chapter focuses on gathering empirical data to validate that proposal, and to provide a foundation for a framework defining the role of the ATist in SE. It describes Phase II, consisting of a second study, its overall aims, the methodology adopted in its execution, results and conclusions.

4.2 The Design of the Study - Phase II

Figure 4.1 illustrates Phase II within the context of the overarching exploratory mixed methods design adopted for this project.

4.3 Aims of the Study

As a result of the language processing[1], motor and sensory challenges they face, children with CCN often require adaptive technologies and equipment to access and influence their environment. This requirement extends to the development of speech and language skills that will allow them to interact with others, express themselves, and work towards acquiring literacy [103]. Since each child's needs and circumstances are unique, this is a complex problem that requires a tailored, and well co-ordinated support strategy. Limited research has been carried out in assisting the TATC in this context [12].

With these challenges in mind, by co-opting the ATist role from the FE sector (see Section 2.7.3), and where necessary remodelling it for SE, the primary research aim of

[1]These might include cognitive difficulties affecting, for example, auditory and visual pattern recognition - and hence language acquisition.

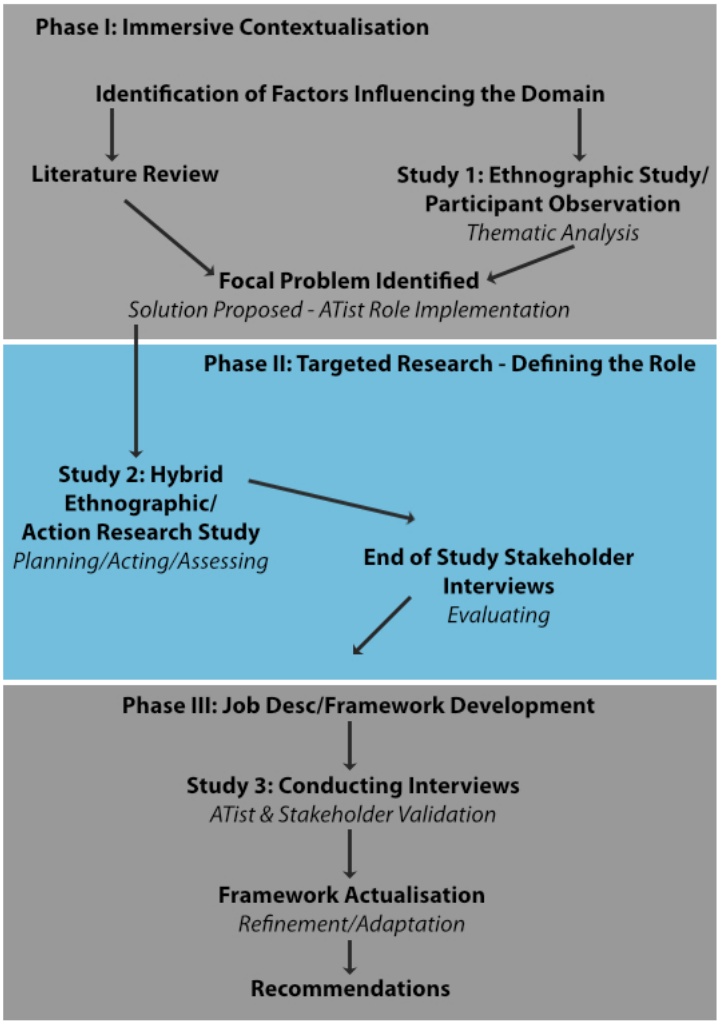


Figure 4.1: The project design (highlighting Phase II, with Study 2 shown in context).

this study was to answer the following research question:

RQ1: *How does the presence of an Assistive Technologist support educators and learners in their use of digital AAC towards meeting pedagogical goals?*

With cross-disciplinary support provided by an ATist, a dynamic could be initiated that would mitigate low adoption/high abandonment issues associated with high tech ATDs, and have a transformational influence upon the lives and educational prospects

of emerging communicators in SE schools. In this way, the overarching problem that this thesis aims to address, described in Chapter One, may be alleviated or resolved.

What was therefore also deemed important was establishing an understanding of how the ATist might go about providing such support effectively. This may be framed as the following research question:

RQ2: *What are the key tasks and duties of a successful Assistive Technologist in the context of a SE setting?*

It was determined that the most impactful way of answering this question would be to structure the investigative results as part of a definitive framework for the ATist's role. This became the critical output goal for this research.

4.4 Methodology

4.4.1 A Hybrid Ethnographic / Action Research Approach

To ascertain the validity of the ATist role, a further ethnographic study was planned. This qualitatively-driven mixed methods approach was proposed to offer similar advantages to those acknowledged in Section 3.3.1 - prolonged immersion within a naturalistic setting and richer engagement with participants - and successfully applied in the construction of novel and credible knowledge during Study 1, Phase I of this project.

However, and importantly, for Study 2 the relative passivity of the embedded researcher as an observer and gatherer of data would be replaced by an engaging and iterative - or cyclical - action research (AR) approach (Figure 4.2). Based on the principle that action is a conduit to knowledge acquisition, the author would take the role of a "friendly outsider" [64], one who orchestrates communication and collaboration with participants within the community, rather than acting as a distant or detached, objective spectator. Hayes describes this approach as creating "research efforts 'with' people experiencing real problems in their everyday lives not 'for', 'about', or 'focused on' them" [69]. An advantage of this technique is the inclusion of stakeholders and subject experts in a recursive inquiry process of planning, action and reflection, potentially engendering

real and sustainable positive change as a result.

Figure 4.2: The cyclical action research approach illustrated (adapted by author from various sources e.g., [69])

.

The focus of this thesis - describing as it does a data-driven movement away from the development of a technological artifact and towards an examination of the effects of modifying policies and practices within a community - makes AR a particularly apt research methodology for this work. One ramification of this change is to give greater weight to social and organisational adaptations as potential solutions - which, along with the technological are "inseparable elements of the same web of relationships" [64], and at the core of AR in HCI [69]. Specifically, exploring the role of the ATist in SE framed the intervention appositely as a sociotechnical one in this context, with a compelling need for close cooperation and ongoing engagement with informants as a result - which the recursive nature of an AR approach appeared well placed to provide.

4.4.2 Context and Recruitment Strategy

In terms of context and recruiting participants for Study 2, Phase II of the project benefited from the knowledge and contacts built during the earlier ethnographic investigation described in Chapter 3. That work had established a number of mutually beneficial working relationships with experts in the field, with positive implications

for recruitment from a pool of enthused collaborators at Study 1's original partner SE school. For this reason, in consultation with senior teaching staff, the decision was taken to continue this association. Accordingly, a class led by a highly motivated teacher (see Section 4.5.2) was selected as the focus of Phase II to evaluate the potential contribution of the ATist role towards more effective AAC support and service delivery.

The changed focus arising from Phase I, and further addressed in Section 4.4.1 above - from development to service provision - resulted in some minor amendments and additions to the extant ethics documentation. These changes (Appendices D.12 - D.16; and the preparation of new information sheets and forms for ATists in FE - see Appendices for Chapter 5) were returned to the University Research Ethics Committee for approval. The focus remained upon obtaining appropriate informed consent and ensuring preservation of participant anonymity [116]. All participation was voluntary, and informants were aware that they could withdraw from the study at any stage of the data collection or analysis without penalty.

All focal participants - including children and their parents - were invited to sign (or stamp) respective ethics consent forms as the study unfolded.

4.4.3 Conducting the Research

Work commenced in late October 2018 and continued through winter into the spring of 2019, encompassing 19.5 weeks inclusive of seasonal holiday breaks. There were 48 full day visits, the researcher typically spending three full days per week *in situ*.

Attendance typically involved full mornings and afternoons embedded within the classroom. A primary school class of children identified as PMLD[2], and the wider team of adult practitioners and clinicians working to support them, represented the group to be investigated. Sociotechnical interventions [69] would be monitored based upon continuous assessment, and also evaluated against the baseline established during Phase I.

[2]Profound and Multiple Learning Disabilities: This selection was made in collaboration with senior teaching staff, and as informed by data collected during the earlier study (Study 1 of Phase I).

The author adopted a hybrid approach combining participatory action research and observation of the effects of the intervention. Active involvement of the researcher and collaboration with community partners would be a hallmark of the research, involving:

- informal canvassing
- formal interviews
- iterative pedagogical and technical interventions
- development of learning resources
- and daily interactions with children, adults and visitors to the environment.

In keeping with the tenets of AR, these activities were planned alongside, and with the input and participation of, community partners. They were cumulatively documented as part of an ongoing process of informed reflection, by the logging of field notes and artefact identification, generation and collection.

Weekdays away from the school were an opportunity for the researcher to reflect and write up notes, and prepare for future visits.

4.4.4 Materials and Equipment

A Panasonic Lumix digital still camera was used for capturing artefacts; a paper notepad and pen were used to document field notes; an interview guide with probes (Appendix D.17) was used for the semi-structured interviews, along with a digital audio recorder to capture informant responses for transcription, and the transcription software highlighted in the preceding chapter. In addition, an A5 notepad was improvised as an asynchronous communication instrument, coordinating collaboration between a participant's home and school. An Apple Macbook Air running macOS Mojave 10.14 and NVivo 12.5.0 (qualitative data analysis software) was utilised in curating and analysing data captured during the study. The JISC online survey resource was also utilised [86].

4.4.5 Environment

The SE classroom that would be the main research space was a bright, open plan area with access to hygiene facilities for personal care in an adjacent room. The main room contained:

Two sinks; numerous storage cupboards; a cloakroom area; the teacher's desktop personal computer[3]*, desk and chair; a soft mat area for floor activities; a 50 inch multi-touch LCD screen on a floor stand with internet connectivity via an Acer laptop; a whiteboard; a standalone touchscreen PC on a floor stand with eyegaze hardware/functionality (shared with other classrooms); numerous standing frames and two Heathfield desks with chairs for postural support; a portable fabric wall for displaying graphical picture communication symbols (PCS)*[4] *e.g., visual schedules.*

Figure 4.3: The main classroom environment, looking NE towards the sinks and soft mats.

In addition, a gym, soft play room, sensory room and swimming pool were regularly scheduled into activities over the course of a school week. All rooms visited by the

[3]A standard office PC running Windows 10 Enterprise edition, with an Intel Core i5 CPU and 8Gb of RAM.

[4]Created in Boardmaker drawing software, Mayer-Johnson picture communication symbols were widely used in the classroom, alongside signing and speech. PCS are understood to be transparent (i.e. easily learned and understood by children with CCNs) and provide a gateway for aided communicators to see and familiarise themselves with the written words used widely within their own language and community [56]. A visual schedule example is presented in Figure 4.8 (Section 4.7) below.

Figure 4.4: The main classroom environment, looking NW and showing the standing frames, whiteboard and Heathfield desks.

Figure 4.5: The multi-touch LCD screen displaying a digitised reading activity developed by the author/ATist in collaboration with the class teacher.

children had harnesses and ceiling hoist mechanisms available for transferring them safely between wheelchairs, floor, or posture support equipment.

The majority of activities involving adult practitioners and children, including most ATist support or collaborative instances, would take place in the main classroom. Space within it was divided adaptively for the use of sundry groups or by individuals as required in the course of each school day.

4.5 Study Participants

As indicated in the study aims (Section 4.3), the role of the ATist was envisaged as one influencing and supporting both adult stakeholders and emerging communicators in the research environment. Accordingly, seeking input - whether active or passive - from both child and adult informants/actors was deemed a vital part of the investigative procedure.

4.5.1 Child Participants

The class consisted of pupils (n=7), two male and five female, with a mean chronological age of 9:3 (years: months), SD=2.14. The youngest was 5:7 and the eldest 12:0 at the beginning of Study 2. They represented a mix of socio-economic and ethnic backgrounds. Clinical profiles varied but overall the class was described to the author as PMLD[5], and each child had significant physical and/or developmental disabilities affecting their ability to acquire functional speech i.e all were anarthric. Diagnoses varied but all had significant developmental delay. All the children in the class were wheelchair users, with none being independently ambulant. All except one were nil by mouth.

Individual baseline literacy competencies were unavailable - these children are not routinely monitored for vocabulary development *per se*. For this reason, a longitudinal corpus of language sample data would not be a significant part of this study. The Curriculum for Excellence (CfE) programme was quoted as the starting point, but it was not considered by teaching staff to be entirely appropriate for this population.

[5]Profound and Multiple Learning Disabilities.

This may be consistent with low expectations for these children [106]. As a PMLD class, the process of assessing progress appeared concentrated on an individual teacher's intuition and adaptive skills, based upon cues from parents/carers and the multidisciplinary TATC - including SLT assessments, physiotherapy programmes, and prior SPT[6] assessments. From these, the teacher would devise and maintain learning intentions (i.e. an individual learning plan) for each of the children in the class.

As Study 2 commenced, one child, C02, was using high tech AAC to support her communication (a Tobii Dynavox I series 12+ running Communicator 5). C02 has had cerebral palsy (CP) with complex epilepsy from birth, and approximately two years' experience with her SGD device, having moved on to that from an Etran frame she had been using since nursery (and still used in certain circumstances). C02 was using eye tracking technology to access her device, constrained by ballistic movement of her arms (although she was able to operate a simple step-by-step device when afforded adequate time and support). C02's primary carer, a very proactive parent, declined the researcher personalisation access to her child's device on the basis that she was comfortable with her daughter's current trajectory and did not wish to distract from that. These wishes were respected, although C02 would continue to be a part of the study and make valuable contributions.

A second child, C01, had just embarked on a three month trial of a SGD and would become a principal participant of the study. None of the other children in the class were using high tech aided AAC at the time the study commenced. No or low tech solutions such as laminated PCS symbols, and step-by-step recorders, were being utilised to encourage choice-making and basic personal narrative sharing between home and school environments.

Of the other children in the class, one (C03) operated step-by-step and similar devices with a head switch. The other four children - C04, C05, C06 and C07 - all displayed some fine motor skill deficits but could use their hands with time and support from adult practitioners to access step-by-steps, switch-activated educational games on the

[6] Single Planning Tool - a bespoke well-being indicator instrument linked to the Scottish Government's GIRFEC (Getting It Right For Every Child) initiative [93].

Table 4.1: Study 2 child participants

ID	CA* at Start of Study 2 (Years: Months)	Gender	AAC at Start of Study 2	Diagnosis**
C01	10:5	M	High Tech	Myotonic dystrophy
C02	10:9	F	High Tech	Cerebral palsy with complex epilepsy
C03	10:5	M	Low Tech	Cerebral palsy
C04	5:7	F	Low Tech	No formal diagnosis
C05	10:8	F	Low Tech	Developmental delay respiratory scoliosis
C06	9:10	F	Low Tech	Semilobar holoprosencephaly
C07	12:0	F	Low Tech	4p- syndrome

∗ CA = Chronological Age | ∗∗ Randomised to preserve anonymity

multi-touch LCD screen, or to make choices between laminated PCS symbols [114].

Focal Aided Communicator

C01 was the principal participant (AAC user) in this study. He was described by his primary carer as having:

> "...congenital myotonic dystrophy, he has a tracheotomy, he's ventilated occasionally, always overnight when he is sleeping, but during the day if he is tired or unwell. He uses a wheelchair to get about, is nil by mouth, is fed through a gastrostomy button and that is our boy."

Like the other children in the class, he arrived at school each day in a manual wheelchair that he did not propel himself, and also like his peers, he would spend some parts of the day in a standing frame for posture support, or on the floor mats. Unlike the others, C01 also had a Heathfield desk and chair that he would spend significant periods of the day seated in. C01 had no functional speech, but would often express his feelings

of agitation, discomfort or happiness with vocalisations. These expressions, and other demonstrative acts, could manifest as disruptive or destructive challenging behaviours [176] - even self-injurious, such as the removal of his tracheal tube (which typically necessitated the attendance of a school nurse).

C01 also had a limited - but highly effective - array of idiosyncratic hand gestures ("more", "yes", "no") that he utilised often to address binary needs. His control of fine motor skills appeared largely unaffected by his clinical profile, allowing him to deploy a variety of direct access interface control gestures such as swiping and selecting symbols accurately on high tech AAC devices. His hearing and vision were within functional limits.

C01 displayed a generally positive response to laminated PCS symbols, often appearing to understand short sequences (e.g., "feeling" "happy") when prompted. He also had some experience with high tech aided AAC, having used an iPad running Liberator GoTalk 9+ earlier in the year before a decision was taken to remove the device on the basis that he was not using it for communication.

Shortly before Study 2 commenced, C01 had been recommended as eligible for trialling another high tech AAC device, this time a dedicated Dynavox solution (the Indi SGD[7], running Snap + Core First with a PCS symbol-based interface (Figure 4.6)).

4.5.2 Adult Participants

As an ethnographic study within a SE classroom, there would be a continual flow of adults entering and leaving the environment as they carried out their respective roles - including healthcare professionals, SLTs, educators, classroom assistants, rehabilitation engineers and technicians. All had the potential to, and often did, influence proceedings or contribute to the milieu in a meaningful way i.e. wielding agency with implications for the research study. This might simply take the form of a brief interaction with the researcher or another individual in the room observable as significant within the conceptual framework of the investigation. As such, all visitors to the en-

[7]A Microsoft Windows 10 Pro tablet PC with a 10.1" multipoint capacitive touch screen, an Intel Atom Z8350 processor, 4Gb RAM and 64 GB flash storage.

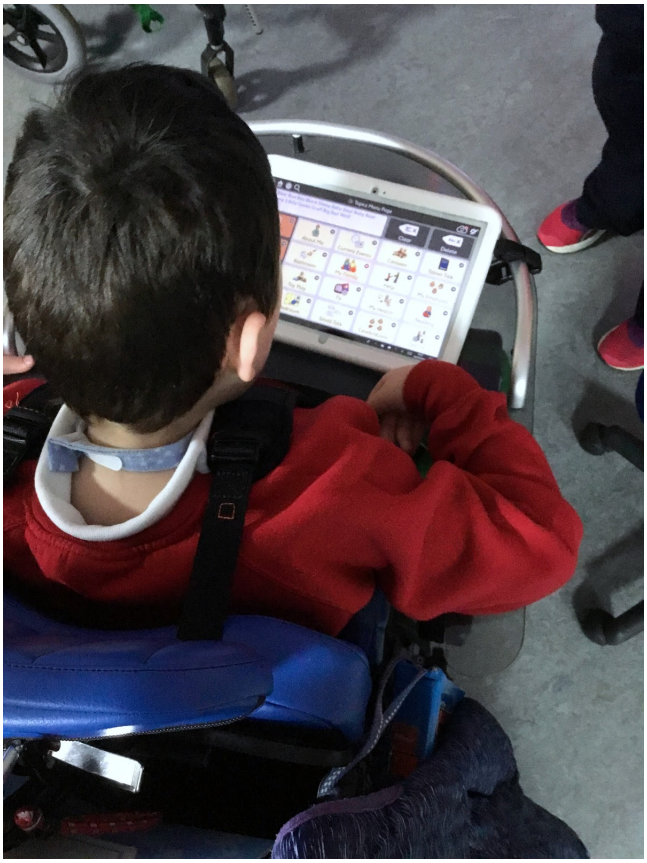


Figure 4.6: Focal participant C01 seated in his wheelchair using his Dynavox Indi SGD.

vironment might be regarded as participants, with valuable contributions to make.

It was recognised in Study 1 that successful interventions must also be grounded in close cooperative relationships with the embedded learning and care assistants (LCAs), and other visitors and staff such as parents/carers and the designated peripatetic SLT for the classroom. C01's primary carer was therefore also identified as a key partner for this study.

Core staff in the study's principal environment were the classroom teacher, P06, assisted by four LCAs (see Table 4.2).

Adult informants in Study 2 were selected from the pool of educators, health professionals - augmented by parents/carers - participating in events as they unfolded over the course of each school day. Criteria were similar to those described in Section 3.4.4

Table 4.2: Study 2 adult participant and interviewee characteristics

ID	Role	Gender	Age (Years)	Education	Experience (Years)	Tech Comfort
P01*+	LCA	F	40	College	4	Moderate
P02*	Teacher	F	37	Postgrad	10	Good
P03*	Teacher	F	64	College	19	Good
P04*	Parent/Carer	F	52	College	8	Good
P05*	SLT	F	33	Undergrad	11	Good
P06*+	Teacher	F	49	Postgrad	8	Moderate
P07+	LCA	F	52	Nil response	20	Moderate
P08+	LCA	F	39	Postgrad	5	Good
P09+	LCA	F	36	College	1	Moderate

∗ Denotes participant interviewees | + Denotes core staff of host classroom

(Study 1) of this thesis. That is:

- they had experience of working with children with CCN either as a practitioner or as a parent;
- they had at least one year of association and/or familiarity with the partner school either in a pedagogical, support, or parental context;
- they were personally comfortable to commit to one interview session of circa 60 minutes, with a possibility of a follow up member check contact at a later date [52].

Study 2 was a longitudinal focused ethnographic study - constrained to one discrete population - with iterative, and collaborative, elements conforming to an action research approach.

Key Adult Collaborator Profile

All participants in this research had some contribution to make, but a key adult AR collaborator for Study 2 was P06, the principal class teacher. P06 had been selected for

interview in Study 1 based on her level of enthusiasm for AAC (she was considering undertaking the Master's degree in AAC offered at the University of Dundee), and had contributed useful insights to that study. P06 had been a teacher for eight years at the beginning of the study, already held a postgraduate qualification, and asked challenging questions of her own during the earlier interview. She appeared highly competent yet keen to further develop her knowledge of evidence-based practice, and to apply it to the benefit of her pupils.

Greenwood and Levin's "friendly outsider", identified in Section 4.4.1 as a pivotal actor driving reflective collaboration in AR, meant that another influential participant would be the researcher (and current author) in the role of ATist. In AR, traditional concepts of impartiality or contamination in inquiry are reassessed, and the researcher's influence embraced as a valuable - and unavoidable - facet of knowledge construction [69]. The researcher/ATist is a computing PhD candidate with 15 years' experience as an inclusive (online) design technologist, a veteran of numerous P/T lecturing positions, and with six years' experience researching in the field of AAC and rehabilitation engineering.

4.6 Procedure

Informed by the AR approach, a partnership was forged between the researcher in his role as an ATist, and community stakeholders. This helped to position him as a trusted actor within the community, involved in and aware of unfolding events i.e. local knowledge. Interventions could then be co-designed between participants, and monitored iteratively and reflectively. The objective was to stimulate incremental, beneficial cumulative change. Thus a regimen of close collaboration between the researcher/ATist and P06 was initiated, with regular meetings agreed to set goals and objectives and as an opportunity for mutual support and problem solving.

A key focus of this study was to identify and define the ATist's role in supporting the uptake and sustained use of high tech AAC through:

1. Working with community partners to guide and raise awareness and integration of EBP among staff.

2. Designing strategies to promote independent use of SGDs by children already benefiting from their distribution.

3. Working closely with other TATC members to identify and assess candidate high tech AAC users and where appropriate promote greater uptake among the cohort of learners.

Additionally, empirical data would be collected on:

1. The nature and balance of technology support - troubleshooting and maintenance - required, and;

2. The ATist's contribution to the promotion of successful pedagogical interactions in the setting under investigation.

4.6.1 Capturing the Evidence

As a hybrid ethnographic/action research study, the researcher was present as both an observer and as an active participant in proceedings as pupils and the TATC progressed through each school day. This allowed direct control and access to data when required, but without compromising the researcher's opportunities to observe and log the dynamics of discrete phenomena as events unfolded. As the research progressed, any implications of captured data were discussed among participants and modifications made to the study's conduct where appropriate.

Data Collection Methods

Multiple methods were deployed as a means of methodological triangulation, a common attribute and strength of an ethnographic action research approach [69]. Data were captured, and sessions (n=48) logged, in the following ways:

Observation and Field Notes

Acting as both an observer and participant, the researcher took comprehensive descriptive notes in an A5 notepad - contemporaneously where circumstances allowed, and as soon as practical where they did not. Entries took the form of a diary of events,

augmented with short transcriptions of dialogue or SGD utterances observed, interspersed with reflective elaboration by the researcher to construct or clarify meaning. To do lists and potential ATist or staff responses to matters arising were also noted. This process of thoughtful curation was carried out as a type of "proto-coding" as material for critical reflection with P06 in discussions - and thus potentially as a contributor to enhanced planning.

Each evening a typed, electronic version of the notes was created, and uploaded for data security purposes to an encrypted drive. At this time, supporting assets were added to the text (see *Artefacts* below). Information was logged about collaborative adult-directed activities undertaken by children in the class, and of significant interactions between any of the participants. Emphasis was placed upon capturing any examples and opportunities for the novel skill set of the ATist to positively influence outcomes in cooperation with educators.

Artefacts

Community artefacts such as noteworthy documents were gathered where permission could be obtained; photography was used extensively to document items or scenes (avoiding participants' faces[8]) that could not be physically collected (e.g., Figure 4.4 above). In addition, artefacts generated in the course of the combined efforts of participants i.e. products of the "action" in AR such as the asynchronous communication instrument (Figure 4.7) also provided significant insights into the culture being investigated. Photography was already commonplace in the class as the teacher strove to capture moments of interest in the children's lives to share with parents/carers (with strict data security controls). At the teacher's behest, the ATist would also take on the role of class photographer, using a small digital camera kept by the school in class for this purpose. In this way, disruption when collecting artefacts on the researcher's own camera could be minimised since pupils were accustomed to the practice of photography.

[8]The exception was P06, who was comfortable with her image being reproduced in demonstrating the Etran frame in Figure 4.13 later in this thesis.

Interviews

End of study in-depth interviews were conducted with key adult stakeholders for two purposes:

1. to supplement the data acquired through participant observation, and;

2. To extend our collaboration beyond the design and execution of activities in the field, and into the phase and processes of interpretation and evaluation, a key requisite of AR.

These interviews are described in detail in Section 4.8.3 below.

Online Surveys/Questionnaires

Short online questionnaires or surveys using the JISC Online Survey tool [86] were variously conducted:

1. To capture demographical data anonymously.

2. An end of study survey - originally targeted at all staff but at the partner school's request distribution was restricted to colleagues in direct contact with the researcher - was also conducted (Appendix D.18).

Asynchronous Feedback Mechanism/Self Documentation

An A5 notebook was also improvised to maintain contact and co-ordinate action with C01's primary carer. This allowed the carer (P04) to log requests and air concerns, or report successes as the project progressed (Figure 4.7 below).

Video and audio recordings were not captured due to privacy concerns.

4.6.2 A Tailored Aided Language Stimulation (ALgS) Protocol

Part of the research included specially (author) designed Aided Language Stimulation. Chapter 2 identified modelling as a potentially transformational technique for instilling communication competencies in people with communication disabilities, and mitigating an identified "asymmetry" [161]. However, it also revealed that the efficacy

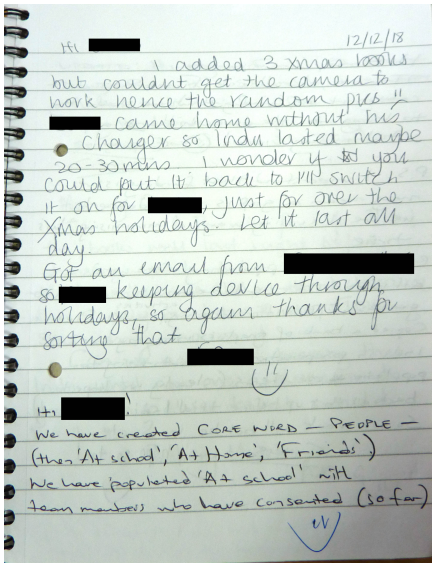


Figure 4.7: A page from the asynchronous collaborative document used to enhance communication between school and home.

of such techniques depends upon competent implementation by well-trained communication partners [21]. Based upon a rationale that the current study could routinely involve the support of unfamiliar AAC systems, and also that the application of ALgS could potentially serve to accelerate the researcher's own operational competency of any system he had not previously encountered, a loose modelling protocol was prepared. This would be a hybrid modelling approach, informed by prior research, and with the caveat that the protocol could be responsively adapted to suit circumstances in the field where required. It was drafted as follows:

1. Aim: The communication partner both prompts responses via, and "models" the expressive use of, the learner's aided communication device as a naturalistic, deeply engaging interaction strategy [153].

2. Approach: Interactions would be timely, with the aim of avoiding delays of more than a few seconds - for example, in constructing a multi-symbol utterance - to maintain learner attention and association [49]. Recasting would be used extensively to signal responsiveness to communicative acts from the aided communicator [81].

3. Intervention intensity: Allen et al. (2017) describe modelling dosages in earlier studies as varying from the very prescriptive (“30 models per 15-min session") to the broader “every opportunity” [2]. The latter approach would be adopted for this study, based upon the understanding that the ATist’s role is cross-disciplinary and often reactive (i.e. likely to require prompt responses to unpredictable environmental events such as equipment malfunction) making rigidly targeted and scheduled ALgS sessions less practical.

This iterative action of performing ALgS within the classroom would also represent a means of diffusing evidence-based practice to the wider team around the child - a parallel, and key, focus of the study.

4.7 Field Work

4.7.1 Introduction

In class, the children would work on a variety of cross curricular learning intentions delivered in individual, small group and whole class activities. The week’s schedule did not typically consist of traditional subjects, but rather a set of activities through which the learning could take place. For example, a whole class “news” session was held each morning. During this activity students would practice literacy skills such as listening; health and well-being targets; and mathematical language relating to time (e.g., days of the week, first, later etc.).

4.7.2 Timetable Structure

The logging of events would occur within the context of a structured weekly timetable. Individual days throughout a working week were comprised predominantly of a mix of interdisciplinary learning (IDL - one of four “contexts for learning” in the Curriculum for Excellence (CfE) programme) activities led by the class teacher, P06. The IDL slots represented periods where P06 had greatest flexibility and control to schedule learning interactions tailored for each child’s individual education plan (IEP) targets. These were interspersed with some specific timetabled subjects e.g., music, art, PE and swimming taught by specialist teachers - though it may be worth noting that these were

interdisciplinary too. A reproduction of the actual timetable is shown in Appendix D.19.

A complicating factor for both children and educators in SE is the considerable additional time necessarily dedicated to postural management and personal care, and the impact it can have on teaching activities - although it should be noted that these also represented important opportunities for communication to take place.

A Typical School Day

For one of the high tech AAC users, a typical day of activities over the course of Study 2 might be as follows:

Upon arrival, the student would be greeted by a member of the class team - typically an LCA - and assisted in removing their coat, having their AAC device unpacked, mounted as required on their wheelchair, and switched on. Their AAC software application would be launched and a quick check made to ensure that it was working as expected. At this point, any problems encountered represented an opportunity for the embedded ATist to intervene. The child would have their home/school book checked to see if there were any messages from home. Once these checks were complete, any personal care needs were attended to by the LCAs. Similarly, if they required to be moved to another chair, the child would be informed verbally about what was about to happen, and the AAC device would also be used to model[9] this activity to the child - agreed with P06 as the ATist's role as the study commenced (see *ATist's Contribution* Section 4.9.1 below). The modelling would depend on the child's level of understanding and the software being used, but would typically consist of a phrase such as "you go class chair". The child would be able to see where the words were found on the device, and once the sentence was constructed the "chatbox" would be modelled so that the student could see and hear the whole sentence being spoken.

Once all of the students were ready for the day, P06 would usually conduct a group session saying "good morning" to everyone. This consisted of a familiar song where

[9] In this context, and throughout this thesis, modelling refers to the process of aided language stimulation described in Section 2.7.2 of Chapter 2. The specific protocol adopted in this study is elaborated upon in Section 4.6.2 above.

each student would be given an opportunity to respond at the appropriate time. The response could take a variety of forms depending upon an individual child's competencies. A simple BIGmack communicator device was pre-recorded with "Hooray!"; then the AAC user could be encouraged to respond at the relevant moment in the song using either the BIGmack, their own device or a vocalisation.

Throughout the group sessions, where possible an adult TATC member supported the learners on a 1:1 basis. This allowed core vocabulary to be modelled appropriately and in a timely fashion. If the student was questioned or appeared to be trying to participate (e.g., signing for "more"), applicable language could then be immediately modelled, and a conversation could be created. This was important as the child would learn to use their device in a social setting.

Working on a 1:1 basis the learner and teacher could practise vocabulary, but also having support in addition to the teacher created the conditions for a conversation to take place. With several high tech AAC users in a class, it became helpful for there to be enough trained adults to support them individually; otherwise there was a danger that the modelling might not take place closely enough in time - or at all - for the learner to link it to events. This proved a key area of ATist support.

Following the "Good Morning" session, students would be shown a visual timetable (or schedule) of events for the remainder of the school day, comprised of laminated graphic symbols with supplementary orthography (Figure 4.8 below). Created in Boardmaker drawing software, these Mayer-Johnson picture communication symbols (PCS) were widely used in the classroom, alongside signing and speech. PCS are understood to be transparent (i.e. easily learned and understood by children with CCNs) and provide a gateway for aided communicators to see and familiarise themselves with the written words used widely within their own language and community [56].

The class might then be separated into small groups, or individuals, to practise specific learning intentions. These sessions consisted of activities such as experiencing and learning shape names. In this case, a game was played where the children would take it in turns to use their device to call out the name of a shape. The teacher would make a game out of finding and showing all the children in the group the correct shape, and

Figure 4.8: A PCS-based visual schedule.

the 1:1 support for each AAC user would model the shape name on individual devices. This would be continued around the group, with opportunities always taken to include the modelling of core vocabulary, and other useful words - for example, “want more”, or “my turn”. Here it was important for the staff to know learners well so that they could model a complexity of language appropriate for each learner.

Next it might be time for a break. The children would be given a chance to choose what they would like to watch on TV. This was a good opportunity to give students motivating choices, and to model core vocabulary. It was also important for them to practise turn taking - which is sometimes challenging for children with CCN who are used to receiving a lot of adult attention. At this time, students might also receive personal care and have a change of position, all communicated to them through symbols as well as speech. After the break, there might be an opportunity to play switching games on the multi-touch LCD screen. Again this was an opportunity to make choices within the context of an enjoyable activity. There are a range of reasons why children in SE practise switching. Sometimes it is actually the choice making that the teacher wishes them to practise - rather than the switching skill itself.

Students were learning to use switches to support their understanding of cause and effect, to work towards using switches to make choices. Starting with timed switching games so they may learn that when they press the switch can be important, they can use one or two switches to learn to make error free choices; then they can move on to using switching as an access method for other types of learning - for example a sorting activity. Switching could also be an enjoyable activity for these children to “play

independently" as they may be able to control something in the environment without requiring an adult to be by their side. It may be that switching is an access method some children will use within the context of a high tech communication device such as an SGD, so the need to hone these skills could prove valuable.

With most of the group playing or watching switching games on the big screen, an individual student might be taken aside to work on the standalone eyegaze device oriented to their individual learning needs (Figure 4.9 below). At the earliest stages they may be playing simple games to understand cause and effect on the device, and developing their skills to look, track and dwell. At the other end of the scale a student who was well practised in eyegaze skills might be offered a shape sorting game.

Figure 4.9: Standalone touchscreen PC on a floor stand with eyegaze hardware in class.

The class typically joined together for a "news" session before lunch. The teacher led an interactive discussion about who was present in school and what day it was, followed by the pupils being given an opportunity to share their news. Their news could be recorded at home on a BIGmack - each child was given one of these simple devices to take home with them each evening - or they might use their own high tech communication device to share.

During these lessons the students were afforded a chance to practise important commu-

nication skills such as listening, turn-taking, vocalising, commenting etc. The structure of the lesson could vary slightly depending on the focus for that day. For example, P06 might want the students to practise their choosing by giving them the option of which student or adult would share their news next. The choice making would be geared individually to the child who might be offered a selection from two laminated photographs of their peers, or they might use an Etran frame to select from six pictures. They could follow an auditory scanning system, or use their high tech device. P06 often tested their ability by swapping the position of the pictures to see if they could maintain their choice.

All of these activities were carried out in the context of fun games and songs. P06 focused upon thinking about novel ways to adapt the group lessons to meet the learners' needs; for example by creating phrases which made use of core vocabulary such as "want" when making a choice, or "not" when talking about the day of the week or who was in class.

Students in the class appeared to be having fun with the teacher, singing the day of the week in different styles (e.g., loud, fast, or silly). This always involved engaging the children and making the process of learning fun and enjoyable. In this way, sessions could be much more motivating, and generally encouraging for communication. There are great potential advantages for high tech users to have 1:1 support in this context so that responses may be modelled in a timely and appropriate way. For students using BIGmacks with pre-recorded news phrases the opportunity was provided to spontaneously share and tell. Staff used these as a basis for modelling how a similar sentence could then be created from individual symbols in the device. This meant that the student could act as a relayer of information without the burden of a large cognitive load – focus being on the function of the communication. However it was also an opportunity to model meaningful sentence building.

Often in the afternoon the class would spend time sitting or lying on the floor. This could create problems for eyegaze users as the device becomes inaccessible in these circumstances. Staff got around this by modelling with symbols, or using an Etran frame. However, it was also deemed important to recognise the value of communica-

tion through body language and vocalisation i.e. low/no tech channels. In this case the children were still learning some of the fundamentals of communication – the human connection and the meaning and fun of interacting with someone else.

On some afternoons a small AAC group with the two high tech aided communicators was run – all supported 1:1. In these sessions, students would specifically practise finding and using core vocabulary on their devices through stories and games. For example, they might read a story about cars which "go" and "stop". Each time these words were used in the story they would be modelled to the child on their device. Afterwards, the opportunity would be taken to play a game where each child could take it in turns to tell the facilitator to go and stop, an activity the learners appeared to enjoy.

At the end of the day, it was time to get the children ready to go home. In some cases, communication devices would require packing away for transit. It was reported as challenging finding time in the day to do any editing or personalisation required on high tech devices. These devices would typically go home with the child so that they and their parent/carers could continue using them together. However, there was rarely time during the day to do any personalisation of high tech devices before they were taken home.

The support of an ATist would prove an invaluable contribution with this task. This was especially true when the child was just starting with their device - when there were often changes to make or vocabulary to add, and also at the beginning of new topics, for example, to make sure any words needed were accessible.

4.7.3 Summary of Classroom Team Roles

In class, the presence of adults comprising TATC members was generally defined by their disciplinary roles, but could be broadly split into one of two categories (author's terminology): constant (the core classroom staff described in Section 4.5.2), and occasional (itinerant practitioners, technicians, and parents/carers).

Visitors in the occasional category could be scheduled and regular (e.g., nurse attend-

ances multiple times per day[10]), or less frequent (e.g., an SLT (P05) visited the classroom weekly to work with child participant C01), or intermittent (the OTs, technicians). Frequency of visits would often be dictated by the needs of individual children.

The following is an adapted version of Figure 2.5, adjusted to reflect the special education context found to be in operation over the course of Study 2.

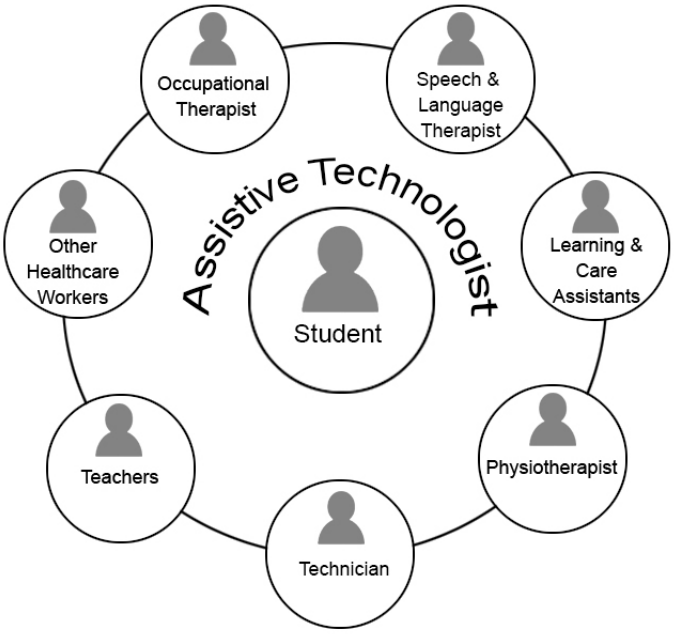


Figure 4.10: ATist's collaborative role in the SE study context, supporting staff and students.

A summary of these roles is provided in Appendix D.22.

4.7.4 AAC Strategies and ATDs in Class

Complementing the table provided earlier for the whole school in Study 1, Table 4.3 below details the AAC systems and strategies observed or confirmed to be in use in the classroom.

[10] Specialist community children's nurses from the healthcare unit appeared at certain times throughout the school day to administer food and water to children who were tube fed. These healthcare professionals were also on call via an emergency alert system if any crises were encountered.

Table 4.3: AAC technologies/strategies recorded in use Study 2

Unaided	Aided Low Tech	Aided High Tech	Access Methods	Assessment
Canaan Barrie	PODD/ Communication Books	Single or Sequential Message Communicators (BIGmack, Smooth Talker, Talking Tiles)	Touchscreen	Routes for Learning
Makaton	Objects of Reference	Tobii Dynavox I series 12+ SGD with Communicator 5	Eyetracker	Derbyshire Language Scheme
Intensive Interaction	Visual Schedules	Tobii Dynavox Indi SGD with Snap + Core First	Headswitch	CODES Framework
Total Communication	Home-School Books		Auditory Scanning	SMART/ SCRUFFY Targets
	Etran Frame		Simple Binary Switch	Observation
	Communication Passports*		Device Mounts	
	True Object Based Icons (TOBIs)			

∗ For this class of participants, sensory style passports were available for adult guidance rather than as a communication support per se.

Light Tech Systems

A variety of digital step-by-step devices were found to be in general service within the class. A mix of single and sequential message devices from a number of manufacturers were in use, procured and allocated to individual children as resource constraints allowed. P06:

> "We had BIGmacks initially - both single message and multi-step. We didn't have enough to give everyone a multi-step, so I had to make a decision as to who would get the most out of them. The multi-steps are quite a bit more expensive. The Smoothtalker is just a different brand - they were cheaper to buy. I do have talking tiles in the class, but didn't use them much (during the study) - physically they would have been harder for our kids to use, poorer sound quality, shorter message length etc."

These devices were employed in a variety of ways as described in the section *A Typical School Day* above, most notably as a story sharing link between home and school environments. Each evening P06 would record a personalised voice memo describing each child's day on their device for them to take home. Each morning it was anticipated that the devices would be returned updated with stories from home for sharing during the "news" activity[11].

Users' Personal High Tech AAC Systems

At the commencement of Study 2, two children in the host class were using dedicated high tech AAC to support their communication (one initially as a trial). This section describes one of these systems in more detail, and gives an exemplar of the interactions between stakeholders in following an ethnographic action research agenda.

[11] Some children never arrived at school with news to share, and during the study it became clear that at least one parent did not know how to operate their BIGmack, nor did they understand its purpose, thus rendering significant daily efforts by P06 over a period of months void.

The devices were[12]:

- Tobii Dynavox I Series 12+ running Communicator 5, with eye tracking access.
- Tobii Dynavox Indi SGD, running Snap + Core First.

Figure 4.11: Indi interface displaying the Tablet Talk page (I Series interface is depicted in Section 2.5.1 of this thesis)

Both devices are accessed via a dynamic display: That is a graphical user interface in which navigating involves the selection of a graphic symbol resulting in the display of a new array of linked symbols. In other words, to simplify the interface, symbols are hidden until contextually appropriate. As indicated earlier (Section 4.5.1), while the I Series would be modelled for its user, the ATist's influence over its content and maintenance was truncated. The Indi device with the Snap + Core First interface used by C01 - its maintenance, support and personalisation - would therefore be the focal high tech AAC technology in this study.

Vocabulary is organised in Snap + Core First as a taxonomic system applying hierarchical categories of words (e.g., Core words - All Word List - Entertainment - Books). These categories are presented in a customisable grid format, with PCS symbols provid-

[12]For brevity, these devices will be referred to as the "I Series" and the "Indi" for the remainder of this thesis.

ing graphical information to the user. According to Drager et al., dynamic display and grid-based systems are difficult for young[13] children to learn, placing high demands on working memory - and also may require a "change" in the support provided to those learning these technologies [49]. That said, the Indi has a modern interface that the vendors have made significant efforts to engineer adaptability into, consistent with the literature review discussion in Chapter 2, Section 2.5.2.

Figure 4.11 shows a typical screen (path: Topics - Tablet Talk) on C01's Indi. Specifics about navigational layout and other operational procedures are available at Dynavox's website[14], but we can see a relatively dense 4 x 4 grid layout in place (not counting the brick-coloured Core First toolbar to the left of the screen), with a selection of personalised symbols. In this case they relate to the Indi and its user's previous device, an iPad with Liberator GoTalk 9+. The symbols have coloured outlines denoting:

1. Green = Positive
2. Red = Negative
3. Blue = Question
4. Orange = Comment
5. Purple = User Content

The Quickfires button on the left hand side of the grid is, as its name suggests, for rapid engagement e.g., generic greetings. The Topics button below that aims to support engagement but is also the path to content most conducive to personalisation.

A free app, Pathways for Core First, is promoted by Tobii Dynavox as an implementation resource with some very useful content included to guide operation and customisation of the device.

In supporting the users of these devices, and other children in the classroom - and in collaboration with P06 - the researcher adopted a mediated learning experience

[13] And, one might assume, children with developmental delays.

[14] The Indi User Manual may be accessed at: https://tinyurl.com/wv29sjl

approach as described in Section 2.6.1. This included prompts ranging from repetition of instructions, providing non-verbal cues such as pointing, through to the carrying out of tasks jointly with the child. This adapted approach is elaborated upon in Figure 4.16 in *The AAC Mediated Learning Experience* later in this chapter.

4.8 Data Analysis

4.8.1 Approach

A key outcome of Study 2 would be any evidence of sustainable systemic change or the adoption of EBP in the school influenced or led by the ATist in collaboration with community partners. A concomitant, and vital, outcome arising from this research would be the gathering of empirical data to define the role of the ATist in SE, providing the basis for a prescriptive framework.

Such evidence would contribute to answering the research questions identified in Section 4.3:

RQ1: *How does the presence of an Assistive Technologist support educators and learners in their use of digital AAC towards meeting pedagogical goals?*

RQ2: *What are the key tasks and duties of a successful Assistive Technologist in the context of an SE setting?*

This section describes the approach applied to analysing the raw data collected over the duration of this study.

As indicated in Section 4.6.1 above, analysis in ethnographic AR commences in the mind(s) of the researcher(s) from the moment the first data is captured, through informed reflection. The ongoing input of fellow participants meant that this analysis was a dynamic, recursive process - mirrored in the note-taking entries. In addition, the multi-method path adopted, intended to infuse rigour into any findings (Section 4.6), meant that the output of each must be considered as relational and in a holistic context. Thus insights gathered from field notes would inform the development of interview schedules, and comments from interviewees reflected or resonated with ob-

servations noted in the field. The goal of this approach is a richer understanding of the community and setting under investigation.

Building upon the insights gleaned through Study 1, the researcher was looking within the dataset for grounded, relevant facts documented through closer collaboration with and among practitioners and aided communicators in the field. Of particular interest would be evidence of positive outcomes or actions resulting from the collaboration[15]. To assist in this, multiple passes were made through the collective datasets, with an adaptive focus for each. This is a variation of Parlett and Hamilton's "progressive focusing" [132], where the analysis would be executed throughout the data gathering procedure, with ongoing attention to refinement - consistent with the overall AR research approach, and with parallels in the constant comparative analysis of grounded theory [33].

4.8.2 Field Work Content Analysis (CA)

A principal source of evidence was the information-rich bulleted field notes log - along with artefacts (mostly digital images, some of which are reproduced in this thesis) - maintained by the researcher throughout the core 4.5 month timeframe[16] of lived, embedded experience.

The stated aim and outcome was to validate and define the potential contributions of an ATist in a SE setting, and this strongly suggested a focus upon describing "visible, obvious components" (Granheim and Lundman [62]). The overarching goal for this analysis would be identifying and evaluating categories - a group of descriptive content with a shared commonality [94] - where the ATist may make the most effective intervention. This knowledge would then form the foundation for a tailored job description and definitive framework.

For analysis, the field notes document was double-spaced using the MS Word Design

[15]Actions manifest, for example, as problems solved, practices improved, resources generated or pedagogical success.

[16]Note that for both ethical and pragmatic reasons, collaboration was not concluded at the "end" of the study, and at time of writing the author continues to have both remote and on-site contact with participants, though significantly reduced in frequency.

tab, and each line numbered using the Layout tab to aid clarity[17]. The field notes logging process ultimately generated 145 pages of textual data (formatted in Arial font size 11). Along with tagged digital artefacts, these were then imported into QSR NVivo, a qualitative data analysis software designed for the analysis of unstructured data [138]. This tool was then used to perform a summative content analysis of the dataset.

The analysis was carried out broadly guided by the CA process described by Granheim and Lundman for text-based observations [62]. This involved importing the document into QSR NVivo and reading through it multiple times to gain familiarity and a sense of the whole. The document was then scrutinised for meaning units - a type of inductive coding identifying words or paragraphs presenting coherent concepts or aspects with a discernible central meaning. These were then subjected to an accumulative process of condensing applied first to summarise the text (manifest content), and then to describe any underlying meaning that might be determined from the text (latent content). Where latent content was not applicable, for example in identifying recurring ATist tasks, these were categorised separately to allow a quantitative task log for a data-driven job description to be prepared under the theme "*ATist tasks*" (Table 4.4). According to Bengtsson, in combining quantitative and qualitative approaches "the magnitude of the individual phenomena studied appears more clearly" [14]. Otherwise the condensed meaning units were inspected again and abstracted into sub-themes, and finally main themes - an example of this process is provided in Table 4.5.

Results

Through this recursive process of coding and refinement, a total of 11 categories or themes were initially described, with 18 sub-themes and two sub-sub-themes.

The overall discussion in Section 4.9 considers these results in detail. For the purposes of defining the role of the ATist in SE, the *ATist Tasks* theme was identified as the most constructive.

[17]This was a step the researcher neglected to implement during Study 1, and proved to be a useful adaptation.

Table 4.4: ATist Tasks theme - A quantitative summary of tasks undertaken

Task	Frequency	Examples*
Operational AAC device support	260	ALgS/modelling; just in time programming; device personalisation e.g., adding vocabulary & pictures, adapting paths/grid to meet user requirements; calibrating eyegaze devices.
General hardware support & troubleshooting	93	Co-ordinating response to catastrophic Indi malfunction; fixing SGD camera; room LCD & laptop troubleshooting; step-by-step repair; implementing device charging protocol.
Pedagogical support	69	Assisting choice-making activities; creating novel content in ChooseItMaker, SwitchItMaker, Boardmaker; digitising storybooks, to build interactivity; troubleshooting extant content.
Other technical support	55	Discussions re co-ordinating device maintenance & programming; tackling implications of GDPR; collaborating w/ SLT & rehab engineer re device mount.
Coaching/training support	8	Demoing Indi interface to staff; assisting LCAs w/ switch setup; informing & sharing literature on EBP.
AAC candidacy	2	C03 assessment for eyegaze SGD; identifying potential candidates in class.

* Note that many of these examples were performed in collaboration with, or with input from, other participants.

Table 4.5: The development of a theme

Meaning unit	Condensed meaning unit description close to the text	Condensed meaning unit interpretation of the underlying meaning	Sub-theme	Theme
C01's indicates "Wind the bobbin up" choice through gesture = I model path to the song on Indi while verbalisingthe path symbols. C01 presses the symbol and also performs his arm rolling sign. Also activates symbol again during the song whilst looking at me - I reinforce this behaviour with praise, spoken and modelled.	C01's choice of song was modelled on Indi with positive, intentional and multiple responses from the child, indicating understanding.	Supporting the child through consistent multi-modal (linguistic and Indi input) modelling produces tangible results quickly	Reducing the impact of input/ output asymmetry	**Modelling as a critical EBP**
P02 has children making pink paint handprints… C01 is immediately on guard… starts to fret and is inconsolable by P02 as she applies the paint, and even after the "ordeal" is over - until I move to him and open his communication book and model "finished". He stops crying instantly!	C01 becomes very upset by a class activity and cannot be comforted by the teacher until ATist models linguistically/ symbolically that activity is over.	Multi-modal modelling is effective in signalling clearly to an upset child.	Reducing the impact of input/ output asymmetry	"
BUT! [Respite team] have not recorded any news on his Smoothtalker Step by Step. More evidence of the disruption poor coordination can cause. C01 is clearly disappointed. I model "I" and "feel" and C01 chooses "annoyed"	Routine disruption causes C01 to be upset - this acts as a spur for communication to take place with modelling cues	User distressed that he is unable to share his news - modelling enables an outlet for these feelings	Modelling as a prompt for expressive communication	"
I and C01 continue work on the mat. Passing a ball. C01 is doing well, signing for more. I model "I" "want" "more" "ball". C01 keeps playing, clearly enjoying the game. After a while I model and ask him to tell me what he wants. "I need changed". Then "I want to play again" (single button). We do this. Then I repeat the communication opportunity: "I want to play again".	The researcher and C01 play pass the ball, with the researcher modelling multiple symbols. C01 responds by selecting "I want to play again" twice.	Modelling when engaging the child in an activity they enjoy presents the motivation for expressive use of their SGD.	Modelling as a prompt for expressive communication	"
Send P06 a paper referring to importance of 200 interactions per day. We are definitely significantly increasing the number of interactions C01 and C02 are experiencing per day on their devices.	Collaborating with adult stakeholders is working to increase modelling dosage in class in line with best practices.	Sharing EBP with adult stakeholders raises awareness and boosts interactions	Modelling dosage is important	"

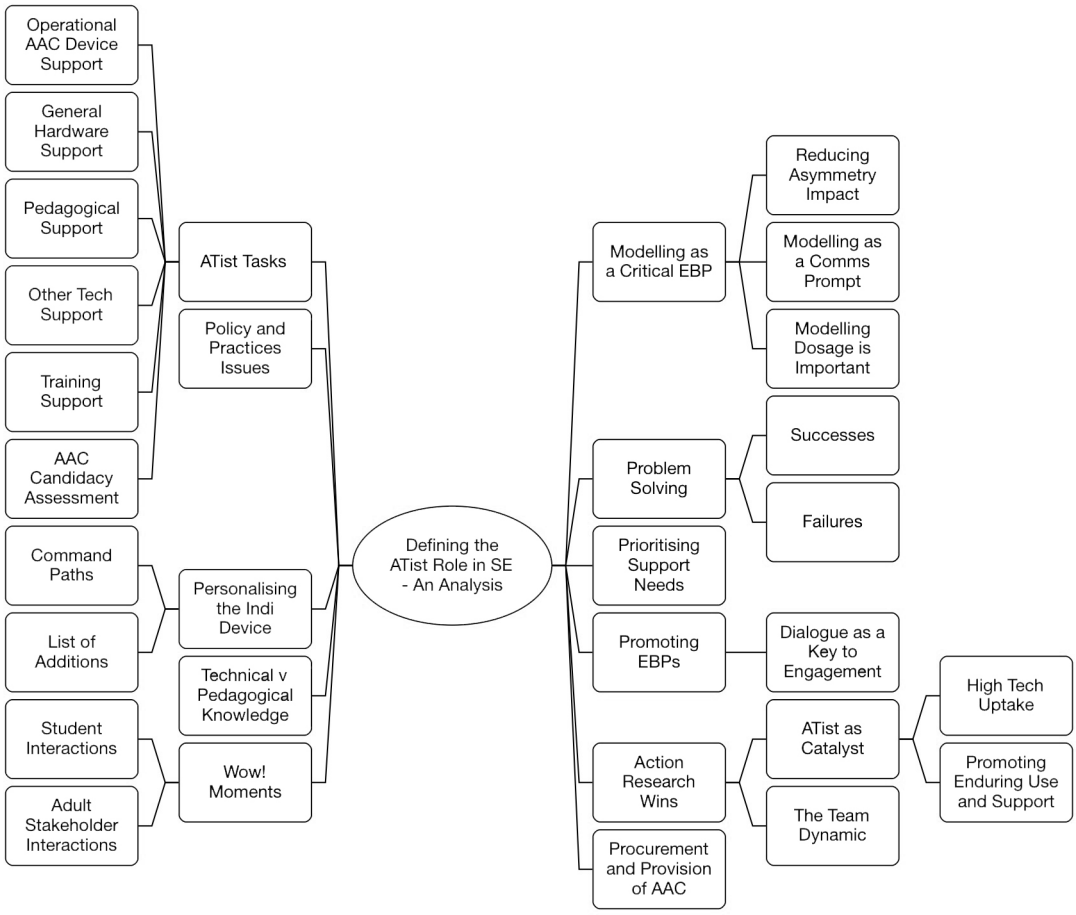


Figure 4.12: Mind map depicting themes, sub-themes and sub-sub-themes from the field notes CA.

Other themes are discussed framed within that context e.g.:

The *Promoting EBPs* theme is used to inform the *Training Support* section; the *Action Research Wins* theme informs the sections on *Co-ordinating Support*, and *Impact Upon the TATC*; data in the *Prioritising Support Needs* theme informed the *General Hardware Support* section; the *Policy and Practice Issues* theme informed the *Limitations of the Study* section; the *Technical v Pedagogical Knowledge* theme is linked to the *Pedagogical Support* section; the *Personalising the Indi Device* theme appears in the *Operational AAC Device Support* section; as does the *Modelling as a Critical EBP* theme.

Bolstered by this mix of qualitative and quantitative evidence, and also by strong sup-

porting data gathered through other methods (see sections 4.8.3 and 4.8.4), a lucid and credible definition of the role and work of the ATist in SE - forged and deeply rooted in a shared communal experience - began to emerge.

4.8.3 End of Study In-depth Interviews Content Analysis

End of study interviews were conducted face-to-face with a selection (n=6) of adults[18] identified over the course of the study as having a significant familiarity with practices and procedures as they evolved, and also of the contributions of the ATist role and that of other key protagonists. All also had daily experience of working with a SE population. The aim of these summative interviews was to explore co-workers perceptions of the value of the ATist's contributions, and to validate the conclusions of the research. They also represented an extension of the active participation of the community the research was intended to benefit - giving them a platform to contribute their own interpretations and conclusions about the experience. In this sense the interviews were a continuance of the ethnographic mixed method approach adopted, and an integral part of Study 2.

The group of selected expert interviewees comprised Teachers (n=3), Speech and Language Therapists (n=1), Learning and Care Assistants (n=1) and Parent/Carers (n=1), as documented in Table 4.2. Each was assigned a number (Px) to preserve anonymity. Participants ranged in age from 33 to 64 years of age (M=44.5, SD=11.44); and the professionals ranged in experience from four to 19 years (M=9, SD=5.01) although these figures may include years in mainstream education in addition to SE. All were native English speakers. As in Study 1, all formal interviewees were female: this was a result of the asymmetric gender balance within the school, a recognised phenomena [166].

Setting

Interviews were conducted during March 2019. All interviews took place in an office in the clinical wing of the host school, with the exception of the first interview (P01) which took place in an empty classroom at the end of a school day.

[18] Participant profiles are detailed in Table 4.2. (Section 4.5.2).

Approach

A semi-structured approach was adopted, with an informal conversational style. This strategy was intended to stimulate a discourse that encouraged informants to speak frankly, allowing them the freedom to explore the topic from their own perspective. An interview schedule (or discussion guide, see below) provided the researcher with a roadmap for returning to the overarching topic, although - responsive to interviewee input - not every question would always be posed, nor was the original order of the questions always adhered to. This flexibility was intended to engender highly detailed responses on issues that informants felt passionate about.

Individual, face-to-face interviews took place over the course of two weeks. Each participant was given time to read a (role) contextual information sheet (Appendices D.12, D.14), and each completed an informed consent and audio/image release form (Appendices D.13, D.15, D.16) at the commencement of the interview, in line with ethical commitments. They were also invited to complete a demographic form (Appendix D.20) to establish their age, gender, educational level, years of experience in SE, and technology comfort level. The interviews themselves were audio recorded, with a total extent of four hours and 42 minutes (M = 46 mins 52 secs). The shortest interview duration was 33.09, the longest 66.42.

As in Study 1 (Section 3.4.5), four broad categories of adult stakeholders were identified (parent/carer, teacher, LCA, SLT). For this study, a decision was taken that each group may hold perspectives contextually distinctive enough to justify the preparation of tailored discussion guides (n=4) (Appendix D.17).

In the first instance, a basic template guide was created aimed at teaching staff, and informed both by the researcher's prior knowledge, and experience in the field. This document was then piloted with two colleagues in the research department, feedback noted and revisions or improvements made where necessary to both the content and delivery of the guide [47]. This piloting process was designed to boost scientific rigour by ensuring an unambiguous and logical focus was imposed upon the guiding question set. It was then adapted, again where required, to better fit the context of the three remaining roles (parent/carer, LCA, SLT).

Each guide included six sections, with a number of probing questions nested within, each designed to elicit data related to informant perceptions of the ATist's role, which skills and responsibilities might be desirable, and any ideas they might have for improving practices within the domain. For example, the six sections considered in the template discussion guide were:

- Initial impressions of the ATist's role, including perceived advantages or disadvantages.
- The focal aided communicator's progress during the study, and the ATist's part in supporting C01.
- High tech AAC candidacy and assessment, and the mechanisms behind the process.
- Further reflections of the ATist's role, its future and required skillset.
- Supporting pedagogy for AAC users, including barriers/facilitators and the ATist's role in this task.
- Adult stakeholder training opportunities, and whether the ATist made any significant contributions in this area during the study.

Audio recordings of the interviews were orthographically transcribed using open source transcription software [171]. A close transcription approach was adopted, and for clarity, the document was double-spaced using the MS Word Design tab, and each line numbered using the Layout tab.

Member Check

Davidson describes the process of transcribing as interpretive and constructive [42]. To mitigate against this phenomenon impacting data reliability, informants were sent transcripts of their interviews and invited to confirm for accuracy. This was undertaken at the data collection stage to mitigate any risks posed by time delay (e.g., the potential unreliability of informant memories [14]). Any corrective amendments agreed were put in place before data analysis commenced.

Content Analysis

The transcription process generated 83 pages of double-spaced textual data (formatted in Arial font size 11) prepared for line-by-line coding. Conformant to ethical requirements, access to these data were limited to the researcher and supervisors and steps were taken to ensure anonymity was preserved, such as the use of pseudonyms to replace real identities.

As before, this data set was then imported into QSR NVivo, where analysis was initiated guided by the CA process described in Granheim and Lundman [62] for an interview text.

Results

During the categorisation process, it was decided that a full analysis would not be a useful deployment of this data set since the content was primarily corroborative in nature. Rather, the testimonies of informants would be used to support the emerging narrative of the field work content analysis in the overall results and discussion sections below.

4.8.4 Online Survey

An end of study online survey was also conducted using the JISC Online Survey tool (Appendix D.18). This was conceived as having a boosted relevance in comparison to typical surveys in the domain, being grounded in a richer understanding as shaped by the multi-method approach of the study.

Procedure

The survey was open for one week in May 2019, and distributed via email to school staff working in proximity with the participating class and embedded ATist. Respondents were asked to read an information sheet, and - upon giving their informed consent - were given access to the survey questions. These covered topics such as demographic information (Q1 - 5), general high tech ATD awareness (Q 6 - 8), and perceptions of the researcher's presence in the school during the study (Q 8 - 12). The principle aims were to gauge:

- staff attitudes towards supporting aided communication,
- any views they might have on improving that support for pupils and staff,
- and how successful or otherwise they considered the ATist's contribution to have been.

The questions posed were a mix of roughly half open-ended and half closed-ended. The guiding rationale was to gather supplementary data towards answering the two research questions posited in Section 4.3 of this chapter.

Participants

The survey was distributed to 31 staff with 11 respondents in total, a response rate of 35.48 percent - although some elected not to answer every question. All respondents were female, although one male was invited to participate. This was a result of the common asymmetric gender balance in this domain, as previously commented upon. Anonymised responses disclosed a diverse mix of ages and roles, though all had a college (or university) education, and rated themselves as good or moderate in terms of their computer literacy. All but two described themselves as familiar with high tech communication aids.

Analysis

As described in Section 4.6.1 above, at the School's request this was a restricted distribution over that originally envisioned (i.e. all staff) - reducing scale, representation, and thus its efficacy significantly. The results therefore had a more limited impact on the validation of this study and a full analysis was deemed disproportionate. With that caveat aside, some very positive comments were captured, adding weight to the discussion in Section 4.9 below.

The researcher printed out and read through the respondents' answers to familiarise himself with the data. Based on the aims stated above, the responses could then be summarised as follows.

Results

- Respondents volunteered a mixed view of how well AAC users are currently being supported in the School. Views were contrasting even between individuals with identical roles e.g., one anonymous LCA believed the children were supported "very well" whereas another reported "we still have a way to go before I feel these children are given appropriate support". Overall, however, respondents seemed to believe that the level of support was improving.

- In terms of how to continue this positive trajectory, six out of ten respondents identified staff training as a significant factor. The second most popular solution could be summarised as greater investment in resources (overcoming budget constraints, procuring and distributing more devices).

- Respondents understood why the researcher was in the School and, importantly, unanimously found the presence of an ATist to be helpful.

- Where staff had worked closely with the ATist, all attested to have benefited in some way, if only by causing them to reflect on their own practices, or to become more confident in using high tech AAC and supporting aided communicators on a day to day basis.

Some of the comments respondents submitted in the online survey are reproduced as corroborating quotes in the following sections.

4.9 Overall Results and Discussion

On the strength of the experiences of the researcher-as-ATist and those of the many collaborators across disciplines and capacities represented in Study 2, there is cogent evidence that this role has a positive contribution to make in the SE classroom.

When combined, the stated research questions have an overarching goal of defining the role of ATist within the context of SE. It is thus most constructive to address RQ 2 first since this question is the most "manifestly" or unambiguously linked to the lived experience of the role *in situ* as articulated by the collated data, and mapping closely

to Table 4.4 (Section 4.8.2) describing the theme *ATist Tasks*. It is also useful to allow RQ2 to inform the subsequent framing of the response to RQ1.

4.9.1 The Assistive Technologist's Contribution (General)

RQ2: What are the key tasks and duties of a successful Assistive Technologist in the context of an SE setting?

The following categories were confirmed or identified as key facets of the ATist's role:

Operational AAC Device Support

Operational support of AAC devices in one form or another proved to place the most frequent demands upon the ATist's time during Study 2 (see Table 4.4). The following section is a breakdown of the tasks undertaken.

Supporting the Indi

At the start of the study, the Indi device had already been distributed to C01 by the SLTs. It proved problematic to determine who had been involved in setting up the machine for the user, and therefore the reasoning behind decisions such as grid size and any personalisation in place remained opaque. The reason for this was:

1. Many adult stakeholders had access to and potentially a role in the device's maintenance. Both the class teacher and C01's parent/carer had received brief training sessions in editing content on the device from an SLT.

2. As the study progressed, it became apparent that - as a trial machine - there remained traces of prior recipients on the individual device e.g., one personalisation change the ATist would make was removing a previous user's name from the login screen. It was not clear if these traces extended to the SGD application layout too.

The support, personalisation and provision of novel vocabulary on C01's device "just in time" proved to be a salient role for the ATist, working closely with P06. A professional discussion on this topic was initiated and maintained almost daily between

these two team members. The other key participants were, of course, C01 himself and his primary carer P04 (in the latter's case, largely through a dialogue enabled by the asynchronous feedback notebook - Figure 4.7 above - which allowed P04 to query, and request support, on a daily basis); and also the peripatetic SLT, although her influence was predominantly manifested in the initial distribution and setup of the device. In-class discussions included deliberations about how to edit and personalise the device; the taxonomic paths, hierarchical structuring and placement of new words and categories; the capture and placement of pertinent assets such as photographs of colleagues or favourite books (and any ethical implications such as GDPR[19] and copyright restrictions).

Device Interface at Beginning of Study

Missing the opportunity to contribute to the Indi's initial setup upon distribution posed a challenge to the ATist's agency (a recurring theme) and diplomatic skills. The researcher was informed that the selection of a 4 x 4 grid size was an SLT decision, and he did not feel empowered to challenge it. Yet for a PMLD learner acclimatising to a new platform, this approach may have contradicted, for example, Drager et al. on the importance of reducing learning demands [49]. On this topic, the vendor Tobii Dynavox themselves counsel:

1. "Simplify language to avoid overwhelming the learner, introduce tools and vocabulary gradually. Take away buttons when learner needs larger/fewer.

2. Provide more buttons (change grid size) and grow language to increase efficiency and precision in communication, social interaction, ability to participate, your ability to model longer sentences, more vocab. Do this when you feel the learner is ready."

Personalising the Device

In collaboration with TATC members as described above, personalisation of the Indi focused on ensuring any vocabulary C01 might need access to was available on his device. This was done on a rolling basis (just in time), with editing often taking place

[19]General Data Protection Regulation - EU data protection legislation.

spontaneously if appropriate i.e. appending to an obvious and extant category. The complete execution of this process however - agreeing location within the taxonomy, inputting (including capturing assets such as graphics where necessary), keeping stakeholders informed, sharing procedural EBP with colleagues - could be protracted and it became a significant part of the ATist's workload (as indicated in Table 4.4 above). This is a recognised challenge in AAC support that the ATist's presence may go some way towards answering [30, 76].

As Study 2 commenced, critical vocabulary related to the curriculum were added having been found to be hidden in the interface or missing e.g., numbers, to support numeracy learning. Other exemplar additions required were:

- People (staff, family and peers) with appropriate consents - policy on this in relation to GDPR was amended school-wide as the study progressed - and seems to have been a study-driven AR outcome.
- Titles of songs commonly used in the School.
- Children's TV shows (often shown in class via YouTube).
- Interactive computer games (operated by the children via binary switching).
- Vocabulary to support recurring class events (such as a "good morning" ritual, news, and pre-lunch routines).
- Vocabulary related to personal needs/modes of delivery e.g., changing glass tumbler symbol associated with "I need a drink" referent to a tube feeder and syringe.
- Book/story titles and characters (C01 was noteworthy within the class as a voracious consumer of storybooks).
- Words relating to new teaching themes as and when required e.g., seasonal events.

The ATist's dynamic updating and contextualising of the Indi infused the experience of operating it with real meaning for C01, enabling richer interactions with communication partners. The device became a tool in the truest sense, allowing C01 extended

agency and control over his environment.

Coordinating Support

As the study progressed, the urgent need for a coordinating influence became clearer, particularly in regard to the manner and resources devoted to supporting high tech AAC users. Patchy or uncoordinated levels of expertise were the hallmark of a system which was composed of diverse actors with varying deficits in accountability. The presence of the ATist - with the role's emphasis upon identifying AT and pedagogical issues and working with others to innovate solutions - presented myriad opportunities for dialogue with stakeholders. These occasionally reflected poorly on individuals - though it should be emphasised that in most cases policy and practice barriers, e.g., in training provision, were at the root of problems. Examples where the ATist was instrumental in identifying issues and promoting solutions or raising awareness include:

- Ensuring consistent access to AAC support. Throughout the school week, C01 attended numerous classes outwith his main classroom. This might place him in an environment where teachers were less familiar with the importance of maintaining access to his "voice", or where situational impairment (e.g., during a PE activity) suggested that an alternative solution needed to be provided.

- Promoting awareness and use of evolving vocabulary available on the Indi - It became apparent that the "Numbers" screen on the Indi was disappearing repeatedly. At first the ATist was unsure whether this was a technical issue (i.e. a software bug). Further investigation revealed that it was being hidden by a stakeholder intentionally, despite that person being informed of the edit when it was originally installed. By chance it was later revealed that the same person was moving or hiding other important vocabulary ("Days of the Week", "Where is my iPad?"), with good - but misplaced - intentions. A diplomatic discussion of the issues with the individual concerned fixed this recurring issue.

- Increasing dialogue between roles - The ATist acted as a troubleshooter, coordinating the response between stakeholders e.g., during a catastrophic failure of the trial Indi (see Appendix D.21), the ATist acted as conduit between a) P06, b)

the SLTs (who were gatekeepers for access to the vendor), c) management (who controlled access to spare iPads that may have been allowed us to implement a temporary replacement), d) technicians (who held cables, and administered wi-fi access required for setting up any replacement device). There is tangible evidence that this type of proactive coordinating activity fostered positive - systemic - changes in the practices of some stakeholders.

- Significantly, this coordinating influence that the ATist nurtured boosted efforts towards achieving the holistic support advocated in the literature (see Section 2.7). This is perhaps best exemplified by C01's carer, P04, expressing an interest in continued contact between the researcher and her family at the close of Study 2, including home visits where necessary. She felt that C01 had greatly benefited from the enhanced communication and support the ATist's presence had introduced and wanted this to be maintained (see Section *End of Study Interview Informants' Perceptions of C01's Progress* below for more of P04's perceptions on this topic).

Maintaining the Device and Troubleshooting

Throughout the study, dialogue with P04 delivered a series of maintenance issues to be addressed by the ATist, including (from field notes):

- Indi screen has become very dark - adjust brightness.
- (C01's) device has been crashing the past two evenings at home. (P04) shared screenshots "Driver power state failure" - ATist researched and adjusted power saving to fix.
- Apply rotation lock on Indi, since it has been changing to portrait when oriented so, (P04) must have changed in error. Write note to her, she later confirms she had noticed this and is glad I set it to lock.
- P04 reports device not finding camera (Indi). This is a serious issue since it is used to populate the device with content e.g., photos of books C01 likes to read. ATist investigates (fix with driver updates and reboot).

Other exemplar maintenance issues tackled by the ATist were (again from field notes):

- Over lunch I try connecting the Indi to (P06's) PC using the borrowed USB 3 cable. Not connecting. Write (P04) a note requesting the original cable be supplied.

- (C01's) Indi screen protector has been peeled off by another child. I am charged with finding a replacement. SLTs not back till new year, (technician) does not have such things, (business manager) has none either. I leave a note on SLT door and later hear that SLT will bring one tomorrow to fix - This is important since (C01) would have had to use the machine over the holiday with no protections for the screen - and he is prone to launching the device when communicating that he is finished with it.

In the latter case, the ATist took ownership of finding a solution before the Christmas break, until constraints upon his agency (which would presumably be absent in any official position) led to a dead end. In January it was discovered that no screen protector had been provided and that the device was placed at heightened risk throughout the holiday season.

Some of the above are quotidian issues which a technically adept individual can easily resolve, yet, on occasions, they represented a significant barrier for some TATC members. The results - in the absence of an ATist - could have meant separating a child from their voice.

Innovating Other Solutions

The field notes record:

- (C01) Indi device DOA. We suspect charging issue but charger not supplied (*As a result of this incident, the ATist initiated a charger protocol, recommending devices moving between home and school should always have their charger at hand*).

- I ask (P01) for a velcro strap or similar to fashion a tether for (C01's) device to the standing frame.

These final two examples represent a type of problem solving typical of the domain. Improvising robust answers to challenges as they arise, particularly in a resource-strapped environment, is a high value skill. In the latter example, as recorded in Section 4.5.1, C01 had three contrasting seating positions that he would move between throughout the day. Secure tethering was important, yet none had been supplied. The ATist fashioned a temporary fix, and liaised with other TATC members to have a full assessment carried out by an external agency (see *Notable Policy Barriers Encountered During the Study* in the *Limitations* section for a fuller description of this interaction).

ALgS/Modelling as a Critical EBP

When Study 2 commenced, it was quickly apparent that modelling [2] was being administered but in a fractured, ad hoc way. P06 was attempting to juggle improvised modelling, for example, upside down on devices while delivering planned teaching sessions in the front of the whole class. P02, the only other regular teacher of the class, had no training in this technique and before the study did not knowingly engage with it in any significant way as indicated in the end of study interviews:

> Interviewer - "So are you aware of the concept of modelling? Or they also call it aided language stimulation?"
>
> P02 - "I am aware of it. But how... you go about it I do not know."

These are indicative of flaws within a system, not in individual members of the TATC - and are consistent with the lack of training for LCAs identified in Study 1. In Study 2, the researcher-as-ATist's protocol (Section 4.6.2) imposed structure, and demonstrated good EBP to TATC members. P02 continued:

> "To have you coming in and seeing you use it and seeing when you can use it and seeing how you can model the answers, and how you can help the children... that's been a learning curve for all of us I think. So I don't think there is a person who would not benefit. The adults and the children I think. All of us!"

Modelling was not restricted to high tech AAC: The technique was utilised with other

children in the class as and when appropriate. In addition, during Study 2, the trial Indi suffered a catastrophic failure that left C01 without his high tech device for around two months while a replacement was organised. During this time he went back to using low tech in the form of his communication book, supported by the ATist and other members of the team (see Appendix D.21).

The overall assessed impact of modelling and other contributions of the ATist upon children and staff is discussed in more detail in Section 4.9.2. However, modelling proved highly effective as an intervention for promoting reflective expression in children (see sub-theme refinement in Table 4.5 for *Modelling as a prompt for expressive communication*). As evidenced in the sub-theme *Modelling dosage is important*, it was also clear that the ATist's presence marked a significant expansion in modelling adoption and dosage within the class which was:

- to the benefit of individual children, through mitigating the impact of input/output modality asymmetry (described in Section 2.7.2; see also the condensing meaning units for the sub-theme *Reducing the impact of input/output asymmetry* in Table 4.5).

- to the benefit of adult stakeholders, through an AR process of demonstration and coaching on best EBP with the ATist at hand.

Data from the field notes corroborate these statements:

> "(P06) is working on Curriculum for Excellence reports. She provides me with a copy - this has previously been agreed with (P04). Quote: '(C01) has benefited from a high level of modelling on the device'."

From the end of study interviews:

P06 (Teacher):

> "I think the most obvious thing is that it has massively increased the amount of modelling that he has had - that we couldn't have provided in the same way otherwise. And that's really one of the crucial things when you are

> learning a device like that and to have that level of modelling - I think that's been amazing for him."

An LCA's perspective (P01):

> "(W)e need to better model that and if we as staff don't have the knowledge then it's difficult for us to model. If you spend most of your time looking for things rather than actually modelling what he is trying to say then that's limiting his experience and his development - so it's been really good for him to have that focus time, and to have someone knowledgeable with it to do that."

And an SLT's perspective (P05):

> "The bit that's been most beneficial to me has been support for the child and the modelling so I'd put that high up on the list."

The coordinating, unifying influence of the ATist - encouraging the adoption of a more rigorous, consistent and enduring modelling approach among the TATC - appears to have been one of Study 2's most significant contributions.

Supporting Other AAC Strategies and Devices

Although the overarching focus of this thesis is to establish a means of providing better support to all stakeholders for the uptake and enduring use of high tech AAC, a significant part of the ATist's role in any classroom will involve supporting low or no tech solutions too. Even if every pupil has a high tech device, there should always be back up alternative(s) to ensure aided communicators' voices can be heard in diverse situations.

Both high tech AAC users in the study's partner classroom had a variety of back up low tech and unaided communication strategies, as detailed in Section 4.5.1. Due diligence would require the ATist to gain familiarity with as many of the technologies and strategies recorded in Table 4.3 (Section 4.7.4) as possible, in order to offer what this thesis will characterise as "full spectrum support". Examples of this would run

from calibrating the eyegaze on C02's I Series (Figure 2.2, Chapter 2) and the itinerant standalone touchscreen PC (Figure 4.9), through modelling aided low tech such as communication books, to experimenting with Etran frames in collaboration with P06 to engage children (not habitually using that tool) in simple DLS activities (see Figure 4.13 below).

Figure 4.13: Engaging an aided communicator with the Etran frame.

In this context, the researcher took particular interest in the advantages for an ATist of learning Makaton. This simple signing technique was used throughout the school, and seemed to have a universal message reinforcing effect. For example, field notes from Day 3 include: "I sign Good morning (thumb up, then open curtains touch either side of chest - Must learn Makaton)". This, and a few other basic gestures, often brought positive responses from the children, perhaps establishing the ATist in a familiar and unthreatening light. In the subject school at least, Makaton appeared the closest approximation of a *lingua franca*.

General Hardware Support

This was the second most common type of activity in which the ATist engaged during Study 2 (Table 4.4). From a technology standpoint, the role of ATist placed the researcher at the technical heart of a 21st century classroom - a "first line of defence" and the "go to" expert for others to approach in the event of malfunctioning equipment.

With an array of devices to be supported - see Table 4.3, but also other equipment such as the shared touchscreen PC (Figure 4.9), the teacher's desktop PC (Section 4.4.5), the multi-touch LCD screen and supporting Acer laptop (Figure 4.5), and peripherals such as the class digital camera - malfunctions or user errors were a daily occurrence during the study. The importance of this "line of defence" - and its capacity to countermand or alleviate potential disruption of critical class activities - should not be underestimated[20].

All computer hardware, including AAC devices and other AT technology solutions, fall under the umbrella of this general hardware support category. Some examples of issues encountered during the study include:

- Access solutions e.g., tailoring access method, timing, sensitivity of the LCD panel screen so that it responded to each individual user's input effectively. From the study field notes: "Screen time (games): (C07) has first go. Screen is a large touch sensitive device. But sensitivity is problematic. (C07) is pressing the screen in the right place but no response. The adults struggle to get it to work. (ATist) researches settings and adjusts screen sensitivity appropriately".

- Devices would frequently suffer a driver failure or a setting would be inadvertently adjusted causing, for example, the audio or graphics to fail or corrupt. A good example from the field notes is: "Over lunch: (P06's) PC has switched to tablet mode and they think it is broken, I return it to desktop mode."

- Occasionally, a device would physically break - yet delving into the inside of the machine, a task non-technical staff might recoil from, could produce a solution in a matter of minutes e.g., "(C02's) BIGmack is malfunctioning. The teacher and LCAs are at a loss but I [ATist] manage to get it working by removing battery and tweaking contacts and controls. Success!".

- The lateral thinking often required to improvise a solution with limited re-

[20]There is an important caveat here: staff in high pressure roles were not always in a position to problem-solve a malfunctioning device where even a simple reboot might fix the issue. Without the ATist, they might very well have to abandon an important activity and move on.

sources was a key ATist contribution e.g., "Over lunch (P06) is trying to program (C02's) device with additional vocabulary but software keyboard is not appearing. I plug her own computer's usb keyboard in for a temp workaround to quickly solve the issue".

- Repurposing mainstream technologies to improvise a solution or fill a gap created by the failure of a dedicated device (see example given in the paragraph below).

Troubleshooting hardware issues as they arose, and taking leadership to boost cooperation between stakeholders in the quest for durable solutions, was a vital contribution that the ATist made during Study 2. A single case study table, illustrating the response to one dramatic device failure and the ATist's pivotal role as a catalyst towards mitigating disruption is available in Appendix D.21.

Pedagogical Support

This type of support was the third most frequent activity in which the ATist engaged over the course of the study. The pedagogical impact of the ATist's role is discussed in more detail in Section 4.9.2 below. In terms of practical contributions, and working closely to meet requirements drafted in collaboration with class teacher P06, the ATist's technical expertise proved a very useful - and frequently utilised - asset.

A vital classroom tool was the large multi-touch LCD screen illustrated in Figure 4.5 (Section 4.4.5). This device was used to access YouTube (and other) digital video content such as children's TV shows for entertainment; familiar music heralding recurring classroom events (such as lunch or toothbrushing); for playing interactive games (to support learning and competencies such as understanding of cause and effect, switching, numeracy); and for group activities such as storybook reading.

The ATist added considerable value to this device as a pedagogical resource - i.e. a device by which pedagogical activities could be accomplished - through a number of contributions:

- Where required (for example when other team members were on breaks or un-

dertaking personal care tasks), the ATist assisted individual children with interactive switching activities e.g., HelpKidzLearn games, or supporting them in choosing TV shows to watch or songs to play e.g., Super Simple Songs.

- Working with P06 to create pedagogical content tailored to meet her teaching requirements, the ATist developed a number of online learning activities and interactive storybooks using a variety of tools including ChooseIt! Maker 3, SwitchIt! Maker 2 and Mayer-Johnson Boardmaker Studio.

In building online learning content, the ATist encountered a number of obstacles (discussed in the *Limitations of the Study* section below), and it was necessary for work to take place both on and off-campus - the latter location due to the absence of audio and graphics editing software, and peripherals such as a desktop scanner on-site. The technical know-how to capture, edit and embed multimedia assets, across a variety of platforms, in the most efficient way was a major contribution of the role - enabling the teacher to orchestrate learning activities that would otherwise have been abandoned, or less engagingly supported. A snapshot of the kind of collaborative workflow in action is illustrated in this excerpt from the study field notes:

> "Discuss with (P06) SwitchIt! Maker 2 software for creating learning activities. Looking at it, it seems pretty basic (created with Macromedia, Flash or Projector), and (P06) wants to import assets (photos, audio) to create a switchable story for the children. I describe how I can create content based on her script or storyboard (as subject matter expert). I also brief her on IPR pitfalls. We also discuss Powerpoint as an alternative tool, and I agree to look into controlling PPT so that it waits until time-based assets (such as an audio file) have finished playing before switch activity focus allows moving to the next slide."

The ATist also took over delivery of the group "Good Morning" session on one occasion when P06 was abruptly summoned from the class for an urgent phone call. The close working relationship between P06 and the ATist allowed this unexpected responsibility to be discharged comfortably, with the ATist also drawing upon his own teaching experiences from former roles.

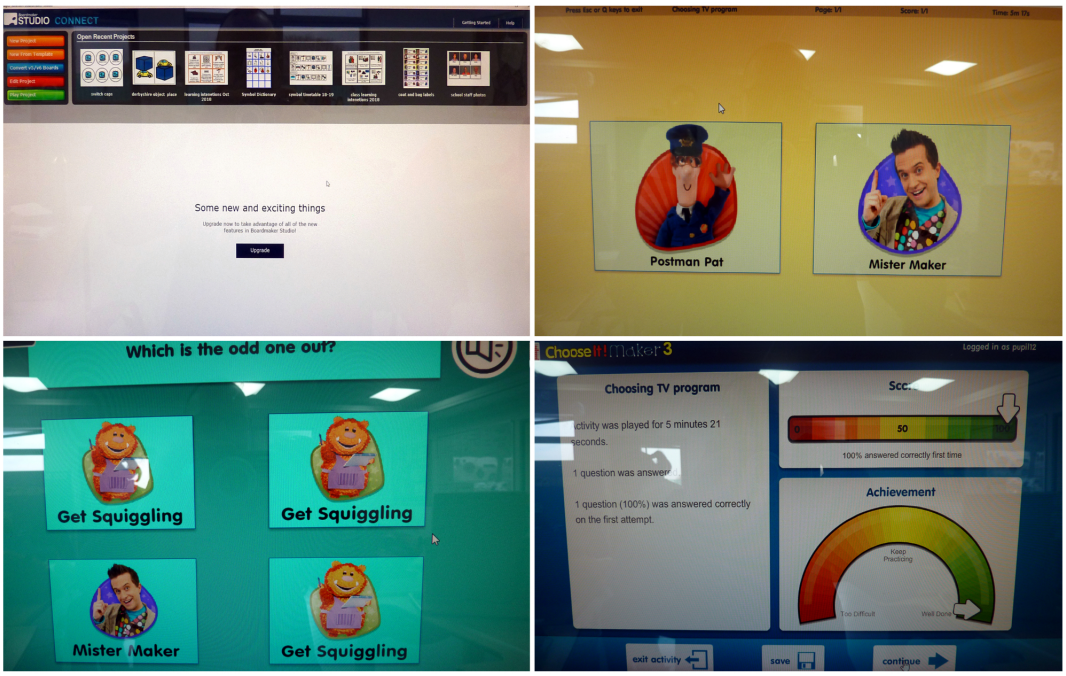


Figure 4.14: Selection of screens from the online development platforms and interactive output developed in collaboration with P06 during Study 2. A digitised storybook can also be viewed in Figure 4.5 (Section 4.4.5).

On this topic, it is worth noting that a number of participants valued teaching knowledge or experience quite highly as an attribute for the ATist to hold. For example, from the end of study interviews:

> P05 - "If there was a teaching background in there I think... that would be quite useful. If not, I don't know how that would so easily work together."
>
> Interviewer - "So familiarity at least. Some sort of qualification?"
>
> P05 - "Yeah."

And:

> P03 - "I think… you'd have to have a teaching degree, to see the developmental needs."

Interviewer - "So more a teaching qualification than a computing degree?"

P03 - "Both!".

This discussion is emblematic of the uniquely "split" role of the ATist. The suggestion that some type of qualification in each discipline would be beneficial for the demands of such a postholder is logical and persuasive - but may restrict the numbers of people in a position to apply for such a role if considered essential, rather than just desirable, attributes.

Other Technical Support

The quantitative task summary in Table 4.4 placed this as the fourth most common activity. In analysing the work of the ATist in SE, this category became a place for sundry tasks that did not quite fit other categories. Some blurring between categories was evident, dependent upon perspective. Some relatively trivial tasks, still with technical requirements however mild, are placed here e.g.:

- Operating the class camera to capture, download, edit and export activity images of individual children - for restricted distribution by P06 only to their respective parents/carers - was a task the ATist was given responsibility for.
- Procuring screen cleaning wipes/cloths for the multiple touchscreens within the environment was allotted to the ATist on his suggestion: A prosaic but important tool, particularly given the hygiene requirements for this vulnerable user group.
- Sharing thoughts on any implications of intellectual property rights and GDPR upon populating SGDs with content.

The collaborative AR approach resulted in many discussions between the ATist and other members of staff, most commonly P06 but also other teachers and SLTs; in the case of some topics, categorised as *Other Technical Support* here. For example, the timing of the Indi trial and - once it had been decided that C01 would be given his own device - the duration of the transition gap (i.e. hiatus without access to the device): During

Study 1, the researcher had recorded evidence of this gap lasting a number of months in one account given - something that, as an ATist with some input for Study 2, he strongly advocated to avoid.

Advice or physical assistance in mounting and positioning high tech AAC devices was also placed in this category. Again, this was an important contribution, one where brute strength was occasionally needed to overcome the barrier e.g., (from the field notes) "ATist and P01 adjust (C02's) arm mount using allen keys - with some difficulty".

Training Support

Informal[21] training and/or coaching is a challenging activity to track. It has a generally impromptu nature, and also does not have a baseline to gauge what knowledge transfer, to whom, has occurred in the general demonstration of EBPs. Thus, the numerical grading in Table 4.4 probably significantly underestimates the importance of training as a contribution of the ATist.

Supporting emerging communicators with diverse and complex needs represents a significant challenge, a fundamental element of the "wicked problem" that pervades the field. Ensuring that stakeholders/the TATC have adequate practical knowledge of EBP and AAC strategies and tools in use in their environment is paramount. Testimony from a very experienced teacher (P03) during Study 2 indicated training availability had diminished dramatically due to resource constraints:

> "When I started I did all of those courses, I was so fortunate, there was plenty of budget, you could get a supply teacher in no problem to cover, and off you went."
>
> Interviewer - "So educational cuts are at the root of it, is that what it is? There's not enough time, not enough people?"
>
> "There's not enough teachers, there's no budget - we used to have a budget

[21]There was no opportunity for formal training within the school to be led by the ATist during the study, though sharing EBP by such events would seem likely and a useful contribution in any permanent post.

for CPD, there is no budget now. No school has that now."

Yet the majority of respondents to the online survey (Section 4.8.4) identified training improvements to be the key to improving support for aided communicators. An anonymous teacher:

> "Keep training staff so they are aware of what is available, how they work and they can model effectively for users."

And from another teaching respondent:

> "We should be supporting our pupils better by receiving training on it. Having to figure things out yourself isn't only time consuming but is not as effective as it could be!"

The embedded nature of the ATist incumbent's role proved invaluable in this respect – it opened multiple cross-disciplinary paths for impromptu training interventions to take place. Examples of this dynamic in action are:

- Dialogue arising from the AR collaboration: The key relationship between P06 and the ATist was one rich source of discussion about EBP, raising the potential for constructive change.

- Distribution of academic literature: Working as part of the TATC, the ATist was able to identify weaknesses and encourage process- or theory-focused reflection, often supported by the sharing of relevant research.

- Modelling modelling: By infusing the daily use - and coaching others in the adoption - of a carefully tailored ALgS protocol (Section 4.6.2) into every classroom interaction, the ATist was uniquely positioned to mentor a "learning by doing" approach among staff.

- Simply having a team member on hand with robust technical expertise and a problem solving focus opened coaching and other opportunities (as described in Section 4.9.1) with substantial implications for the overall impact of the team. P01: "(I)t was good having someone else, having the support and having someone

who is knowledgeable… having someone to call upon when you need help or advice with something."

Beyond the direct impact of having the ATist embedded as a potential source of instruction or advice in the classroom, the researcher also observed adaptations in training policy that may reflect an increased focus on improving support provision. From the study field notes:

> "Met (P03) in corridor, Tobii[22] is coming to train LCAs in February, and would I like to attend? Yes, if still here. This is progress since LCAs were not receiving training on high tech AAC last year (during Study 1)."

The LCAs referred to were those from the participating class of Study 2, and the training was Snap + Core First, the software driving the Indi SGD. It would seem reasonable to assume that the ATist's presence and AR approach adopted had in some way influenced what must be considered a significant and welcome change. However, the precise decision-making dynamic for this enhanced training initiative could not be conclusively established.

Nevertheless, what both Study 1 and Study 2 reveal is that there remains - or has developed - a significant training deficit, with a widening gap between EBP in supporting AAC users and the actual level of support that is currently being provided in the field. Study 2 also delivers persuasive evidence that the guiding presence of an ATist with cross-disciplinary proficiencies in the TATC represents a valuable training or coaching influence towards closing this gap. This sentiment appeared to be confirmed by participants of the end of study interviews, for example:

> P02 - "I still don't know about (C02's) device, I still don't know about (C01's) device."
>
> Interviewer - "Do you think training other team members in assistive technology skills should be a part of the Assistive Technologist's role?"
>
> P02 - "Well you would be the (one) to train those people, yes."

[22] Indi vendor.

On this evidence an ATist - skilled in both specialist and mainstream computer technologies and available to share their knowledge with colleagues at the time and point of need - would seem an important addition to any TATC in SE.

AAC Candidacy

Where the provision of adequate and engaging support for people who use AAC technologies seems a prerequisite for their sustained use - thereby alleviating the chronic abandonment issues highlighted in Chapter One - matching candidates to suitable AAC solutions is another vital facet. In terms of relative scale, the inadequacy of uptake of high tech AAC in SE was a key insight proceeding from Study 1. During Study 2, the researcher-as-ATist was given occasionally mildly contrasting accounts of the processes triggering assessment from various sources, indicating a (perhaps necessarily) ad hoc approach.

Class teacher's description:

> Interviewer - "So you speak to the speechies, they liaise with SCTCI[23]..."
>
> P06 - "In [Child X's] case it was. With [Child Y] they decided that they would give him a trial and they had the device within (Regional) SLTs."
>
> Interviewer - "So the speechies decided they would give him a trial, and the SCTCI weren't involved?"
>
> P06 - "Not that I am aware of."
>
> Interviewer - "So it seems to me there is not a set way of doing it, it depends. Responsive, perhaps."
>
> "Yes, I think it's something between the teacher, professional discussions between the teacher, the SLT and also probably parental concerns as well, which is the other thing I have not mentioned."
>
> P03 (Teacher) - "But that would be the process, the teacher recognises,

[23] Scottish Centre of Technology for the Communication Impaired.

then liaises with the speech and language therapists and then do the assessment or get someone out from the centre in Glasgow to come in and assess and see what is the most appropriate device."

P04 (Parent/Carer) - "I don't know if there are more children getting assessed because I think the range of devices has become a bit more known to other parents. Like I know some who have seen [C01] with his device and have gone back to the SLTs and said 'How about that?' so I would say it's probably more - I don't know how each individual is - but more the parents going to the SLTs and saying 'How about this?'".

Interviewer - "So parents could be driving some of this?"

P04 - "Yeah I think a lot of it - but then again I don't know but I know the parents I am in contact with, they are the ones asking for it."

P05 (SLT) - "For high tech, there's different routes we would go down. For [C01] the path was that we identified just through observation of him, his use of low tech AAC that he might benefit from high tech, so we spoke to our lead SLT within (region) for AAC and arranged a loan of a device, one we have in our department, that are loaned out across (region), so we arranged for a loan for him...The other pathway is we refer the child on to SCTCI in Glasgow because we don't have within our department the bigger range of equipment that they have for trialing things so similar pathway, it's just the load and the assessment comes through SCTCI, so their SLT comes out to support that."

In a class of seven children with CCN, there are clear constraints around how often an ATist might engage with AAC candidacy issues. Table 4.4 only documented two activities in which the ATist was involved in this respect. However, during Study 2, the ATist's presence, married with the adopted AR approach, appeared to galvanise interest in assessing individual children for high tech AAC solutions. The study field notes for Day 41 recorded:

"C03 SCTCI assessment now postponed from 5 March to 12 March. I am

> also informed C05 and C06 possible hi tech users. That would be five in all [out of our class of seven, with two hi tech AAC users currently] - this means three other children are now being considered as candidates and are likely to be assessed."

Considering that as Study 2 commenced there were approximately six high tech AAC users in total from an entire school population of c.180 (or 3.3 per cent as noted in Chapter Three), this is a remarkable change in approach. The ATist role within the school should take some credit for such signs of progress in high tech AAC adoption.

Summary

Reviewing the research question:

RQ2: What are the key tasks and duties of a successful Assistive Technologist in the context of an SE setting?

Table 4.4 (Section 4.8.2) gave a quantitative snapshot of the work of the ATist in SE. On a superficial level, this may be seen to answer RQ2 as it stands. However this summary, while informative, does not capture the scale, technical demands and sophistication of the role on the ground. In this section (4.9.1) the author has attempted to audit the wide range of proficiencies and characteristics that a person fulfilling the ATist role requires. That is, a full spectrum of support including "hard" technical skills such as:

- software development,
- hardware adaptation
- and protocol design and implementation.

And "soft" person-centred skills such as:

- cross-disciplinary networking,
- empathy and patience in interacting with vulnerable clients to identify and devise solutions to meet their individual needs,

- and diplomacy in engaging multiple stakeholders on potentially sensitive topics and/or situations.

Emerging from the work of Study 2, we see the unique contribution that the ATist can make in nurturing EBPs and providing the technical expertise to solve complex and challenging problems in a timely manner; co-ordinating and boosting the impact of fellow professionals working in the field - and always with a focus upon prioritising the educational support of the young emerging communicators in their collective care. Importantly, this section records some evidence that, in performing the ATist tasks and duties described, uptake of high tech AAC in the participating class may have increased.

The next section considers further the evidence Study 2 provides for the qualitative difference such a trained professional on-site can make - with a particular focus upon pedagogical outcomes.

4.9.2 The Assistive Technologist's Contribution (Pedagogical Outcomes)

RQ1: How does the presence of an Assistive Technologist support educators and learners in their use of digital AAC towards meeting pedagogical goals?

This section will show that the results of Study 2 support the notion that the ATist's role has a significant contribution to make towards enhancing pedagogy in the SE environment.

Observations and Findings

The following appraisal has a caveat: With the evidence at hand, we can never absolutely attribute the positive (or otherwise) influence and effect of the ATist's presence within the classroom. There are too many parameters - a wicked problem - in the complex system under investigation. However, by listening to the participant collaborators' opinions and identifying occasions where the technical and cross-disciplinary acumen of the ATist was able to provide benefits beyond those that would otherwise have been available, this study provides some compelling insights.

Impact Upon Learners - Focal Participant C01

As a summative exercise, consistent with the AR partnership approach that had leveraged their respective strengths throughout the study, the ATist researcher consulted with P06 in assessing any identifiable benefits or gains for C01; and which may, at least in part, have stemmed from the ATist's presence and contribution.

These reflections are broadly expressed with reference to Light's *Framework of Communicative Competence* [101] described in Section 2.7, to recap:

- Linguistic (**LC**)
- Operational (**OC**)
- Social (**SC**)
- Strategic (**StC**)

On the basis of the evident frustrations experienced by this population of pupils - as occasionally articulated by participants in counterproductive ways - it was decided that these competencies should be augmented by a fifth: Blackstone and Wilkins' Emotional Competence (**EC**), which considers the emerging communicator's command of emotional vocabulary, awareness and self-regulation [23].

The researcher and P06 agreed that C01 had become less reliant on reflexive verbal utterances (shouting for attention - **SC/StC**), and progressively better at using his device to make more precise requests (**LC/SC**).

C01 was observed to start using his device for multi-symbol messages e.g., "want" "more"; these increased in frequency as the study progressed (**LC**). This would be a "critical shift" and positive result[24] consistent with an improving symmetry between linguistic input and output promoted by persistent modelling [22], which was fostered by the embedded ATist (see Section 2.7.2).

[24]Analogous to the second of three important transitions in language development thought to be modulated by speech, and leading to a "higher level of complexity of expression" [133].

In honing his ability to communicate more clearly, C01 demonstrated reduced frustration levels - with very positive improvements in his behaviour (**EC**). For example, as described in Section 4.5.1, C01's regular protest strategy in the early part of the study was the self-removal and discarding of his tracheostomy speaking valve. According to P06:

> "Newer members of staff show surprise that he used to throw his speaky off nearly all the time. And sometimes in class now if he is upset, he responds best if you model on his device as well as verbalise what is happening e.g., if he is sore in his standing frame and you (model) 'book first then class chair' – he will concentrate more and respond better if you use the device to communicate to him."

This tangible impact is underpinned by literature emphasising the role and importance of providing children with CCN "appropriate and effective supports to resolve challenging behaviour" [176].

C01 had prior experience of using a touchscreen dynamic display device (an iPad running Liberator GoTalk 9+). His skill and understanding of this selection technique predated Study 2. However, during the current research C01 was observed to start using both hands to swipe through the menu system and make selections. From the beginning of the study, with the ATist regularly providing modelling support, C01 quickly became familiar with the new navigation interface - occasionally outperforming the adults in this regard[25] (**OC**).

P06 stated that over the course of Study 2 C01 had "certainly (become) a much more skilled communicator… he can say what he wants when he wants and have his voice heard (**OC/SC/LC**). His communication is much more accessible for everyone and not just a skilled communication partner who knows him and when they happen to notice he has something to say. He can communicate on much more equal terms".

[25]Example: P06 was momentarily searching on the Indi for *Numbers*, installed in collaboration with the ATist the preceding week to support numeracy instruction. C01 was observed to press the appropriate button, scroll down two screens and find the correct location without hesitation. This was a path he had clearly remembered precisely from the earlier session.

Throughout the study, the ATist worked closely with C01, with an emphasis on modelling in line with the protocol described in Section 4.6.2. An example of an interaction from the field notes on Day 19 demonstrates **LC**, **SC** and **EC**:

> "(ATist) and (C01) continue work on the mat. Passing a ball. (C01) is doing well, signing for more. I model "I" "want" "more" "ball". (C01) keeps playing, clearly enjoying the game. After a while I model and ask him to tell me what he wants. "I need changed". Then "I want to play again" (single button). We do this. Then I repeat the communication opportunity: "I want to play again"... (P06) is watching, impressed. ("Wow!") This is probably the best interaction to date with (C01)."

At the end of November the ATist attended a meeting with P06 (class teacher), P04 (C01's parent/carer) and P05 (SLT) where news was announced that the device trial had been deemed a success and that C01 would be given his own Indi. Field notes documented this event: "Big news: (P05) announces (C01) will get funding for an Indi of his own. Major milestone!". This decision was a positive response to mounting evidence that C01 was "matching" with the AAC technology in a beneficial way i.e. across all five of the competencies described. As discussed, it is problematic to establish precisely how far this success reflected the support provided but it does represent a tangible achievement in a case where the ATist's contribution was substantial.

End of Study Interview Informants' Perceptions of C01's Progress

In the end of study interview sessions (see Table 4.2), general comments on C01's progress were positive. It is clear that the AT device was seen as an intrinsic part of progress made but the impact of the enhanced level of support provided by the ATist is not easy to isolate definitively. P01 (LCA), however, did link the two factors robustly:

> "I think during the study (C01) has improved, it's been amazing, what he has been able to achieve through having his device and having the support during the trial period - having someone who could give him the focus and the time to get, become familiar with his device… being able to communicate has improved his behaviour and his mood. He's learned the

> advantages of being able to communicate. He's learned a lot outside the technology through having a more intensive interaction with an adult."

P06 (Teacher), as primary collaborator (and primary mediator in the traditional MLE described in Section 2.6.1) made the following assessment - and distinctly focused by her pivotal position of ultimate responsibility for C01's progress:

> "So has (C01) made good progress? Yes, amazing… I am hugely impressed with the way he has picked (using his Indi) up. But I think particularly towards the end of the trial and he'd had a really good stretch at it… I think he was more communicative, he was very eager to use it, he was eager to initiate things, and I think his behaviour improved to some extent."
>
> Interviewer - "So you think the improvement is partly because that device has been really helpful for him?"
>
> P06 - "I think it's brilliant for him, I think it's really successful."

P06 had a holistic view that rightly prioritised her charge's well-being.

P04's perspective as C01's Parent/Carer proved illuminating:

> "But just to be able to hear him having that voice, I think it's taken, it had taken away some of his frustrations."

She identified an interesting lateral advantage of Study 2:

> "Well I think you can kind of gather that I think it's been really positive - helpful for me - but positive for (C01), not only because of the role that you are (undertaking) but because you are male."

This observation, while in no way a characteristic intrinsic to the ATist role, is interesting since staff in SE are predominantly female and - as Chapter 5 will demonstrate - current ATists in FE do appear to be predominantly male. For C01, as a boy, having a male role model could be significant - though clearly in this respect a more balanced gender mix throughout society is the solution to aim for.

P05 (SLT) - acknowledging her limited access, and basing her assessment partly on informal reports from staff and family - offered this encouraging reflection on C01's progress mapped to Light's Competencies:

> "Well it sounds like linguistically he is finding new words that he can use, he is exploring his device, so he's definitely made progress there. I guess socially, because he is using his device for different purposes, so that's a bit of progress - I guess that's the main two areas. Operational - I guess travelling through the pages. I don't know he does a whole lot of operational stuff."

P02 was a teacher covering the class at times when the main class teacher was timetabled to do administrative or CPD tasks. As such she had an excellent professional familiarity with the individual children, if not quite on a par with that of P06. At the same time however, this itinerant role afforded her intermittent snapshots where progress could be conspicuous:

> "It's been wonderful! Absolutely wonderful. And the fact that (C01) - see I remember months ago, and he didn't even want to interact with the device, and the way you have been doing it so subtly, and obviously the very crucial moments of you having the knowledge what was on it … That was spot on, because you knew you would get an answer."
>
> "He told me all about his feelings today, and he also asked me how I felt this morning. That was just wonderful, that has never happened before so it was a sweet moment."
>
> Interviewer - "So that's been quite a Wow! moment?"
>
> "Uh-huh. I've never… you know it was mostly one way communication, yes or no questions. Where now he can actually ask me a question that I can reply to. And now I can ask him more complex questions - 'How are you feeling?' Which is wonderful because he replied to me and then asked me. That was… that's a huge progress. Picturing him (at the beginning of the trial) just wanting to have nothing to do with the device, poking it off

the table."

Interviewer - "Well he'll still do that occasionally *laughs*."

"Well I would say less so. I think he is enjoying himself, I think it's given him confidence. I think I can see his mannerism and the look on his face that he is pleased with himself."

These anecdotes indicating improvements in socialisation, communicative competencies, and emotional stability and fulfillment provide evidence that the reach of the ATist may go beyond day-to-day problem solving, and contribute positively to the attainment of wider life goals for children with CCN.

Impact Upon Learners - Other Students

Study 2 had a particular (case study) focus on C01, the child trialing the Indi SGD. For this reason, and due to time constraints, less time was spent gathering data relating to the progress of other individual children in the class. However a second focus of the work was supporting other students with their pedagogical and aided communication needs. A great deal of the ATist's time and effort was devoted to assisting all of the children in the class. These interventions took many forms that were both direct e.g.:

- Modelling language using their AAC strategies and/or devices per the protocol described in Section 4.6.2.
- Simple manual tasks such as adjusting device mounts, and moving or repositioning other equipment to match a child's needs.
- Adapting access methods to individual requirements (tailoring switch access and touchscreen sensitivities, calibrating eyegaze devices).
- Working with individual children to facilitate choice-making exercises (e.g., interactive games, songs, TV shows) through their high, low and/or no tech AAC.

And more indirect e.g.:

- Taking ownership of technical/hardware/software faults or errors, and ensuring

prompt solutions were delivered to minimise class or activity disruption.

- Working with TATC and other adult stakeholders to provide a more seamless pedagogical experience (e.g., creating and supporting the delivery of online learning activities; assisting in other teaching activities - Figure 4.15 below).

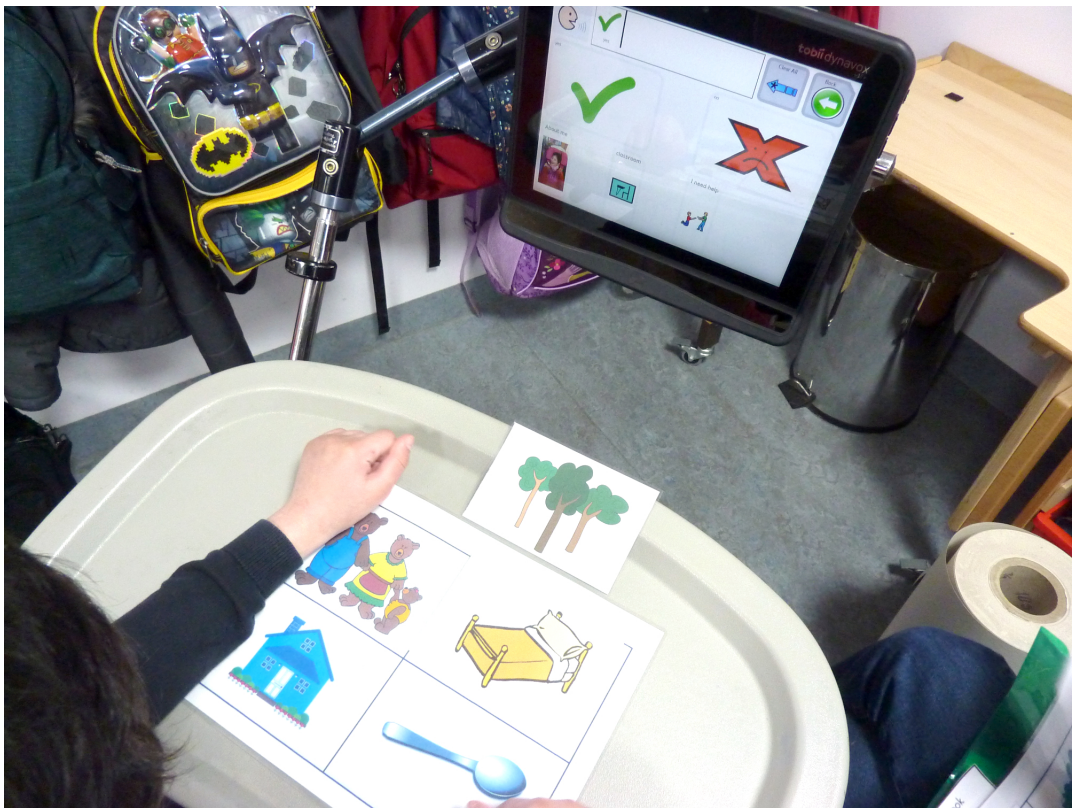


Figure 4.15: ATist works with LCA and I Series user on a DLS activity.

There was also a reciprocal group dynamic: Supported by the ATist, C01, arguably already prominent among his peers, enhanced his communication competencies and therefore became a more responsive presence - leading to more engaged and animated group work. This was a phenomenon that positively influenced the class *milieu* for all participating students.

Other positive impacts are recorded elsewhere in this thesis, such as the dramatic increase in uptake of high tech AAC mooted in the section on *AAC candidacy*; and more generally, by the improvements in the understanding and application of EBPs by practi-

tioners (and the researcher) associated with the study, and the hybrid ethnographic/AR approach taken - as described in the following section.

An anonymous LCA respondent to the online survey summarised the input of the ATist thus:

> "I found the researchers (*sic*) presence in school very helpful. His knowledge and skills were appreciated and having someone with time to spend time communicating with the children benefited them."

Impact Upon the TATC

Staff attending the classroom are *prima facie* examples of Light and Mcnaughton's "partners in the environment" who hold a critical influence on the efficacy of intervention deployment and support [106]. As such, it proved essential for the ATist to work closely with them and, where possible, parents/carers to foster a co-ordinated EBP approach.

The relationship between P06 and the ATist was at the heart of this AR study (see Section 4.5.2). A professional dialogue was maintained throughout that informed decision-making about all aspects of support within the class. P06's reflections:

> "I think there was an ongoing professional discussion between us pretty much everyday even if we didn't manage too many specific meetings; we talked about where to put various words, how to edit, how to model, etc etc. Because it was new for me as well as for (C01), I was really feeling my way, and it was really helpful having you to bounce ideas off, and especially it was good to know you had good knowledge of a lot of underlying theory around modelling/high tech devices/language competencies etc. For me it was and still is very much (of course) about giving the child a voice - a means to communicate in a very practical way, but you had all the sort of backup theoretical stuff, so if I questioned something you often had a solution, e.g., the thing about how much vocab should be available from the start. Also you were able to give advice and discuss with me creating 'pathways' for vocabulary e.g., setting up the entertainment route through to TV, books, computer games etc. I think without your help I would

> have had less confidence. As I say it was such an advantage to me having someone to talk and discuss with who had the same goals, you brought the theory, the research knowledge; and I brought more knowledge of the individual child, how the child communicated already, and what situations we could set up to encourage communication."

P06's comments allude to a functional (action research) accord, where support and knowledge transfer were mutual - and importantly enabling the teacher to confidently manage and further her teaching goals for the class. Her use of the word "professional" is significant: No longer was she wrestling with complex technologies that she may not have received adequate training for, and directing LCA staff "alone". Now, there was a trained professional peer regularly present in the room to collaborate with[26].

Demonstrating and training to raise awareness or depth of knowledge of EBPs was a key impact of the ATist's presence upon staff in contact with the ATist (see *Training Support* above). This dynamic of knowledge sharing may have raised the overall level of support within the class for both students and adult stakeholders alike. Improvements or uptake in modelling practices among LCAs, for example, may have allowed P06 to focus on other important tasks. This was certainly the case with the ATist in place. However, with LCAs modelling more confidently, these good practices were likely to be sustained beyond the study.

Freeing up time for other things was a comment made by a number of the TATC regarding the ATist's significance. There can be little doubt that having a technical expert at hand, addressing issues arising responsively, promptly (see for example, *General Hardware Support*) made an impact in helping to keep practitioners' planning on course and on time.

> P05: "So it was all helpful, the modelling, the availability to fix things if anything went wrong, to have that knowledge of what it might be if it was more of a computer issue."

[26]That is not to denigrate the LCAs as individuals in any way, all of whom were able and committed individuals, but rather to highlight relative role responsibilities.

During Study 2, adaptations in practice - often subtle, without fanfare - were observed to take place (certainly in relation to orthodoxies established during Study 1) e.g., the inclusion of LCAs in Snap + Core First training organised by the SLTs and described earlier in this thesis. This would provide a very tangible benefit of the study for the TATC and the children in their care. In a workplace of complex team dynamics, P01 shared this opinion:

> Interviewer - "Are you aware of any impact the presence of this role in your classroom may have had on the practices of (others)?"
>
> P01 - "SLTs. Yes. I think having someone in the Assistive Technologist's role has definitely prompted SLTs to look at things differently and in more depth. Because someone in that role has the knowledge and experience then they are much more able to speak to the other professionals about it and have more clout."

Finally, the experienced teacher P03 had the following to say - and although there had been little or no discussion with this individual specifically about the AR approach adopted, her comments appear to be a conclusive confirmation that it was a functional strategy[27], and was having a beneficial impact on the team and their practices:

> P03 - "I mean… what we are doing now is, because of you, and you've actually gone through that with [P06], you've sort of driven that, and we will actually carry on the momentum. So we'll not do anything differently because you've already started it. We will embed what you've been doing now and take that forward."

The AAC Mediated Learning Experience

As the study progressed, incoming data painted an increasingly vibrant picture of the complex interactions between emerging communicators who use high tech AAC, and the educators and other adults charged with their pedagogical support. This was on a level both corroborative of prior research, and on a novel basis - emerging from the opportunities afforded by field work in the SE setting.

[27] Although with some perceived limitations - as described later in this chapter.

Discussions about the data between the author and his two supervisors (one of whom has a rehabilitation engineering background, the other an educational psychology background) yielded new insights through a pooling of knowledge and expertise. It was clear that, against the backdrop of Light's *Framework of Communicative Competencies* [101], the task of formulating the most effective approach to pedagogy supporting a child using AAC was exponentially more complicated than that for a NT child. This is a result of the necessary but obfuscating barrier of the technology placing increased demands on its users - a situation that has been compared to a multilingual environment [183]. Waller notes that mastering these technologies may take years, with access and operational concerns necessarily becoming the focus instead of "using technology to achieve communication goals" [180].

Based upon the ethnographic action research described in this study, the addition of a second mediator - the ATist - to this SE setting is significant. Such a practitioner may not only promote EBP and the benefits of enhanced technological know-how to the classroom, but their collaborative presence may also free or support the teacher to maintain their primary focus: the meeting of pedagogical goals. In this way the debilitating dynamic described by Waller may be alleviated, or at least reduced. Figure 4.16 below is an augmented version of Deutsch's tripartite MLE interaction diagram (Chapter 2, Figure 2.4) to illustrate this modified paradigm as informed by Study 2:

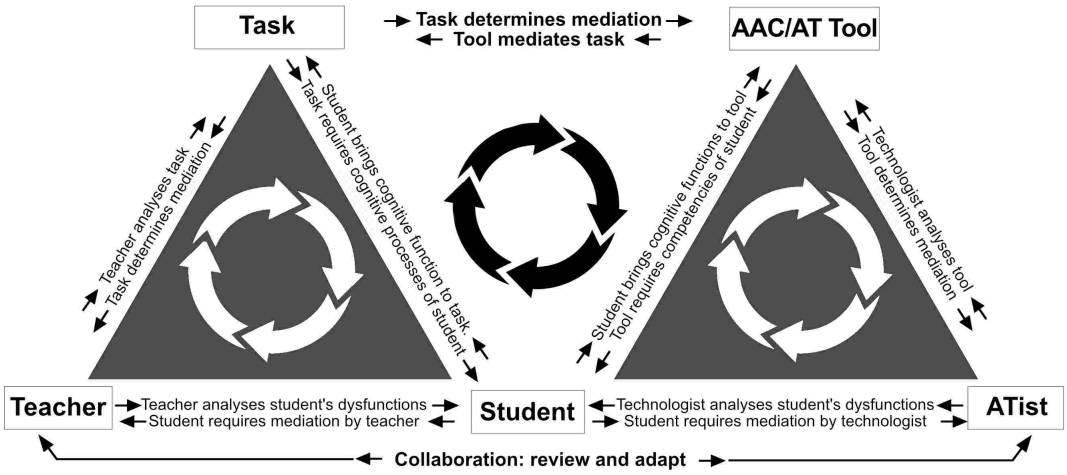


Figure 4.16: MLE interaction diagram adapted for AAC technology support

This adapted diagram describes the novel support potential of the ATist role within a SE classroom. It suggests the further expansion of the interaction system described by Benigno and McCarthy (see Section 2.6.1) from a quadratic to a quinary[28] one - but with very significant benefits. Similar to the teacher, the ATist can carry out a careful analysis and assessment of the child's communication competencies. But by observation in the naturalistic environment, and bringing in specialist knowledge of a range of AAC technologies, (low through to high tech), they will be able to assess the potential suitability of new and novel technical tools for assisting that child.

To facilitate the child's learning, an important role for the ATist is also to collaborate and liaise with the class teacher to gain a better understanding of their intended pedagogical goals (tasks) for that child; and to identify and put in place assistive technology solutions towards achieving those goals.

Again, working closely with both the teacher and learner, the diagram illustrates that the ATist will also have a role in assessing the child's ability to use the tool and personalising (mediating) it to the child's individual requirements. The ATist may trial the use of the identified tool in a specific task, assessing how the child responds[29], adapting it responsively as required - rendering it "uniquely relevant" in other words [45] - and/or providing training or modelling support as we have seen in this study.

Summary

Reviewing the research question:

RQ1: How does the presence of an Assistive Technologist support educators and learners in their use of AAC towards meeting pedagogical goals?

This question is partially answered in Section 4.9.1's description of ATist contributions (in particular *Pedagogical Support*). The embedded researcher was there as a source and demonstrator of evidence-based knowledge, technical support, teaching resource development and as an easily accessible fellow professional to coact with. The modicum of pedagogical knowledge the researcher came equipped with was also seen as a boon,

[28] Consisting of five, rather than four, parts.

[29] The process of dynamic assessment.

and would seem likely to aid the relationship between teacher and ATist in the adapted MLE diagram introduced in the section *The AAC Mediated Learning Experience* above.

The question spotlights the relatively unique position of the ATist in SE: Serving to support both emerging communicators with CCN *and* the community of practitioners and ancillary staff facilitating their education. This section has considered the ways in which the ATist's presence may have impacted upon both traditional protagonists in the mediated learning experience (the mediator - or teacher in a school setting - and the learner), and importantly presents an adapted model to help define and understand this complex five-part dynamic.

With full acknowledgement of the caveat that begins Section 4.9.2, it does appear reasonable to conclude - on the basis of documented comments from those community partners closest to the learners - that:

1. Teachers and supporting staff benefited from the presence of the ATist during the study in a multitude of ways, but particularly in gearing support practices to enhance pedagogy, and meeting P06's goals for her class;

2. Children in the class benefited both from working directly with the ATist; and indirectly from the enhanced application of EBPs by practitioners via the synergy of the AR approach.

3. Both of the preceding points arguably represent a bolstering of holistic practices to AAC interventions identified as beneficial in the literature review (Section 2.7) of this thesis.

4.10 Sundry Recommendations

Over the course of Study 2 (and to a lesser degree Study 1), the author compiled a number of policy rules in his field notes - in some cases based on good practices observed, in other cases noting areas for improvement - collected here as a bulleted list of axioms. While not intended as exhaustive, they were deemed useful as a form of supplementary guidance in appropriate circumstances - and would later contribute toward the

development of the framework under construction.

4.10.1 Key Role Accountabilities

Coordinating

- Liaising with other professionals (teachers, LCAs, OTs, physios, SLTs, rehab engineers, clinicians) to ensure an holistic support structure is in place, and to engender awareness and raise aspirations in terms of goal setting for children with CCN, whether through high, low or no tech AAC adoption.
- Supporting managed transitions between classes and planned life events.

Training

- ATist to be at the forefront of leading and promoting training in all staff who have a role interacting with children on a daily basis.
- Conducting of staff knowledge/skills awareness audits.
- Designing and delivering formal programmes of CPD to support allied professionals in developing their awareness and capacity to support aided communicators.

High Tech Device Support

- ATist to maintain links and engage with HCI/AAC/Academics/Conferences to keep abreast of latest tech developments.
- Conducting regular reviews of general strategy in light of developing tech and EBP.
- ATist to innovate, encourage and support dosage of augmented input and infusion of language, communication and literacy into teaching wherever possible (including interactions outside of the classroom e.g., at lunch, in PE, swimming, assembly, on field trips, walks etc).

General Best Practice Suggestions

- TATC: Each to know and adhere to procedures (candidacy and assessment processes).
- Aided learners to have access to their own devices or communication strategies at all times unless impractical.
  - This will extend to backups and surplus devices being maintained to counter disruption in the case of damage or malfunction.
  - Engender awareness of the gravity of depriving a child of their voice/mode of communication.
- Promotion of training to all staff who have a role interacting with children on a daily basis.
  - All staff interacting with children should be aware of the goal to engage aided communicators 200 times a day, and to engineer communicative opportunities accordingly throughout the timetable.
- Technology trials should recognise that SEN children take longer to learn, and reflect this reality in their timing/extent.
- To fully support transitions and elevate a sustained focus on lifelong learning for this population.
- Hardware/Software maintenance.
  - ATist to have access to the network for updating and maintenance of drivers etc where necessary.
  - ATist to have access to direct lines of communication with vendors to aid in problem solving and boost horizon scanning.

4.11 Overall Summary

As defined by the experiences of the embedded researcher working in concert with the TATC for Study 2, the ATist's role in SE is singular if not exceptional. They must straddle a fence where computer technology - with its history of usability shortcomings and capacity to demoralise technophobes and digital natives alike if poorly deployed - meets humanity at its most vulnerable. They do so against a background where uptake in the use of these computer technologies - principally in the form of high tech AAC - is low and abandonment rates are high.

Entering this environment, and working closely with the people there revealed a community striving to achieve good results under considerable pressure - constraints of time, personnel, budget and access to evidence-based knowledge. The researcher-as-ATist found many engaged and talented individuals embedded in the TATC. During this study through action research - together - they forged a path that may have reinvigorated another "resource": one of enhanced coordination.

In effect, the ATist was able to become a catalyst, involving himself in many areas of daily life for this community (full spectrum support). The outcomes were a boosting of technical knowledge and confidence among colleagues to act, expanding dialogue between and among all[30] stakeholders, and keeping pedagogical plans on track - thereby amplifying the effects of their own respective areas of expertise. Study 1 (Section 3.5.1, Sub-Theme: *Partner Relationships and Attitudes*) provided testimonies from educators emphasising the importance of LCA relationships in their classes. Study 2 provides evidence that an embedded ATist may similarly boost educational achievement partially through relationship building with both learners and staff - best illustrated by the MLE adapted for aided emerging communicators above (Figure 4.16). To recap, the ATist's contribution comprised a sometimes pivotal role in the following critical areas of SE operations:

[30] Including - through sensitive acclimatisation - increasing opportunities of dialogue and agency for the learners themselves.

- Operational AAC Device Support
- General Hardware Support
- Pedagogical Support
- Other Technical Support
- Training Support
- AAC Candidacy Support

Many of these contributions rely upon nurturing familiarity and understanding for successful results. With prevailing policies and practices, itinerant SLTs - for all their formidable expertise in language development - appear relatively poorly placed to offer adequate support for even a moderately scaled distribution of high tech AAC technology. The system they operate within is simply not geared towards supporting these devices, and this must at least partially explain the poor levels of uptake and high abandonment that we see throughout SE. Yet in Chapter 2 of this thesis we identified the massive opportunities for some emerging communicators that high tech AAC represents. Systemic change here can make a positive impact on real lives.

On the evidence of the multitude of positive contributions[31] - if we accept the opinions of co-workers and evidence of pedagogical progress documented in this chapter - that the embedded ATist was able to make toward supporting staff and students alike during Study 2, this novel role embedded in SE may be the addition or change that is necessary to begin addressing the problem stated in Section 1.1.1.

4.11.1 Limitations of the Study

Numerous barriers were encountered by the ATist in the course of Study 2. Some are described in the foregoing text. Many of these limitations were there for the researcher during the study but presumably would be addressed for any individual in a permanent or officially established ATist post. Although acknowledging this, for pragmatic reas-

[31]The author would note that the opportunity as an ATist to make a positive difference to people's lives, often with a relatively "quick fix", also proved to be a fulfilling personal experience.

ons the author lists below the most egregious issues faced in the data-driven context of his lived, embedded experience as an ATist within SE.

Action Research

The ethnographic aspects of this hybrid study were very similar to Study 1. Indeed, as stated in Section 4.4.2, Study 2 was very much a continuation - benefiting from already forged relationships and communication channels. However, the AR approach proved more complicated to harness in practice in this environment: Imposing the discipline of AR in a busy classroom - with regular crises occurring and a stretched or distracted teacher (and other staff) - was not alway practical. Whatever good intentions any of the team had (including the ATist) - such as conducting regular planning meetings at a specified time or place - these would frequently be abandoned in response to other emerging priorities. Compromise was an inevitable part of this research process.

That said, both P06 throughout this chapter, and P03 in the section *Impact Upon the TATC* above, provide good evidence that an iterative process of AR was achieved.

Sampling and Representation

The study was restricted to one class within one school. It may therefore have benefited from triangulation elsewhere. However, as variously highlighted in these pages, a noteworthy contribution of both this and Study 1 has been their immersive nature i.e. intensive, ethnographic, and longitudinal - an approach unusual in this domain and one that in the estimation of the author has borne dividends. Study 2 in particular has benefited from the investment in time in getting to know, and being accepted by, the sensitive and vulnerable participating target group. This allowed the researcher a clearer window into the children's thoughts and emotions, as well as the insights and opinions of those adults working to support their education.

Time is in limited supply for a PhD project, however, and the researcher opted to protect the quality of the study by focusing on one school and describing what he found there with integrity. We might expect other special schools to be broadly comparable and, were more time available, conducting further validating studies embedded in analogous SE environments would be an interesting prospect.

Potential Gender and Cultural Biases

As small a scale study, the diversity of views available may have been curtailed - most notably by the limited number of formal male interviewees within the partner school. This was a result of the asymmetric gender balance within the school, a recognised phenomena [166]. The ethnicity of adult participants was also largely uniform. Gender and cultural differences therefore may not be well represented here, although the latter disadvantage may be offset to some degree by the absence of any language barriers.

Notable Policy Barriers Encountered During the Study

Despite being integrated into a tightknit classroom team, issues arising from a lack of agency and authority dogged the investigation - and this represented the most impactful limitation. Although the host school community were very generous and accommodating in welcoming the researcher into their midst, the ATist as a "friendly outsider" did not automatically have access to certain vital data, systems and services. Oftentimes, nor could such access be arranged. In some circumstances this was a natural result of right and proper data security policies. Nevertheless, this frequently proved disruptive to the hybrid ethnographic/AR research approach adopted, extending the recursive inquiry process of planning, action and reflection described in Section 4.4.1 as workarounds were invented, or simply bringing progress to a particular endeavour to a halt. Examples include:

- Accessing school records on individual child participants' clinical profiles - even with parents' permissions, these attributes proved challenging to establish for (anonymised) write up.

- Troubleshooting and fixing software and hardware issues - a core of the ATist's role involved resuscitating malfunctioning computer devices. However, access to wifi was extremely limited for security purposes; and where it could be arranged (after considerable consultation) it also proved to be physically patchy, with many classrooms "dead" zones. The implications for downloading device drivers, installing software patches (including those improving security), upgrading operating systems and even simple personalisation tasks such as downloading IPR-free images meant that some simple fixes were impossible to achieve

on site. An occasional workaround for this problem was to take a device to the University campus for updating, or to bring assets in on USB. The SLTs appeared to be working within the same constraints.

- The ATist did not have access to contacts, by telephone or otherwise, in external agencies such as software vendors. SLTs were gatekeepers to these suppliers, and their peripatetic contracts at times prevented responsive support (e.g., the screen protector issue in the section on *Maintaining the Device and Troubleshooting*; Indi failure RTB Appendix D.21). Such inefficiencies could be highly frustrating, did not prioritise the education (and therefore the welfare) of these vulnerable learners, and highlighted the need for organisational restructuring to support high tech aided communicators more sensitively.

- Despite training being rapidly identified as a core function of the ATist's role, it proved impractical to schedule any formal sessions as a temporary presence in the field.

- Because of licensing issues, the author was denied personal access to softwares used in the class for online activity development, with detrimental repercussions for the capacity of P06 and the researcher-as-ATist to work creatively together. Field notes record: "NEWS: (P06) has investigated and established - according to (the Headteacher) - that (the ATist) cannot be given access to ChooseIt! Maker etc since he is not a member of staff. There is little to be done. The suggestion is I can work on (P06's) machine in the classroom, but when? Lunchtimes? This is not a practical solution and will impact on my ability to build content for (P06) to her pedagogical specifications." In the end, as described in the section on pedagogical support, a significant amount was achieved - but time, and teaching materials, were lost.

- At the start of the study, the ATist raised the possibility of procuring an arm mount for C01's Indi device. This was based upon his observation that:

  - C01 would communicate that he had finished using the device by pushing it from his desktop (the ATist improvised a number of short-term solutions

using cable ties, elasticated string etc to secure the Indi in place).

– C01 also needed his deskspace for storybooks, that he liked to read interactively with communication partners - and for which the Indi had been populated with relevant content such as story protagonists and other assets.

P06 shared these concerns. On Day 31 of the study therefore, a meeting was arranged between the SLT, and an external AT consultant to discuss a more permanent solution, with the ATist standing in for P06 (who could not attend). The consultant quickly decided that a velcro patch on the desktop would secure the Indi adequately. The ATist's reflective response was that this solution may be inappropriate on the basis that C01 needed the deskspace to read books and operate his device concurrently; and that C01 also had a habit of licking velcro to the point of irritating the skin on his face. The ATist's objections were largely ignored by the consultant as he continued his conversation with the SLT (who - having much less contact with C01 - was comparatively ill-suited to advocate for the specific needs of the child in question). The dynamic appeared to be that the AT consultant was unaccustomed to *bona fide* user-centred solution seeking. The velcro system was ultimately not successful, and a compromise solution was eventually put in place. An ATist with an enduring acknowledged position may have exercised greater influence on the outcome of this meeting.

The purpose here is to further illustrate the complex system with diverse actors into which the ATist was attempting to integrate; to demonstrate not only the technical requirements of the role, but the accompanying - critical - need for the instrumentality to act; and to show the very real impact on service provision that marginalising an ATist might represent in the real world. The takeaway message for this study is, however, broadly positive: Good progress was achieved - and without the barriers described here, the impact of the ATist's presence could have been greater.

4.12 Conclusion

To restate the problem presented in this work: *How can the special education environment be enhanced to promote the effective introduction and support of high tech AAC solutions into the lives of children and young people with complex communication needs?*

To address this, Phase I of this project used a literature review and an immersive study to reveal a disturbingly low level of uptake among emerging communicators with CCN, while substantiating reports of high abandonment within SE schools. Accordingly, it was decided that improving those figures through enhancing support for AAC in these institutions could be transformative for the long term prospects of those attending them.

The work described in this chapter, Phase II, documents the role of the ATist, a trained and technically literate professional, as defined during an immersive longitudinal study within a SE context engaging closely with community partners to support curriculum delivery. The results paint an encouraging picture of enhanced coordination between adult stakeholders, raised levels of support, and possibly improving pedagogical - and high tech AAC performance - outcomes. As the limitations of the study also suggest, formalisation of such a post would deliver yet stronger outcomes.

Such benefits, if accurately assessed, should not be optional where human well-being is at stake. If current organisational paradigms - however well-meaning - are failing CYP with communication disabilities then we must look seriously at making the necessary changes to improve that status quo. It is the contention of this thesis that, given strong indicators in this study of the worth of an ATist in SE as a galvanising influence, every child in every SE school could potentially benefit from such a presence.

To further this aim, it was decided that a *Framework for Assistive Technologists Within a Special Education Setting* should be prepared. This process is described in detail in the following chapter.

Chapter 5

Framework Development and Validation

5.1 Introduction

Chapter One of this thesis identified the uniquely complex "wicked problem" that this research focuses upon and aims to address. Chapter Two highlighted the benefits of early intervention and high tech AAC, and the necessity of broadening the scope of these interventions beyond those with communicative disabilities to include "partners in the environment" [106]. It also identified the Assistive Technologist (ATist) role in FE as one potential means of achieving this goal. Study 1 (Chapter Three) applied immersive research methods initially to understand context with a view to building a novel technical tool - only to reveal the dramatic scale of low uptake and high abandonment of high tech AAC in SE schools. This led to a change of focus from the planned UCD development of a technical tool promoting language acquisition, to the quality of user-centred support and service provision - and completed Phase I of this doctoral project. In Study 2 (Chapter Four), Phase II of the project concluded with a number of important insights on the practical contributions an ATist might make in the SE setting, and their perceived benefits, gleaned again through immersive, person-centred investigative methodologies.

It was decided that the next logical step - a final Phase III building on the work of the foregoing two phases - would be to develop a framework for the role of the ATist in SE

as a means of summarising and disseminating the evidence-based practices identified or collated through this work. The framework would be a culmination of this research, and a platform to promote the adoption of enhanced practices and policies towards resolving the focal problem identified in Chapter 1 that this thesis aims to address: *How can the special education environment be enhanced to promote the effective introduction and support of high tech AAC solutions into the lives of children and young people with complex communication needs?*

This chapter presents Phase III of this research - focusing upon a third study aimed at validating prior phases' conclusions as they consolidated around the emerging framework-in-progress.

5.2 Design of the Study - Phase III

Figure 5.1 below illustrates Study 3 and Phase III within the context of the overarching exploratory mixed methods design adopted for this project.

5.3 Steps in Developing the Framework

The following sections describe the steps undertaken towards developing an initial framework draft. Definitions of a framework can appear fluid, but, for this project, a job description was deemed to be an important first stage.

5.3.1 Fast-tracking the ATist Job Description

As a first stage of developing a job description, contact was established with Rohan Slaughter, currently (in 2020) employed by JISC but formerly the assistant principal of an FE college for young adults with CCN - and who had a major role in the DART Project (see Section 2.7.3). Through this contact, a number of person specifications and job descriptions for ATists in FE were shared with the researcher, who collated and adapted them to reflect the SE context that this project focuses upon (see Appendix E.23).

This process of contextualisation was a relatively straightforward one of selecting relev-

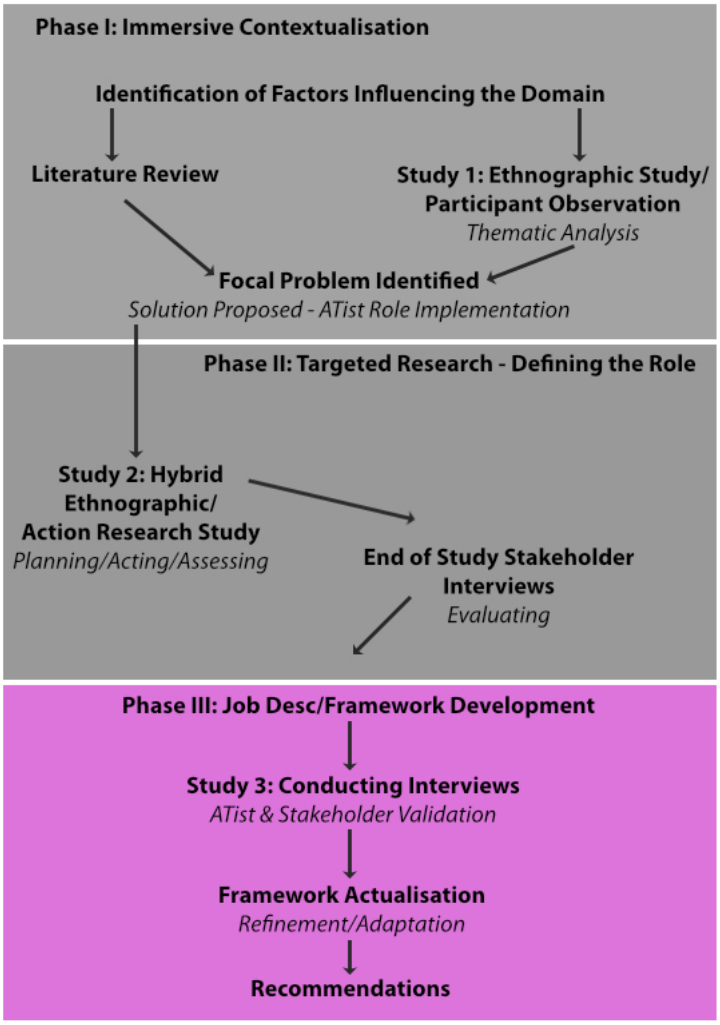


Figure 5.1: The project design (highlighting Phase III, with Study 3 shown in context).

ant duties and where necessary adapting them (for example, by replacing descriptions of "the College" with "the School"; adding parts specifically identified as important during the research for this project to date (for example, promotion of EBPs, and the creation of classroom teaching activities); and removing contextually speculative or potentially inappropriate content (for example, sections about the post requiring "extensive travel"). In order to validate this document - in combination with other insights and outputs emerging from the first two studies - a further study was designed and launched. This new study is described in the following section.

5.4 Study 3: Validating the Job Description and Findings from Prior Phases

Having developed a job description and person specification as discussed in the preceding section, the next stage of this investigation was to seek the endorsement of professional individuals with significant experience in similar roles. Although initially planning to deploy an online, asynchronous focus group [184] approach, at this stage of the research a decision was taken to continue data collection through semi-structured interviews. This was determined to be likely to produce more timely results[1] than the original idea, or other methods of eliciting subjective views from participants, such as the Delphi method [158].

5.4.1 Context and Recruitment Strategy

At the time of this thesis write-up, there is no "School of Assistive Technologists". Where ATists are in post - further education - they are by no means ubiquitous. With no typical career path, routes into the role are diverse and idiosyncratic. There is, however, a community of ATists and similar professionals sharing good practices and expertise on email discussion lists such as:

ASSISTIVE-TECHNOLOGY@JISCMAIL.AC.UK.

Through these, and other contacts already made over the course of this research, interviews with FE ATists and relevant stakeholders were proposed and organised, intended to canvass the opinions of those already in these roles, albeit in a different context[2]. In this way the author planned to validate the outputs from phases I and II, and the job description described in this chapter.

[1] In implementation, arranging some of the interviews took significantly longer than anticipated, raising doubt on the merits of this decision as a time-saving device.

[2] The FE environment may be similar, but is not identical to SE - most significantly, in SE we are working with educators and young emerging communicators to leverage the benefits of early interventions, endeavouring to infuse pedagogical experiences with effective high tech (and other) AAC support.

5.4.2 Aims of the Study

Ten participants with subject matter expertise were recruited to take part in in-depth semi-structured interviews. These were intended to:

1. Triangulate findings, and seek validation of observations and extant artefacts emerging from preceding phases (I and II) of this research.

2. Identify any additional issues that the nascent framework should describe or address.

5.4.3 Participants

The group of selected expert interviewees (n=10) comprised ATists in FE (n=5), Speech and Language Therapists (n=2), an Occupational Therapist (n=1), a Phonetician (n=1) and a parent/carer (n=1), as documented in Table 5.1. Each was assigned a number (Px) to preserve anonymity.

Participants ranged in age from 25 to 79 years of age (mean=45.8, SD=16.61); and the professionals ranged in experience from four to 45 years (mean=18.3, SD=14.47). All were native English speakers. The gender balance was a more even split than prior studies of six females and four males - the increased male presence (all ATists) a reflection, perhaps, of the computer engineering emphasis apparent in the role and the lingering dominance of that gender in the engineering domain.

5.4.4 Setting

Interviews were conducted between July and October 2019. As a result of wide geographical spread, these were mostly undertaken remotely, using a mix of Skype, Facetime, and landline telephone, with the author stationed in a University campus office for each interview. The exception was one participant who was able to attend the office in person.

Table 5.1: Study 3 ATist and allied professionals interviewee characteristics

ID	Role	Gender	Age (Years)	Education	Experience (Years)	Computer Literacy
P01*	FE ATist	M	36	PG	10	Expert
P02*	FE ATist	M	46	PG	17	Expert
P03+	FE ATist	F	25	College	4	Good
P04*	FE ATist	M	41	UG	18	Expert
P05+	FE ATist	M	35	UG	5	Expert
P06**	SLT	F	70	PG	45	Good
P07**	Phonetician	F	79	PG	40	Moderate
P08*	OT	F	43	PG	12	Good
P09*	SLT	F	48	PG	26	Good
P10++	Parent	F	35	PG	6	Expert
* Denotes Skype | ** Denotes telephone | + Denotes Facetime | ++ Denotes face-to-face						

5.4.5 Materials

An interview schedule (or discussion guide) with probes (Appendix E.24) was used for the interviews, along with the ATist job description discussed in Section 5.3.1 above. A digital audio recorder was deployed to capture informant responses for transcribing, alongside the transcription software highlighted in prior chapters of this thesis. A paper notepad and pen were used for writing notes. An Apple Macbook Air running macOS Mojave 10.14 was used for Skype and Facetime communication with six of the interviewees. A landline telephone located on the University campus was used for the remaining two. NVivo 12.5.0 (qualitative data analysis software) was utilised in curating and analysing data captured. The JISC online survey resource was also utilised for capturing demographic data [86].

5.4.6 Approach

A semi-structured approach was adopted, with an informal conversational style. As with the end of study interviews of Study 2, this approach was intended to promote informants' freedom to explore topics from their own perspective. The interview sched-

ule provided the researcher with a roadmap for returning to the overarching topic, although - responsive to participants' input - not every question was always posed, nor was the original order of the questions always adhered to. This flexibility was planned to elicit highly detailed responses on issues that informants felt were important.

Significant parts of the inquiry mapped closely to earlier discussions with educators during Study 2. As a result, the interview guide from that study provided a useful starting point in developing the interview schedule for Study 3 e.g., impressions of the role, AAC candidacy, contributions to training. Additionally, reflecting the major focus of Study 3, questions eliciting opinions about the evolving job description and framework - shared with participants in advance - were added, along with a section canvassing impressions about the MLE model adapted for AAC (presented in Chapter 4 of this thesis).

With the exception of P10, interviews were conducted remotely. Therefore each participant was sent an information sheet in advance of their scheduled interview to read, and a consent form to sign (respectively, Appendices E.25, E.26) consistent with ethical commitments. Prior to interview, participants were also invited to complete an online demographic form (Appendix E.27) to establish their age, gender, educational level, years of experience in their role, and level of computer literacy. Interviews were audio recorded, with a total extent of ten hours and 18 minutes (mean = 62 mins 40 secs). The shortest interview duration was 38 minutes and ten seconds, the longest 1 hour 32 minutes and 23 seconds.

5.4.7 Analysis

As indicated in Section 5.4.5 above, audio recordings of the interviews were captured. In contrast to Study 1 and Study 2, however, a close transcription was not undertaken. According to Cohen et al. (2013): "The researcher should consider the costs and benefits of transcription, judging whether close transcription is really necessary" [36]. They go on to indicate that an alternative is to write a summary of the data from the recording "selecting out the important material directly from the original source". Such an approach does not preclude the use of "verbatim quotations and short extracts" and has the advantage of maintaining the bigger picture. It would also accelerate analytical

access to the data locked within the (over) ten hours of recordings.

The author elected to use a hybrid approach, listening carefully to each interview and using the interview schedule section headings as a guide to concurrently analyse and categorise responses. Collated together into one document, this procedure generated 29 pages of double-spaced textual data (formatted in Arial font size 11) prepared for line-by-line coding. This constituted the unit of analysis. Conformant to ethical requirements, access to these data were limited to the researcher and supervisors and - as described in the section on *Study Participants* above - the anonymity of informants was maintained.

The output of this process was very information-rich text, representing in many cases a "condensed meaning unit description close to the text", resonant with the second column in Table 4.5 (Chapter 4 - from Granheim and Lundman's examples [62]). Verbatim quotes and short extracts also featured strongly, however, and in some cases interpretations of underlying meaning were also possible - mapping to column three in Table 4.5. Since this was predominantly a validation exercise however, the goal of divining underlying meaning - while studied and explored for - was not necessarily considered a priority.

Within the output document, each informant's condensed or verbatim comments were allocated and stored within the following contextual categories:

1. Reflections on the ATist's Role
2. Skills and Qualifications
3. Person Specifications
4. Supporting Pedagogy
5. Training/Coaching Others
6. Role Profile/Job Description Feedback
7. The Adapted MLE Model Evaluation

This document was then shared with a fellow researcher (the project's second supervisor, S02), and both she and the author independently prepared initial codes from reading through the data before reconvening to discuss the process. It was quickly apparent that there were strong similarities in the codes concurrently generated from the text. S02 agreed that for this dataset, meaning was at a more surface level as opposed to a deeper interpretive level. Time and calendar constraints restricted access to a formal collaborative cross checking process. Instead, the author continued an iterative abstraction process, comparing the two sets of codes and preparing a hierarchical coding[3] frame using the seven deductive categories specified earlier (above) as top level themes. Sub-themes were identified by a process of reading through the two sets of initial codes and refining i.e. collating and collapsing codes where appropriate (e.g., *Positive influence of ATist Presence* and *Advantages of ATist* collapsed to *Importance of ATist Support*). The results of this process of analysis, linking and categorisation of congruous topics to develop a synthesis are detailed in the following section.

5.4.8 Results and Discussion

Each of the "themes" identified above, and the narrative that they present, are explained below. Hierarchical sub-themes or categories are also documented below as sub-sections. Verbatim quotes have occasional grammatical corrections applied, a legacy of the hybrid approach described above - and intended to enhance clarity without altering substance or meaning in any way. For brevity, the frequently used title "Assistive Technologist" has also often been replaced with the term "ATist" .

Theme: Reflections on the ATist's Role

As noted earlier and summarised in Table 5.1, five of the study's participants were employed as ATists in FE at the time of interview, with the five remaining offering some expertise or knowledge from a differing perspective of the contribution such a professional *in situ* could make. All were positive about, or displayed great passion for the role - either currently (from the perspective of a post within FE) or conjectured as

[3] In content analysis, coding data into a hierarchy of themes, sub-themes and - if necessary - sub-sub-themes, is a way of documenting organisational relationships that can support insightful knowledge construction.

a new practitioner within SE. Recurring contributions are described below:

Sub-theme: Part of a Cross-disciplinary Team Participants were keen to stress the significance of teamwork, and the specialised contribution such a practitioner can make:

> P01: "We are a full member of the (cross-disciplinary team), as important as the others involved".
>
> P04: "Teamwork is essential".
>
> P06: "An active team member".
>
> P09: "They have to be a team player, and listen to the person using the tech".

Within that team, the ATist potentially performs a very significant role, guiding others, promoting EBPs, enhancing collaboration - and in so doing answering a need lucidly articulated by our OT participant (who worked in an environment deprived of such support):

> P08: "Individual therapists have said we're all working in silos. This person (the patient/client/pupil) is in the middle, every now and then getting bits of us, but there's nobody bringing it together".

One informant made a particularly insightful plea for the benefits of such close co-operation and positive team dynamics - emphasising the ATist's potential influence:

> P10: "There are so many people involved, paediatricians, physiotherapists, OTs, but if we can't work out the best way to help that person communicate… in whatever form, then none of those can truly be person-centred. The ATist becomes the advocate for advocacy - you have to be focused on the person not just the tech. This is a person, not a disability, so let's work together to make that person as autonomous as possible. The ATist is not just a techie, they're the negotiator, the expert, the advocate, there's a lot of people to link together".

Sub-theme: Importance of ATist Support Building on this theme of indispensability, P04 noted ATists are:

> "Someone who is the glue to hold it all together, a facilitator to ensure correct hardware/software is available, correct training is provided, and that all is documented correctly".

> P07: "A very challenging but very important role".

P02 describes their role as being:

> "…a bridge to technology, talking the language of the technician as well as the language of the tutor or SLT."

With that in mind, this unique post might well be a catalyst boosting the performance both of colleagues, and learners alike:

> P07: "A lot of children could do a lot of work on their own if the school environment supported it, that is with Assistive Technologist support".

Conversely:

> P06: (On the prospect of an ATist's absence) "I think that limits the availability of individuals to access the curriculum and to develop appropriately".

Comments explicitly in favour of increasing the availability of ATists were prevalent, for example:

> P04: "In the future, ATist's should become more common".

> P09: "I think we need more".

> P10: "I think having an ATist on site with regards to the battles that parents have, I think having somebody else who we would feel was more on the side of the family, I think that would be a good thing".

This idea of an advocate as a solution, an individual taking ownership of the whole process of AAC provision, enhancing cooperation and championing adoption and support, resonates with the (occasional) failings observed in Studies 1 and 2 (e.g., the child struggling with the over-sized iPad in Section 3.5.2, or the inadvertent removal of C01's SGD in PE, Section 4.9.1). Such an advocate, with such a focus on supporting communication, would surely raise the visibility and status of these impairments - and the unacceptability of support failures - to a level on a par with other disabilities. As P02 noted:

> "It would be on the front page of the papers if someone said 'oh they took my wheelchair away, they never said when it was coming back'. It wouldn't happen with other enabling devices."

The real importance of the ATist may be their capacity to be present, and to shine a spotlight on - and preferably prevent - such failings on behalf of a population that to date remains both chronically under-represented and overlooked. Having a technologist in this role provides a clear focus on the synergy between the user and the AT device.

Sub-theme: Enabling Client Access to AT

This sub-theme encapsulates a core goal of the role of the ATist in supporting diversity of provision of AT. For the individuals currently in post contributing to this research, their duties in this respect were remarkably consistent.

> P03: "My role is to support students - aged 19 to 25 - to become more independent either using tech or with the use of tech, finding stuff on the market or hacking stuff already there to fit their needs."

> P04: "My role is offering advice, guidance, and improving support regarding accessibility and assistive technology."

> P05: "I'm working to improve access to learning and improving independence for people with disabilities."

P09 offered another (in this case, SLT's) perspective, yet one still closely linked to and corroborative of the descriptions from FE ATists in the field:

> "The ATist will pick up any support issues in terms of technological solutions required if an individual wants to fulfill a particular function e.g., if someone wants to send emails with their device or print or some similar function that is beyond a therapist's expertise then we'll ask the ATist to do that, and if there are bespoke solutions (e.g., Snapchat) the ATist pulls that together… for us."

Informants were also keen to emphasise the breadth of clients with very diverse needs that they were supporting, seeing this as a challenge - but as testified by the sub-theme that follows (*A Rewarding Career*), a fulfilling one:

> P03: "The range of communication needs is really wide. Some students use iPads and Windows tablets, with Proloquo2go, Snap and Core, and Grid 3; some students have lower ability and use switches."
>
> P04: "I work with a wide range of disabled clients, CCN to clients with physical access requirements."

Sub-theme: A Rewarding Career

Without exception, all of the FE ATists interviewed expressed enthusiasm and satisfaction with their role. P01 gave this incisive appraisal:

> "It's genuinely very rewarding, I like that I am doing good in the world, as a career choice that is very important to me. I like the problem solving, and solution finding, I like the quick wins AT gives you that you don't get in therapies like SLTs, interventions that 'now I have implemented this simple change to your software you are now able to do the task'. I think it makes such a difference to kids' lives."

And P05:

> "It's a role I didn't know existed years ago, and the more I found out about

it the more I enjoy it really - the difference you can make and the impact you can have is massive."

These accounts strongly correlate with the experiences of the author acting in the role of ATist during Study 2, as recorded in Chapter 4 e.g., Section 4.10.

Sub-theme: Formalisation is Important

Two participants, both ATists, raised the issue of the importance of formalisation of the role, framing the absence of, for example, recognised qualifications as a significant brake on their individual agency in the field otherwise:

> P05: "Professionalisation of the ATist's role is important - If there were some (academic) ATist course, that would be great."

> P02: "This is about my ability to persuade people to do something, my authority if you like, I can get the back up of a tutor or SLT to support my decision".

And, in contrasting the advantages other recognised professionals might enjoy in undertaking their duties in the field:

> P02: "An OT or SLT doing that has the backing and the basis of their qualification and their stamped certificate to say 'I've done the work, I've done the research'."

This sub-theme is closely mirrored in the issues of (lack of) agency and authority identified as limitations in Study 2 e.g., *Notable Policy Barriers Encountered During the Study* in Section 4.10.1.

Sub-theme: Horizon Scanning

One issue discussed in Chapter 3 around technology procurement (Aim 2 of Study 1) was horizon scanning - in this context a methodical process of identifying emerging trends in AAC strategies and upcoming technologies that might benefit your clients through research (e.g., attending conferences, reading journals and science articles

in the popular press, maintaining dialogue with manufacturers). During Study 2 this proved impractical to investigate in any meaningful way due to a mix of ethical concerns, and the temporary nature of the post - which led to restrictions in access to vendors, and fundamental research resources such as network access.

Study 3 reinforced the concerns raised in Chapter 3, with testimonies producing strong evidence of the importance of horizon scanning for any ATist.

> P04: "Our role (is) to review (R and D) technology solutions, and if nothing is available off the shelf then (we'll) innovate or improvise."

> P05: "And obviously keeping up with the latest developments. That's key, to be looking all the time for changes and updates and then evaluating retrospectively 'Who that I am working with can benefit from those changes?'."

Horizon scanning was also recognised as a significant advantage of the presence of an ATist for those employing - or working closely with - them:

> P06: "That's so important, keeping up to date with what technology can do was something that we relied upon our ATists for".

> P09: "(T)hey also keep on top of the latest developments for us…".

The pace of technological advance - for example, the promise of brain computer interfaces [112] - demands the close attention of someone in the team or organisation who will keep up to date, maintaining dialogue with vendors, and assessing technologies as they emerge with respect to their utility as potential AAC support tools for the learners in their care.

Sub-theme: The ATist as Participant Observer

Some participants were eager to underline the significance as an embedded presence of the ATist's role. P02 noted the downside of peripatetic contact for these vulnerable CYP:

> "(I)n a school situation with a peripatetic ATist, the young person doesn't see them for two or three weeks' time (but) for vocabulary that might need to be populated to enable their learning and happen very quickly… ."

For P06: an SLT and academic with considerable professional experience working with technologists - this was a very important topic that she felt strongly about:

> "I am not keen on the peripatetic model - they need to get to know the children and the team. It doesn't help changing people's behaviour."

And:

> "An impossible situation. What can you do with a person with those complex needs by dropping in once a week? You can only do it by becoming a member of the team around the child so that the approach is completely consistent."

P07: again an academic with long experience in supporting CYP with CCN - was unequivocal:

> "It would need to be an embedded rather than a peripatetic role."

The ethnographic role of participant observer undertaken and described in Study 2 bears a close resemblance to the approach advocated by these participants, and for closely analogous reasons i.e. a responsive presence, geared towards building relationships and familiarity with these vulnerable emerging communicators.

Sub-theme: Promoting Holistic Support

It is generally accepted that an holistic approach to AAC interventions is desirable, and possibly essential for beneficial outcomes to be achieved - as discussed in Section 2.7 of the literature review and the summary of Section 4.9.2 of this thesis. Study 3 informants endorsed this perception, paying heed to the role of the family in this endeavour:

> P09: "The family really needs to be onboard so that that tech gets used, so there needs to be that holistic, joined up working."

The potential for the ATist to boost this aspect of service delivery was the factor most recognised and passionately espoused by the lone parent, P10, in the participant group - vindicating the decision to canvass a broader range of informants than ATists alone to gather insights. P10 grasped the significance of the ATist's potential as an ally and advocate, and a bridge - not just to the technology but between the two pivotal environments of home and school:

> "I think having an ATist on site with regards to the battles that parents have, I think having somebody else who we would feel was more on the side of the family, I think that would be a good thing."

This recognition of the ATist as key champion and conduit for cooperation moving between these two environments echoes C01's carer's request for continued contact at the close of Study 2 - interpreted there as evidence of enhanced holistic support proceeding from the ATist's presence (see *Coordinating Support* in Section 4.9.1 of the preceding chapter).

Sub-theme: ATist Role Challenges

In general terms, participants identified the ATist role as a "unique job" (P06), requiring a "special person" (P09) to undertake it - on the basis of the mixture of both soft and hard skills required, perhaps the most significant challenge acknowledged. P07 described ATists as:

> "(V)ery special and rather unusual people."

This could have unexpected implications. One issue highlighted by those occupying the ATist role was the loss of colleagues - with abundant technical skills - to industry, where salaries were often more attractive. At the time of interview, P03 was struggling with an increased workload resulting from just such an event. This was an issue also recognised by another expert witness:

> P06: "I think there may be a disadvantage for the ATist in that their career structure is fairly poor, I think the awkward thing is keeping people of their expertise in this area and valuing their role appropriately… they

should be properly remunerated."

Sub-theme: Funding the Role

Participants were in little doubt that the value and benefits of the ATist's role made it one worth pursuing.

> P06: "In a way it is going to be cost effective (to have a ATist) because having a teacher or a therapist fiddling around in this area without the background knowledge and the confidence and the focus is going to be more costly".

Supporting that view:

> P08: "It reduces so much on burden of care. Unless people can participate in society… you need heavy investment in the start of that person's journey".

There appeared a consensus that the role should be recognised as a professional one with a salary to reflect that status - but one that would pay dividends in terms of delivering successful outcomes once the required investment had been made.

Skills and Qualifications

All participants, bar one (P08), offered opinions on the skills and qualifications most compatible with, or required, for the role of the ATist.

Sub-theme: Creativity and Problem Solving

If you are the sort of individual who sees problem solving as fun and a challenge, then the role of ATist may be worth considering. P01 highlighted this very attribute in describing their satisfaction with their work in *A Rewarding Career* above. Similarly, consider P04's response in the *Horizon Scanning* section (above), "if nothing is available off the shelf then (we'll) innovate or improvise".

> P03 described: "…thinking of new and inventive ways to support the students. Adapting tools already on the market, being creative."

P05 mentioned "Technical know-how, problem solving" in this context; P07 "Thinking out of the box"; P10 highlighted "Problem solving, flexibility, critical thinking, being able to translate knowledge from one context into another"; P06, echoing the adapted MLE model in Study 2, used the example of assessment to illustrate the ATist's value:

> "The ATist is essential - they will look at what technology can overcome these problems and how they need to be adapted for a particular individual - without that, assessing somebody and looking at their needs isn't very useful. It's solving the problems where the ATist comes in."

All of these responses are resonant with the experiences of the researcher-as-ATist during Study 2 e.g., as documented in the *General Hardware Support* section of 4.9.1 (Chapter 4). Clearly a significant part of the role is being creative and coming up with imaginative solutions, often at short notice and with limited resources, to overcome obstacles encountered by other members of the TATC and meet the diverse needs of their learners.

Sub-theme: Hardware/Software Skills

Technical skills are always going to be a requirement for anyone pursuing a career as an ATist. Being a first line of defence - being there to field both hardware and software malfunctions or undertake requested adaptations, and to maintain devices in use in the classroom on a daily basis - is a core responsibility of the role.

> P03 stated: "If a camera is not working on an SGD then that would be my responsibility" (although she added that she would have the backup of the IT team if required).

P05 noted:

> "In practice I will often fix items as (problems) arise - but the main focus is customising the device (personalisation) and making it work for the individual."

As P09 put it succinctly:

"Yes that's important, making sure the tech is working."

Study 2's results presented many examples of the ATist's work in this context: From peripherals such as printers; through classroom PCs and the multi-touch LCD screen; to shared resources such as the standalone eyegaze and sequential message communicators; and finally, dedicated SGDs such as C01's Indi - the ATist was tasked with keeping the tech running smoothly. The implications are not trivial, coalescing around the vital concept of access - a point acknowledged by P01:

"The ATist's remit would be how they access the device."

Where that access is not supported adequately, a core organisational outcome described in Section 3.6.1 of this thesis i.e. giving pupils with highly complex needs a life-enhancing pedagogical experience with proficient support, will not be met. The section on *Supporting Pedagogy* below explores this topic in the context of ATist support more thoroughly.

Sub-theme: Record Keeping

The need for good record keeping - and the accompanying desirability for good written communication skills, as well as disciplined attention to detail - was not a factor specifically acknowledged during Study 2 (Chapter 4). However, during Study 3, P04 highlighted the reason for its importance:

"Good record keeping is vital for consistency and mitigating risk e.g., staff absences, or knowing distances a wheelchair has to be from the desk, monitor, keyboard for individual students."

Also P05, on describing their procedures for assessment:

"We have a team of three, we always write up an assessment proforma and put that on a data bridge… all staff and teachers working with that learner can see what their basic access needs are."

The limitations section of Chapter 4 highlighted the disadvantages of the researcher's "friendly outsider" status, on occasions denying him the "instrumentality to act". This

would appear to be another example - without a formal role, as a temporary participant, there appeared little cause or opportunity to record such data, and indeed doing so may have raised some ethical concerns. In capturing these details of the lived experiences of ATists in the field, Study 3 contributes to the richness of our understanding of the role's requirements.

Sub-theme: Qualifications/Certificates

Participants were asked what qualifications they thought might be important for an ATist to possess. Some felt that being educated to degree level was a useful requirement, without an overly draconian focus on the specific discipline:

> P01: "A degree level qualification in education, IT or health related subject - so being able to work at a certain competence level".

> P02: "I don't think it's essential for an ATist to have a professional qualification in the IT field because this is rare, but you might specify that they are educated to degree level?"

Some favoured a teaching background with the capacity to learn technical skills, others preferred the other way around.

> P07: "A teaching qualification would be good - some kind of knowledge about child development, it could be part of some special training for some sort of qualification, a degree course or something like that."

> P04: "I think technical understanding is most important, teaching knowledge is important to have but technical knowledge is the greater requirement for this role."

Five informants recommended or mentioned undertaking a PTTL course or similar - a basic teaching qualification. P03 thought "An IT or design apprenticeship NVQ would be good". Also:

> P01: "I did an in-service PGCE (post-16 training one) - I had a technical background and then learned the teaching element through that."

More generally, a course raising awareness of disability-related issues was suggested as valuable. P06 considered:

> "I think it's very useful for them to learn some of the principles of the (WHO's) ICF [128], I think it is very useful for them to know issues to do with motor functioning, difference in speech and language, cognition and those things. Not necessarily in great detail, but the implications, the knock on effect of one against the other."

The vulnerability of the learners was also considered, with disclosure check certification being essential:

> P01: "An enhanced DBS certificate (Disclosure and Barring Service, England and Wales) is required."

Similar certificates would be required elsewhere e.g., Enhanced Disclosure in Scotland (as obtained by the author before undertaking Studies 1 and 2).

Person Specifications

Participants were asked to describe the personal qualities they saw as important for an ATist to possess. P07 summarised the perfect candidate / role combination thus:

> "They should be as high level as possible, someone who is properly remunerated, who is broadly educated, has people skills as well as technology skills, and they are very special and rather unusual people."

Sub-theme: A Mix of People and Technical Skills

As with P07 above, the study's remaining informants were almost unanimous on one crucial requirement for any ATist: People skills. Soft skills, diplomacy, empathy, networking, patience - these are examples of closely related nouns that appeared throughout Study 2 in Chapter 4. Study 3 clearly validates those insights, and the technical know-how that must inform the most effective interventions.

> P10: "An ATist is at the centre of person-centred care."

> P09: "Having knowledge and skills in the area required, the technical skills. But also being personable. Interpersonal relations, to be able to work, to be able to assess and support the person using the AT, and to be able to adapt your communication that way which requires a lot of patience, requires a lot of intuition, requires a lot of knowledge and flexibility in your thought."

> P06: "The ATist is unique, translating between the technology and the pedagogy - that ability to communicate, interpersonal skills between professionals and their clients."

> P01: "It's more about people than it is about tech, we need someone that can talk to a disabled young adult or child, and be engaging to them and understand them, and they need to be able to liaise with professionals like a physio or in our case a solicitor. So you need someone with some pretty high people skills."

P02 also placed a particular emphasis on the virtues of people skills:

> "When I am looking to employ someone, I'd rather they came with those skills and we can train them up, as long as they have some technical bent, but we can't train them on the interaction skills."

Similarly, P03 stated:

> "You need to be really empathic, and caring for students, and anything technology-wise is an interest and can be learnt - being able to deal with the care side is vital, and the tech comes second."

Unquestionably, a clear consensus emerges here that people skills are a key requirement for an effective ATist to bring to the field. Yet in general, it may be acknowledged that "techies" are not renowned for such qualities. This may explain P07's insistence above that good ATists are "unusual" or "special" people.

Sub-theme: Communication Skills

Related to record keeping and interpersonal skills, general good communication skills were identified as a vital part of the ATist's role:

> P01: "Excellent verbal and written communication skills are needed."

> P06: "Good communications skills, good negotiation skills, is a resilient person, and all the personal skills that show the individual can do quite a unique job."

Supporting Pedagogy

A focus of Study 2 was the ATist's role in enabling pedagogical goals to be realised within the SE classroom. With that in mind, the participants' own thoughts on this topic were sought.

Sub-theme: Early Intervention is Good

While early intervention has been a particular focus of this thesis - investigating how educators in SE support emerging communicators with CCN - it may have had less relevance to ATists within the FE Sector. Nevertheless, participants had special insights to share. P01, who had experience working with both children and adults with disabilities expressed a preference for the former on the basis that:

> "I can make a difference in three weeks with a child, instead of three years with a young adult."

> P07: "As far as interventions are concerned, I'd say the earlier the better."

Both statements support the hypothesis that providing children with effective support to acquire communication skills early enough will benefit them immeasurably and in the long-term, thus addressing the fundamental problem space that this doctoral project examines (described in Section 1.1 of this thesis).

Sub-theme: Creating/Adapting Learning Materials

The same requirement that the author encountered (in Study 2) for developing or adapting learning materials to support meeting the teacher's pedagogical goals was volunteered as a significant duty by two of the informants.

> P05: "I am also involved in the development of computer-based learning materials."

> P04: "I also created interactive learning materials."

P09 emphasised the importance of this duty in supporting clients assisted by her company:

> "Creating bespoke resources, there are many generalised resources but that need tailoring, and that's a big part of what our ATist, and our SLT assistants do."

Creating such resources is certainly stepping into the realms of software development, a task the author in Study 2 felt comfortable with as a former multimedia developer. However, it requires a different set of skills again from those we might associate with an IT technician, for example (who might be comfortable with the hardware troubleshooting and maintenance requirements considered above), let alone the people-centred "soft" skills also highlighted as an essential part of the ATist's role.

Sub-theme: Learning Support

Earlier, the role of the ATist was summarised by one participant as being centred around enabling access to devices. Of course, also as discussed earlier in this work, we identified the role as being integral, in collaboration with educators, to technology mediated learning (see the modified MLE diagram in Figure 4.16) - although of course it is the learner who is at the centre of that model.

Supporting learning is at the heart of the ATist's role, both directly and indirectly, as corroborated by participants' insights for Study 3.

> P10: "Obviously the kids then benefit from… from the assistive tech being supported more - getting the right AT for the right child will inevitably help their development."

P04 was a regular visitor to classrooms, and tutors would discuss their pedagogical goals:

> "We'd work out the best solutions to the access, short term goals would be agreed, then I would work with the individual to ensure they could use their AT proficiently."

Developing this topic of the indispensability of access:

> P01: Working with a child - if you give them access to writing, to reading, to speaking - you can boost those skills like literacy."

P05 described the criticality of their role in assessment (again echoing the MLE):

> "Identifying what the learner can and cannot access and trying to match the technology up to meet them… can make the difference between the learner accessing their educational programme or not."

Considering Light's four competencies [101], P02 described supporting a student:

> "…whose linguistic complexity skyrocketed with better access and support. It's easy to ignore the linguistic but it's probably the hardest to implement, so that might be why it gets ignored. (T)he operational can tie into that."

P02 saw the role as very much a "learning support role, taking a programme and running with it", working closely with other members of the cross-disciplinary team.

Sub-theme: Modelling

Modelling, or Aided Language Stimulation (ALgS), while perhaps differing in emphasis in an FE context, remained a significant and frequent act (one informant es-

timated it to be about 40 per cent of their work). It may be a form of learning support but is given its own sub-theme here on that basis.

> P03: "(Modelling) how to use AT devices for students is a big part of my role here."

> P04 describes "modelling AT with individuals to show them how systems work."

P05 related modelling within the overall context of an ATist's role:

> "There's a journey between the device and the learner where the device needs to learn how the student works and we need to program it accordingly, and the student needs to work out how the device works."

So modelling as a helpful means of "programming" Light's competencies into an emerging aided communicator perhaps? But of course - again resonating with discussions in Chapter 4 (e.g., *ALgS/Modelling as a Critical EBP*) - ATist modelling of AAC devices is also beneficial, and perhaps just as essential.

> P09: "I think that as a visitor to the classroom, you are always going to be trying to endow the adults in the room with the necessary skills, so take modelling: you are not doing that because you feel that student needs that modelling for that half an hour only, you are doing that because you hope that the teacher or the teaching assistants will see you doing that, and that they will then do it for the rest of the time when you are not there, so I think your focus has to be on showing other people how to do certain things."

There is a blurring here of who actually is the learner benefiting from the ATist's presence? This topic is further developed in the sub-section on *Training/Coaching Others* below.

Training/Coaching Others

In Chapter 4 (the section *Training Support*) it was noted: "Ensuring that stakeholders/the TATC have adequate practical knowledge of EBP and AAC strategies and tools in use in their environment is paramount". In this theme, informants for Study 3 share insights on the topic.

Sub-theme: ATist as Promoter of Good Practice

P01 believed an important part of their work involved promoting best practice among colleagues:

> "You need to be the expert and teach and train and advise, and be diplomatic."

P05 described being involved in building guides, webinars, and training resources to help staff question their practices:

> "Training is a massively important part of the role. Most of my time... involves training - we will make recommendations based on an assessment, picking out key staff, doing a skills audit."

Similarly, P09:

> "I think that the ATist has a responsibility to make sure that the people in that environment know how to do some trouble shooting or know how to report issues that are beyond their skillset."

Sub-theme: Delivering Training to Others

The importance of providing training as a mechanism to promote uptake of AT was underlined by P05:

> "Other barriers are knowledge of AT. As people don't understand (the technology), they don't understand the value of it."

> P02: "Yes, I'd say (training is) a significant part of the role. Hopefully the

kind of short term training that will result in people taking on those tasks for themselves."

P06 highlighted an obverse problem to that of poor uptake of AAC - raising additional issues from the training perspective (and reminding us of the overarching "wicked problem" being investigated):

"They [ATists] have to be involved in the training of all the professionals working with that client - my concern is still that we have so many people with technology but they don't exploit it to the best effect because they haven't been given enough support from other people in their environment to use it appropriately."

In collaborating with colleagues, P02 emphasised the desirability of running a digital skills audit:

"I want to know where (you) are starting from so I can help you make this work for this student in this context."

All the ATists reported training or coaching to be a core element of their role, sharing their expertise with others to raise awareness and enhance working practices - again a key corroborative message mapping to the outcomes of the earlier Study 2.

The Adapted MLE Model Evaluation

Participants' feedback was overwhelmingly positive with the following comments being offered:

P01: "Yes you've got this two stage process to learn, you're not just learning the task. You're also learning the tools to engage with the task, and our role is to teach the access to the tool, yeah it makes a lot of sense."

P02: "I quite like the model, I think it shows what an ATist needs to be capable of, there's a lot more to the job than might be assumed."

P05: "Yeah I really like it."

> P07: “I like the interactive and repetitive nature of the learning process, and the tripartite interdisciplinary nature - pupil, teacher, ATist.”

> P09: “General feedback is that the model does look appropriate and useful.”

However, most informants had suggestions to improve the model, many focusing on its complexity - and how that might be mitigated:

> P05: “I think it’s massively complex but then you’re not just showing people ‘this is how it works’, you’re actually going into more detail and showing them ‘well actually we’re going to break down all the processes that are involved in this so that people understand what an ATist does and how they work with the teacher, student, technology and task. It’s quite a busy page, I suppose. I think it needs to be, that’s why I’m struggling with it.”

> P03: “I like it, I think it would benefit from being simpler but I can’t think of many ways to make it simpler.”

Also recurring were suggestions for amendments to the terminology used. Three informants, for example, objected to use of the word “dysfunctions”:

> P05: "Using the term ‘dysfunction’, we’re trying to move towards learners being neurodiverse, having different ways of thinking, it isn’t always dysfunctions - an example might be a learner with autism who can focus massively well on a certain task but can’t focus on multiple things so you need a tool to help them organise. Trying to work out if there’s a more positive way to… that’s just initial thoughts. More positive language.”

Two participants (P03 and P09) suggested replacing “dysfunctions” with “needs” e.g.,:

> P03: “I think it looks good, at the bottom it says student’s dysfunctions, I think I would describe that rather as a need.”

P09 also offered:

"For the label 'teacher' could we have 'professional' or similar? The learning may be directed by a teacher/SALT/other professional, not just a teacher."

And:

P09: "The word 'tool' is maybe a little opaque - would 'equipment' be more understandable to people?"

These comments from participants were given consideration and used as a basis for updating the draft model (see *Key Amendments Arising from Study 3* below).

Role Profile/Job Description Feedback

Participants were invited to comment upon the Role Profile (Appendix E.23) distributed to them before their scheduled interview. The consensus was very positive, with some suggested improvements as documented below.

General Feedback

P01: "Nothing in your document that jumps out at me and shouts 'I wouldn't agree with that'."

P02: "I really like what you've done with it and I'm shortly having to recruit an ATist to (P02's organisation) so I might use yours *laughs*."

P03: "This reflects the job profile I applied for, I think it is appropriate."

P04: "I would say that's a good basic outline."

P05: "I like it - there's quite an emphasis on being responsive and reactive."

P07: "Need this, the role needs to be developed (by formal documents like this) and made more specific than it is at the moment. I thought it was very thorough."

P10: "It looked really comprehensive."

Motivated as described in Section 5.3.1, these responses appear to validate the re-

purposed Role Profile/Job Description document as an instrument fit for its proposed purpose, with the caveat of a few minor amendments (see below).

Suggested Improvements

> P02: "Someone who might work out very well as an ATist and could skill up very quickly might be scared off by the amount of requirements in a JD like this."
>
> P05: "It might be worth talking about assessment and deciding where support is needed, linking with teaching staff and literacy staff."
>
> P06: "Interpersonal skills get missed out of role profiles for this type of job - good communication skills, good negotiation skills, is a resilient person, and all the personal skills that show the individual can do quite a unique job. You look for these things in the interview, I would definitely want to emphasise it more (in the draft role profile)."
>
> P09: "In the purpose, second line down, novel solutions - bespoke solutions might be an improvement."
>
> P09: "And in principal duties: maybe an added one about developing joint aims as part of a team."
>
> P09: "In the Experience section, there's nothing there about working with a team either."
>
> P09: "Personal qualities: attributes and competencies - maybe something about listening, working jointly because you do want someone who will listen to other people and problem solve."
>
> P09: "Maybe rather than specific techniques, maybe experience working with people with different communication systems and styles. Experience of working alongside SLTs/OTs/Teaching environments."

As with the MLE model, comments from participants were given consideration and

used as a basis for updating the draft profile (see *Key Amendments Arising from Study 3* below). This mechanism of validation and amendment was deemed to accord with the two respective RQs stated in Section 5.4.2.

5.4.9 Outcomes

As the foregoing results attest, which are supported throughout by relevant comparisons with Chapter 4's findings, Study 3 presents as a convincing validation of the contribution and lived experience of an ATist, despite the differing contexts of the two investigations. Participants describe a challenging but fulfilling career as a critical coordinating member (the "glue") of a cross-disciplinary team. They emphasise the need for creativity in finding solutions; for a person-centred approach, backed by good technical skills and some understanding of pedagogical issues; and for an embedded presence, responsive and geared towards delivering holistic support. They describe being there to support learners and learning - both colleagues and clients/pupils - through the active promotion of good EBPs. These testimonies speak of the salient need for such a cross-disciplinary practitioner to help implement and optimise access in a domain where AAC technology-mediated support - despite its promise - appears to remain the exception rather than the rule.

The vivid picture painted by active ATists of their lives in undertaking the role is a familiar one to the author (and participant observer) of the earlier study. It is in this sense - the abundance of similarity or overlap between accounts of the two different studies - that Aim 1 of Study 3 (see Section 5.4.2) is deemed to have been met i.e. to:

- Triangulate findings, and seek validation of observations and extant artefacts emerging from Phases I and II.

Aim 1 is further satisfied by canvassed feedback from the evaluation of artefacts developed earlier in the project, and described in the final two "themes" of the *Results and Discussion* section above.

Key Amendments and Artefacts Arising from Study 3

Aim 2 of Study 3 (again, first specified in Section 5.4.2 above) was to:

- Identify any additional issues that the nascent framework should describe or address.

Study 3's investigation now led to a series of changes or additions to the dataset delivered in Study 2. These were as follows:

Amendments to the adapted MLE model

Reflecting comments gathered in the corresponding section above (*The Adapted MLE Model Evaluation*), the following updated diagram (Figure 5.2, below) was created.

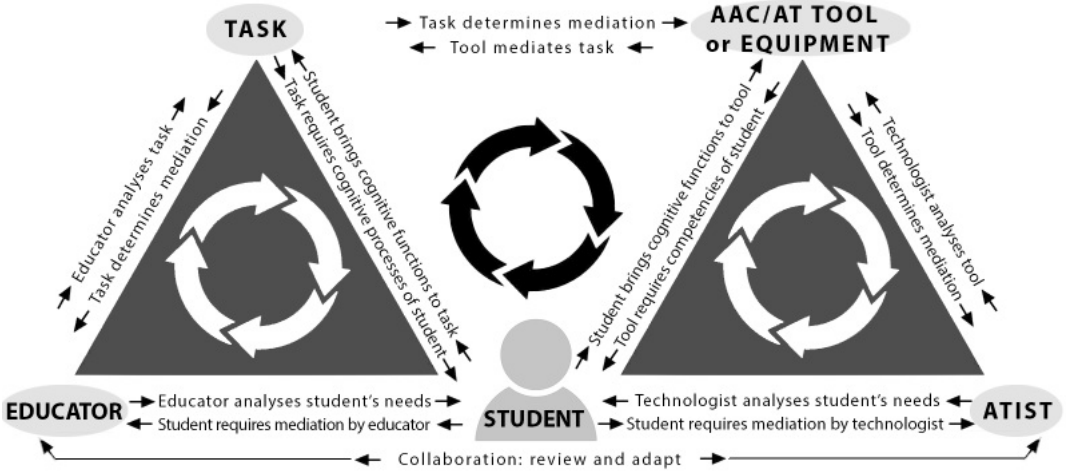


Figure 5.2: The adapted MLE model with ATist amendments applied.

In this iteration may be seen numerous terminology amendments e.g., "needs" replacing "dysfunctions". Greater emphasis is also placed on the student at the centre of the MLE, with the goal of graphically clarifying the focus, and thus enhancing readability.

Amendments to the Draft Role Profile/Job Description

Very positive responses to the Role Profile document by Study 3 participants meant that only minor changes were required. In general, greater emphasis was made for a person-centred focus and skill level, with amendments related to teamwork, listening, and maintenance of records related to individual requirements. P02's observation that the list of requirements may intimidate potential candidates, while legitimate and insightful, was not acted upon on the grounds that it was perceived as incompatible with

efforts to accommodate other participants' suggestions, nor did it appear accordant with any overarching drive to formalise the role - another important takeaway message from the study.

The updated document may be viewed in Appendix E.28, with amendments highlighted in red.

5.4.10 Limitations of the Study

The following potential limitations are attached to the conduct of Study 3.

Potential Gender and Cultural Biases

The ethnicity of participants was largely uniform. Cultural differences therefore may not be well represented here, although the latter disadvantage may be offset to some degree by the absence of any language barriers.

Study 3 may also have allowed some gender bias to be introduced with all bar one FE ATist being male - a reflection, perhaps, of the computer engineering emphasis apparent in the role and the lingering dominance of that gender in the engineering domain.

5.5 Framework Actualisation

The outcome of any scientific research should be harnessed to have an impact beyond university campus walls. This is a process - known as valorisation - of growing importance in recent years, with a focus upon driving innovation beyond academia via knowledge transfer and implementation, to foment wider societal and cultural change [16]. In this way, the societal value and relevance of the work is enhanced.

The complementary exercise of Study 3 provided data verifying the scientific rigour - and, via the amendments described, enhancing the delivered output - of the findings from Study 2. This engineered a solid foundation for the ATist framework under construction to progress. The framework now began to take shape around the two verified and amended components described in *Key Amendments and Artefacts Arising*

from Study 3, with the addition of a graphical framework model based upon the collated evidence of the data gathered in conducting all three studies. This model would demonstrate the creative, dynamic relationship between theory and practice unveiled by the author's lived experience in the field.

In sum, these three components were designed to furnish "useful knowledge" [16] in the form of a suite of instruments with high practical (transferable) value for use by others outwith academia - targeting those in SE in this context.

5.5.1 Developing the Practical Framework

The practical framework was rendered as a data driven diagram emerging from the ethnographic and AR approaches adopted with the author as a participant observer. It broadly documents the mutually supportive, parallel processes of theory and practice as encountered in attempting to define and integrate the role of the ATist within a SE setting.

The framework's creation was an iterative - and summative - process. It involved revisiting the aggregated datasets, pulling together themes generated, processes identified, and knowledge accumulated through the literature review (underpinning theoretical knowledge, challenges and EBPs in the domain), the two ethnographic studies, and the insights of informants gleaned through active participation, observation, and interviews. An early draft is shown in Figure 5.3 (below).

Early versions were subjected to a process of refinement, in an effort to create a logical working draft to effectively depict and explain the relationships between the main constituent parts. The final candidate framework diagram is structured to reflect the active knowledge construction process described throughout this research project, from the background and related work of Chapter 2 to the final syntheses of qualitative data collection phases in Chapter 5. It is designed to provide a "network, or 'plane', of linked concepts that together provide a comprehensive understanding of a phenomenon" [83], and also to provide a practical requirements and workflow template for embedding the ATist practitioner in the field.

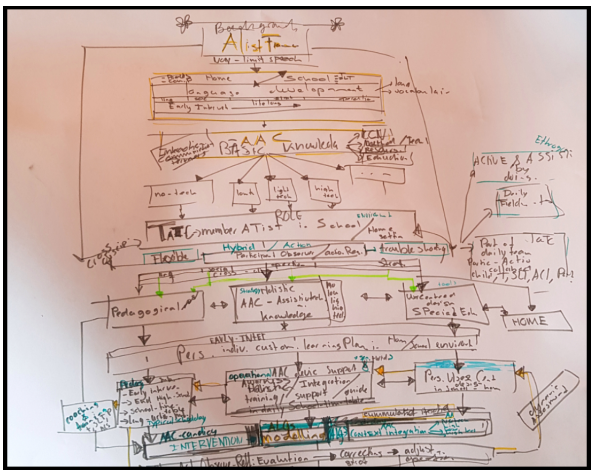


Figure 5.3: Early framework model prototype.

5.5.2 Draft Framework Overview

The working framework diagram that emerged from this process is broadly divided into three symbiotic areas:

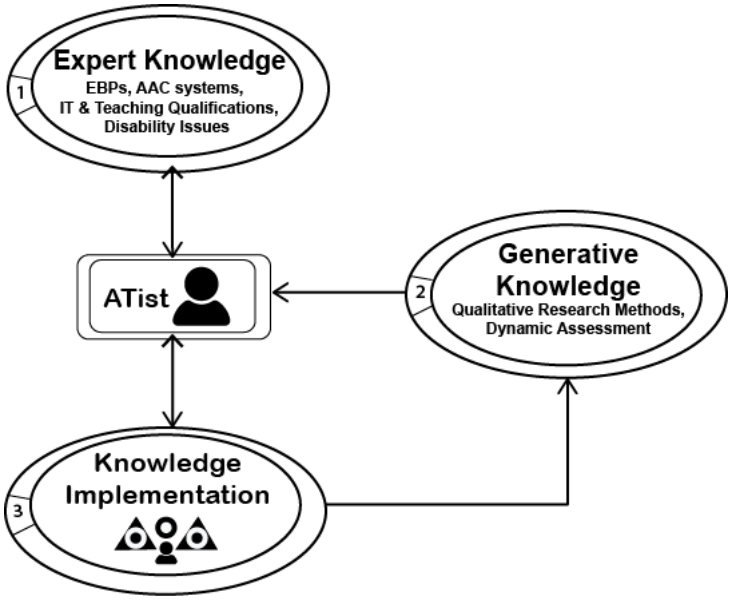


Figure 5.4: Framework overview diagram.

These are defined by the author as shown in **Table 5.2**.

Table 5.2: The three symbiotic areas of the ATist framework knowledge synthesis.

Knowledge Component	Description
Expert Knowledge - "A way of thinking"	Intrinsic underpinning knowledge - technological, pedagogical, methodological, analytical, clinical, strategic - that is fundamental to an ATist's role as a collaborator with a diversity of colleagues and clientele, providing a substrata for their worldview and workflow approach. Broadly concordant with the literature review of this thesis. A base for effective knowledge sharing and implementation. Ongoing review - e.g., horizon scanning/EBPs - is a vital element.
Generative Knowledge - "A way of understanding"	Needs-based knowledge actively and recursively acquired in the field by the ATist as a participant observer through appropriate application of philosophies, methodologies and processes such as ethnography, action research, dynamic assessment (DA), UCD. This dynamic data flow is harnessed to personalise, further inform, evaluate, review and adapt the knowledge implementation process. A key means of enabling the achievement of task-driven goals, and extending communicative competencies.
Knowledge Implementation - "A way of doing"	The application - typically decision-making - in the field of the knowledge flowing from the Expert Knowledge and Generative Knowledge sources. The tasks and responsibilities that the ATist executes on a daily basis to support fellow TATC members and emerging communicators in the SE classroom e.g., knowledge of research methods, or about assistive technology systems. Incorporates the ATist's contribution to the MLE.

All three areas have a level of mutual dependency and interaction: For example, accessing discussion lists such as ASSISTIVE-TECHNOLOGY@JISCMAIL.AC.UK or attending conferences to aid horizon scanning as part of the *Knowledge Implementation* component will feed into the *Expert Knowledge* component.

Similarly, the *Expert Knowledge* component provides the instructional and data-driven know-how to run formal or impromptu training sessions for pupils or colleagues.

Maintaining documentation and acquiring an understanding of the skills and needs of individual learners in the field through ethnographic and dynamic assessments[4],

[4]Both ethnography and DA may be seen as key "generative knowledge" engines for gauging the effectiveness of interventions, and achieving robust, person-centred solutions [43].

identified collectively here as *Generative Knowledge*, requires *Expert Knowledge* and also boosts the co-design and delivery of effective bespoke solutions as their needs evolve - *Knowledge Implementation*.

The draft practical framework diagram may be viewed below (Figure 5.5 on p 210).

5.5.3 Final Validation of the Framework Diagram

Drafts of the framework diagram[5] were sent via email to participants of Study 3 for comment, with their anonymised P*x* identities preserved for this section's write up.

In addition, a small expert review panel was convened, comprising four subject matter experts, members of the AAC Research Group at the University of Dundee - in this case participants are similarly identified by number (E01[6] - 04) to preserve anonymity (see Table 5.3 for participant demographics).

The aim of convening this expert review panel was two-fold:

1. To gauge/confirm progress at a critical phase in the research trajectory.

2. To complement and bolster the parallel validation process with Study 3 participants initiated as described above.

Data were captured via contemporary note-taking by the author/facilitator. For this reason, quoted remarks from review panel participants may not be verbatim, although efforts were made to preserve accuracy as far as possible.

Together, these combined approaches furnished initial feedback on the nascent resource, and provided confirmation to the author that the developing output was theoretically sound.

Responses were very positive. The expert review panel discussion revolved around the value of the ATist as a catalyst, facilitating the educator to focus on teaching and enhancing their learners' access to the curriculum. The framework was recognised as a

[5] That is, Figure 5.5 plus the supporting text in Table 5.2.

[6] E = Expert.

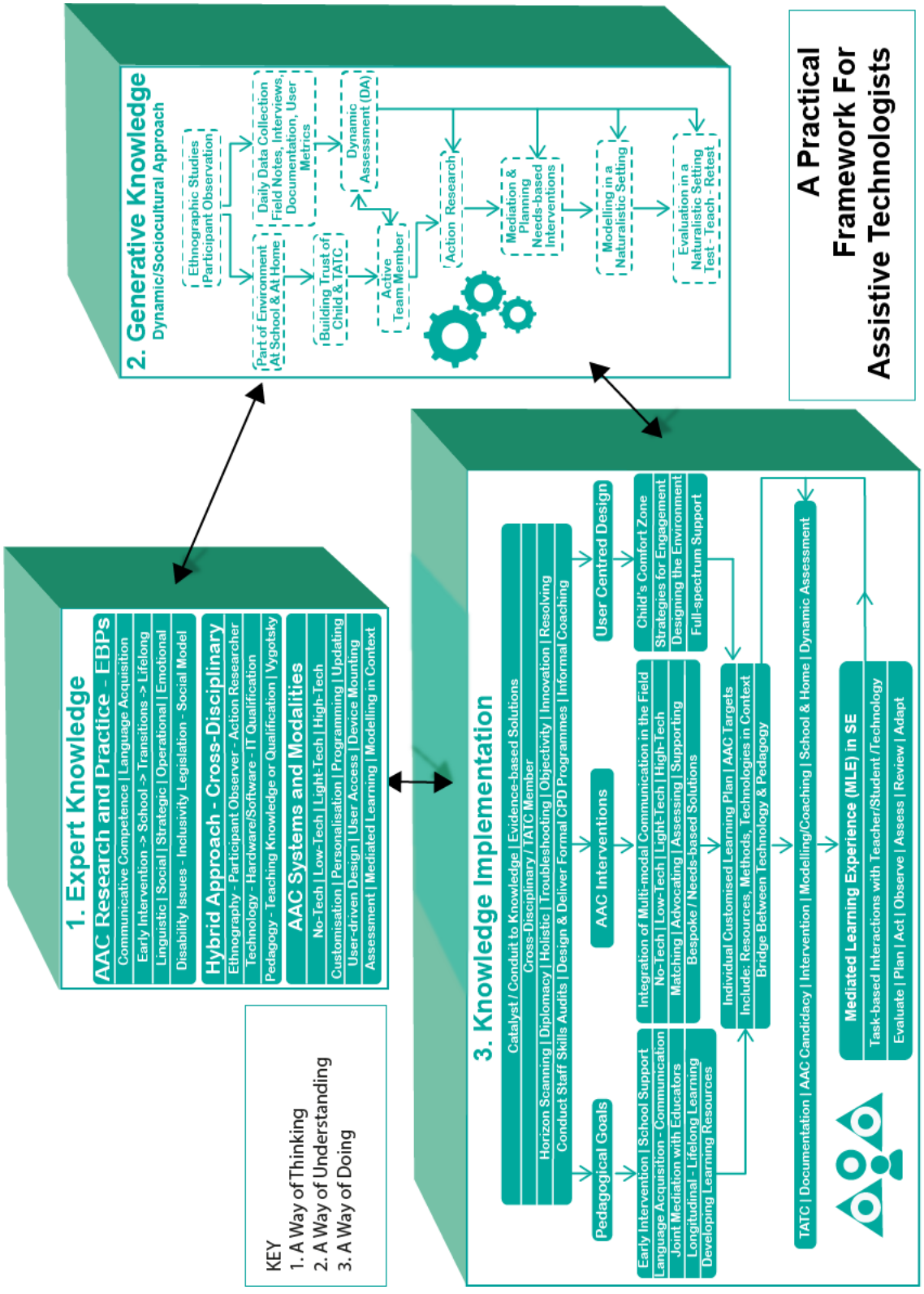


Figure 5.5: A draft practical framework for Assistive Technologists in SE.

Table 5.3: Study 3 Expert panel review participant characteristics

ID	Role	Gender	Age (Years)	Education	Experience (Years)
E01	Computer Scientist/ Academic	F	57	PG	40
E02	Computer Scientist/ Academic	M	53	PG	25
E03	Computer Scientist/ Academic	M	26	PG	16
E04	Computer Science Doctoral Student	M	57	PG	27
N.B. As computer scientists invited to participate based upon HCI proficiencies, level of computer literacy is acknowledged to be expert.					

novel representation of the need for such a practitioner in SE, underpinning practice with theoretical knowledge.

E01: "You are attempting to do what very few people have tried."

Led by E02, a consensus of the group was that *AAC Interventions* (in the *Knowledge Implementation* area of the diagram) should be amended to the more general *AT Interventions* to reflect the significance of an holistic approach as an important part of the ATist's role. For example, wheelchair seating or standing frame adjustments are common requirements of ensuring optimal access for CYP with CCN, and altering such AT may require the expertise of multiple members of the TATC.

E01 noted that:

> "This will generate the most incredible discussion in the field… we are looking at something that is questioning how (support in schools) is being delivered."

Responses from participants in Study 3 were similarly positive:

> P07: "This is thought provoking… Your area of investigation and contribution is very important and will be valuable in taking forward the role of individuals within the team i.e. the framework could be applied to other members!"

P07 went on to comment on the importance of the interrelationships between the three different components and the significance of team dynamics in ensuring successful interventions. This resonated with P01 who observed that not "all of the implementation section is… under (the ATist's) control".

These comments confirm the value of holistic support, and the necessity of engaging closely with other members of the community for the most effective outcomes.

P01 continued:

> "The cyclical/feedback approach of 2 (*Generative Knowledge*) and 3 (*Knowledge Implementation*) is key and often what gets missed. This is not always an ATist's fault, they sometimes are expected to provide one-shot solutions."

This would appear to be a positive acknowledgement of the benefits of DA and similar, recursive strategies for this population, as construed in the diagram.

P05 commented positively on the framework's utility for practitioners in the field:

> "The diagram is very useful and most comprehensive; it is making me think more consciously about how we carry out our work with learners and I would use it with both those new to the field and established. I think this work is a great starting point for developing resources that break these ideas down further… I cannot think of anything you have missed and can

> see an opportunity for this information to be put out to the community in a webinar format at some point in the future."

P05 also suggested a rephrasing of the block key text i.e.:

- "A way of thinking" becomes "These are the things I know about Assistive Technology".
- "A way of understanding" becomes "These are the things I can find out about the learner".
- "A way of doing" becomes "These are the things I can do to help the learner".

This text was accepted as more accessible and precise, and the diagram was amended accordingly.

P03 commented:

> "From an educational perspective the framework explains AT and how it fits in with education effectively…The framework as a whole is student focused which is perfect! You have understood how the role works alongside other professionals to fully support young people with disabilities."

P10 also appreciated the user-centred focus of the diagram, making clear the benefits that she believes could accrue:

> "As a parent, I appreciate that the knowledge gained from observing and assessing the child has equal weighting or value in the framework to the expert knowledge. Those individual differences can then assist in generating a more tailored service for the child and also their support network - no two children or contexts are the same and so nor should the approach be. I feel the framework captures that essential child-centred aspect well."

Finally, from participant P04:

> "I feel the detailed framework (the author has) modelled is by the far the

most expansive and detailed I have reviewed during my career in providing digital inclusion, accessibility, enabling and assistive technology solutions in public, private, education (mainstream and specialist) and third sectors."

The final practical framework diagram, amended to reflect the above input from both the expert panel review and participants of Study 3, is shown in Figure 5.6 (p 215).

5.5.4 Utilising the Framework Diagram

The framework depicted in Figure 5.6 is envisaged as a flexible blueprint of the working practices of an ATist within SE, reflecting insights gathered through this research. At its heart is the notion of leveraging (person-centred) evidence as a catalyst for change to improve outcomes in AAC interventions. As Table 5.2 and its supporting text makes clear, the three principal areas are not fixed, but responsive to both intrinsic and extrinsic factors e.g., monitoring of evolving EBP. It is anticipated to be deployed as a basis for:

- The establishment of formalisation/professionalisation - in tandem with future accredited educational programmes for assistive technologists - of the role of ATist within SE, with the important boosts for operational agency and transdisciplinary recognition that this would yield. The framework represents a tangible outline of this vital role in an easily accessible format, addressing interpretive ambiguities around the job title that may exist in the absence of such a tool.

- The procurement of ATist posts within SE schools - headteachers or human resources departments may reference the tool when creating posts and advertising for, or selecting between, candidates for new ATist position(s) within their organisation. The framework highlights the degree of professionalism and expert knowledge required to carry out the role effectively; educational level/qualifications; and person specifications and skill set. It is also useful in clarifying the level of access to organisational infrastructures and external bodies that the role demands - for horizon scanning, record/documentation consultation and upkeep, software upgrading - and where the role fits within a school's ecosystem, workflow and

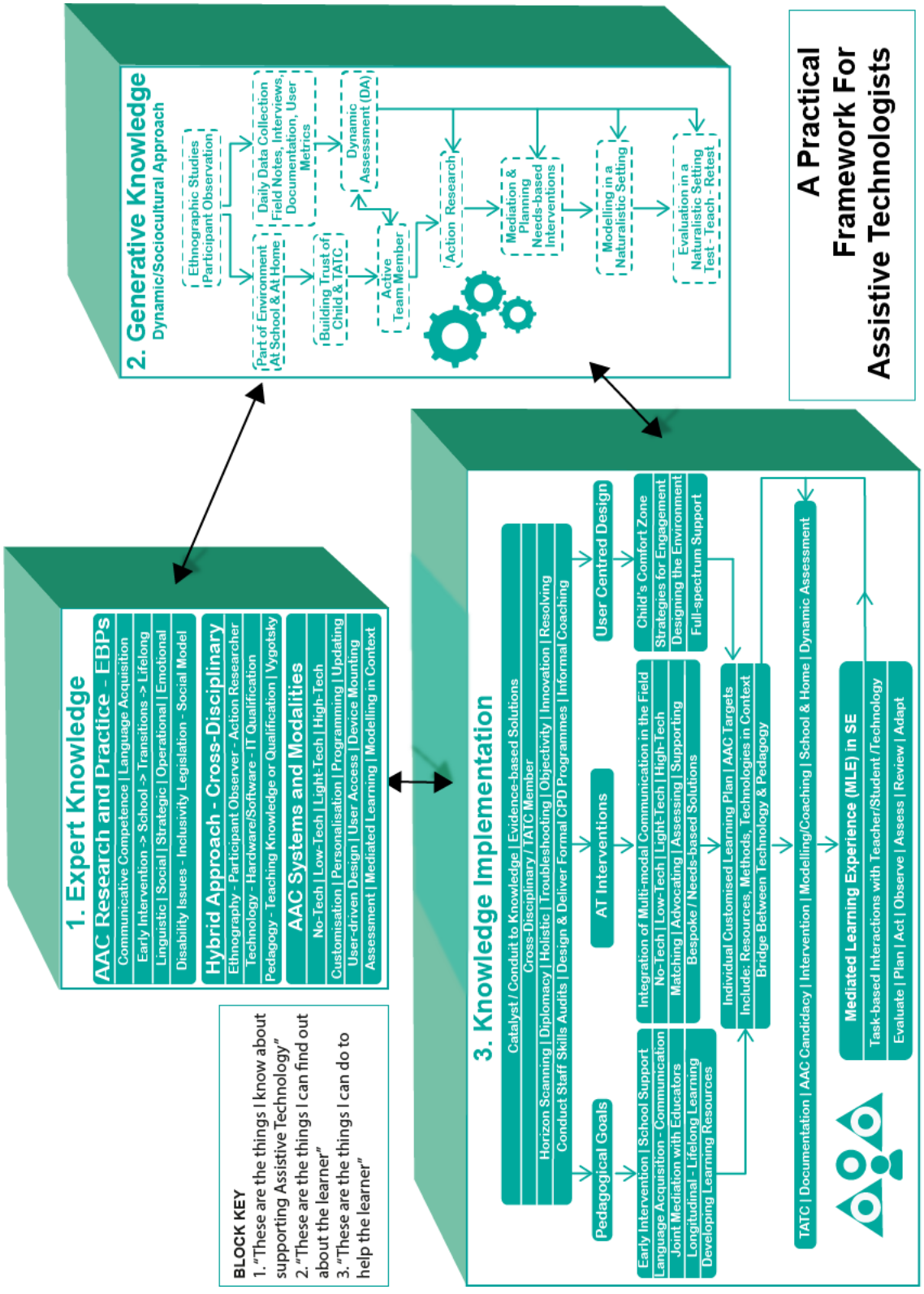


Figure 5.6: The final amended practical framework diagram of the ATist's role.

personnel structures.

  - For example, it may be determined that an aptitude for person-centred design processes will be advantageous - considering the level of needs-based knowledge construction required to competently undertake the role.

    This is apparent in terms of *Expert Knowledge* (ethnographic/AR), *Generative Knowledge* (ethnographic assessment, building trust) and *Knowledge Implementation* (UCD, the MLE).

- A roadmap for new ATists - newly appointed practitioners may refer to the framework as a guide. From it, he or she may determine what is required to undertake the role - and, for example, identify gaps in their knowledge, or skills that may need improving; who they will be closely collaborating with, and how they might work to complement each other's role and impact; how they might go about the task of embedding seamlessly within the TATC, and achieving the best possible technology-mediated solutions / pedagogical outcomes for the CYP they collectively support.

  - For example, a focus on teamwork and the desirability of innate people or interpersonal skills for a successful ATist - an attribute repeatedly raised by participants in Study 3 - is apparent in *Expert Knowledge* (cross-disciplinary, ethnography), *Generative Knowledge* (active team member), and *Knowledge Implementation* (diplomacy, advocating, UCD).

Purely as a corroborative probe, the person specification table from the *Role Profile* document was reworked to test how well it mapped to the three areas of the framework diagram. This activity proved to be a relatively simple copy and pasting exercise, indicating close alignment. The results are presented in Appendix E.29.

5.5.5 Assembling Final Framework Documentation for Distribution

The final exercise was to collate the practical assets generated by this research into a shareable document that would be useful to external groups - and without the necessity of reading this doctoral thesis in its entirety. These were determined to include:

- The final MLE model (Figure 5.2) with supporting text.
- The final framework diagram (Figure 5.6) with supporting text.
- The final role profile / job description exemplar.
- A short list defining any abbreviations.

These were collated into a PDF document collectively entitled the TACTS Framework:

Transforming **A**ssistive **C**ommunication **T**echnologies **S**upport

This document is provided in Appendix E.30, and is also available for wider distribution on the website located at: https://tinyurl.com/yyfb2ar6. It is intended as a practical roadmap toward implementation of the evidence-based approach to early intervention and AAC service delivery spearheaded by the induction of the ATist role into the SE ecosystem.

5.6 Conclusion

Through the testimonies of the participants in Study 3, robust validating data was gathered to triangulate the picture of the ATist's role emerging from the two earlier studies and the literature review (Phase I and Phase II of this research project). Both the adapted MLE model emerging from Study 2, and the draft Role Profile documentation (Section 5.3.1) were amended to reflect the comments of Study 3's informants.

Through a process of further analysis this aggregated dataset became the basis for the draft practical framework diagram shown in Figure 5.5, comprising of three symbiotic areas:

- Expert Knowledge
- Generative Knowledge
- Knowledge Implementation

This was envisaged as a flexible blueprint of the workflow and practices of the ATist within the SE community, for use by any individual or organisation interested in delivering more holistic support for young emerging communicators with CCN.

A final validation exercise - email canvassing Study 3 participants, and a small expert panel review at the University of Dundee - was undertaken to validate the tool. Respondents were very positive in their assessments, although some amendments were recommended and consequently put in place (see final output in Figure 5.6).

Finally, key assets emerging from this thesis were collated into a distributable PDF document entitled the TACTS (**T**ransforming **A**ssistive **C**ommunication **T**echnologies **S**upport) Framework - a Framework for Assistive Technologists Within a Special Education Setting (Appendix E.30). Based upon the insights forthcoming from this research, it is a recommendation of the author that the ATist has an important contribution to make to the community under investigation - and potentially a transformative one for the support and educational outcomes of children living and learning with CCN. The TACTS framework is the key deliverable arising from this thesis. It is intended as a first step toward professionalisation, elevated adherence to (ethnographic) data-driven decision making, and wider induction of the ATist's role within SE - and perhaps any educational community where assistive technology-mediated support is currently struggling under a burden of sub-optimal utilisation.

In promoting the widespread establishment of trained ATists in the classroom, it is hypothesised that the holistic support they stimulate might precipitate real progress in alleviating the overarching problem that this thesis seeks to address (Section 1.1). Such a significant change to the mechanisms by which CYP with additional support needs are assisted - with greater emphasis placed upon achieving pedagogical goals, literacy and numeracy targets - could enhance the communicative competencies of these learners where they might otherwise lose out. The change this research seeks to foment therefore has the potential to improve many people's lives: learners, their families, the wider support community around them, and society in general.

Chapter 6

Discussion

6.1 Introduction

This chapter examines the contributions of the research work as presented in this thesis, and considers its potential impact. It returns to the basic problem identified in Chapter 1 (Section 1.1) and considers how the solution explored might be improved or augmented in the future.

6.2 Reflective Overview of the Research

There is a parable about a traveller in India who stops an old man and asks him for the best way to get to Delhi. The elderly gentleman pauses for a moment deep in thought, and then answers "I would not start from here". When the author began looking for a problem to investigate, as a computing candidate, the development of a truly novel app aimed at supporting emerging communicators appeared a natural option to pursue. Prior work and reading had convinced him of the criticality of early intervention in terms of the impact, and therefore lasting influence, on people's lives. In addition, the opportunities for extending best practices in user-driven development with such a traditionally hard to reach, vulnerable audience seemed clear.

However, the application of UCD processes - in this case the ethnographic field work

undertaken during Study 1 - quickly amassed persuasive evidence that simply developing yet another technical tool could not begin to address the focal problem that this thesis set out to address, described in Chapter 1:

How can the special education environment be enhanced to promote the effective introduction and support of high tech AAC solutions into the lives of children and young people with complex communication needs?

Early intervention is recognised as a potentially significant factor in diminishing the impacts of a communication impairment upon young learners. Yet in terms of developing another new high tech AAC device, however innovative, to improve communicative competency outcomes, the uniquely immersive experience of Study 1 represents the old man telling us "I would not start from here". Why? Because it introduces evidence that the addition of another app or device to the environment as it currently stands - with its absence of concerted, enduring support - may be little more than a sticking plaster [115].

In this thesis, user centred design processes - and importantly the longitudinal access they granted to the target user group(s) - are pivotal in demonstrating the criticality of paying heed to the design of the support environment in addition to the technology itself. The embedded principal investigator watched non-technical members of the transdisciplinary TATC struggle (a) to coordinate effectively; (b) to maintain and support AAC (and peripheral) technologies; (c) to provide adequate pedagogical support to aided communicators. This - together with the stark metrics for very low adoption and significant abandonment of high tech AAC which he gathered - made a fundamental reappraisal of the nature of support provision a clear and pressing priority.

Results of a thematic analysis of the data collected in Study 1 - an exploratory ethnographic study of a SE school to understand context - emphasised the expertise required to make effective AAC interventions. Importantly, in pedagogical terms, it also highlighted the additional complexity of applying mediated learning models of joint engagement (identified in Chapter 2, Section 2.6.1) to the interactions between educators and young learners who use communication aids. In turn this had implications for the successful knowledge transfer of vital communicative competencies to these

emerging communicators.

Study 1 concluded by identifying the role of the ATist within the support team as a possible solution, providing pedagogical and technical expertise and assistance as an integral, enduring presence of the TATC in SE.

The goal of Study 2 - a hybrid ethnographic/action research study at the same school - was to understand and evaluate the ATist's transdisciplinary role as a link between the AT, education and therapy elements. In its execution, Study 2 demonstrated the importance of an holistic approach with greater strategic oversight, and - by engaging and supporting both TATC members and learners collaboratively - the unique contribution that the ATist could make in bolstering access to the curriculum for emerging aided communicators. A key output from this study was the adapted MLE model (Figure 4.16, Chapter 4), subsequently updated to form part of the eponymous framework for this thesis in Chapter 5. This illustrated an augmented MLE, expanded by the presence of an additional mediator - the ATist - who would work closely with the educator and emerging aided communicator to boost the attainment of communicative competencies and other pedagogical goals.

Study 2 provided compelling evidence of systemic change influenced and/or led by the ATist in collaboration with community partners. Empirical data was also collected to define the role of the ATist in SE, providing the basis for a prescriptive framework. The ATist was documented as having important input in the following critical areas of SE operations:

- Operational AAC Device Support.
- General Hardware Support.
- Pedagogical Support.
- Other Technical Support.
- Training Support.
- AAC Candidacy Support.

Study 3 (Chapter 5) consolidated data from foregoing chapters, and validated earlier outcomes via a series of 10 semi-structured interviews canvassing the opinions of ATists in FE (and related stakeholders). Significantly, these proved closely concordant with the experiences of the author in the SE setting. Alongside an expert panel review, additional insights were gathered by this process and acted upon to refine the framework under construction. These describe the different strands of the ATist's role as an integrated whole.

A practical framework was then developed as a composite visual representation reflecting workflow processes identified over the course of this research. The overarching goal of this instrument is to support projection of the knowledge captured here - and by extension, the embedding of these essential practitioners - into the SE classroom; and to thereby go some way to providing a solution to the stated problem (above and Section 1.1.1 of Chapter 1) that this thesis seeks to address.

The combined output from these three studies is a template for the role of the ATist as part of a transdisciplinary team supporting children in SE with highly complex needs. This is instantiated both by the MLE model and also the draft job description for an ATist.

6.3 Potential Impact of this Research

This research has communication at its core, a *sine qua non*[1] of the human condition. For a neurotypical population, the desire to communicate is not considered optional: even simply "saying" nothing can convey much. People with an impairment affecting their ability to speak do not have quite that same luxury. Young, emerging communicators in SE are just as that description connotes: In their own unique ways, however falteringly, each individual is trying - learning - to reach out. The onus therefore lies with the community around them to responsively support and direct those efforts through a realisable lens, in whatever form their needs demand. High tech AAC devices have been demonstrated to offer critical potential, alone or as one ingredient of an aggregate solution - but as the research here verifies, levels of service provision and support to

[1]Literally, "without which [there is] nothing".

that end have been generally fragmented, sclerotic and therefore disappointing.

What this work highlights is that communication between practitioners, roles, and stakeholders must be improved. There can be no question that the people who make up the adult SE community of teachers, SLTs, LCAs, parents/carers, and medical professionals earnestly want to assist the children in their care, and to impart those skills necessary for their students to thrive. Against them are the pressures of time, role disparities, technological and pedagogical complexity, resource shortages, and of keeping up-to-date in a rapidly developing and progressively turbulent domain.

This research describes a disruptive new way of supporting this SE community, a fresh approach to curating technical processes and research in the domain - and the meaningful deployment of ethnographic methods in a new, although arguably particularly well-suited, field. And it is as the catalyst driving this new approach that the role of ATist can make a decisive impact.

At its most fundamental level, the ATist's role is about communicating, about developing relationships - and being close - to every stakeholder in the system. Why is this so important, and how does it advance what the field has had in place to date? With their unique skill set, the ATist can operate as a linchpin, focusing the inherent power of ethnographic research upon the technology, to direct and simplify it, and to make it usable - and useful - for all.

A significant advantage of the immersive techniques used in ethnography is the access it grants to the community under investigation. As noted in earlier chapters, this approach bears particular dividends where the population of that community is sensitive to the intrusion of strangers. Simply being there, becoming, first, a familiar, unthreatening figure, allows the ATist to cultivate trust - crucial for the important interactions that must take place to achieve the depth and scale of influence that is required to make a difference. In this way, a successful action research partnership, as documented in Chapter 4, may be formed with stakeholders.

For practitioners who do not yet have the EBP or knowledge of devices, who may feel as though they are drowning in it all, the ATist offers diplomacy, proximity, kind-

ness and help; technical and pedagogical know-how; a human face to the intimidating confetti of academic papers, and the avalanche of often high-maintenance, potentially flawed or malfunctioning technology. For colleagues in SE, the presence of the ATist builds confidence, shares the burden of problem-solving, and supercharges their own respective contributions through training and enhanced collaboration.

The same proximity - this time being close to learners in the classroom - allows for truly insightful participant observation, and enables the ATist to collect the data necessary to identify the most fitting constellation of AAC solutions to meet each individual child's needs. Alongside, and in concert with the rest of the team, the ATist drives an upscaling of the tools, the techniques, the entire *milieu* to establish an environment that is truly *listening* to what the child has to say. In so doing, the ATist leads the elevation of the child to full stakeholder status on a par - and as engaged in proceedings affecting their futures - as any adult. It is for this reason that the title of this thesis describes "valuing the child".

It is through instituting this bilateral approach - ensuring that from an early age there is a TATC consisting of fearless, well-informed, well-supported and connected practitioners delivering the optimum (and evolving) tailored mix of tools and strategies into the hands of the child; while simultaneously elevating the child's agency to shape that tailoring process, and boosting support for their acquisition of communication competencies - that the ATist has the potential to make a massive difference to the lives of so many people. Crucially, by adopting ethnographic methods, and advocating sensitive dynamic assessment, this work finally unlocks common UCD principles of joint engagement and collaboration to deliver, to children with CCN, a voice. That this is also a voice that can now be heard and acted upon not only by the immediate SE community but - again spurred by the mediation of the ATist - by external developers of emerging AAC solutions is just one of many exciting dynamics that remain to be explored.

Described in Future Work (Section 6.4) below, further investigation is needed, but the author believes that the results and recommendations of this research represent a real opportunity to transform the SE landscape, reinvigorate the community, and to

positively influence the futures of all those affected by congenital communication disabilities in the medium to long term. On the evidence gathered to date and presented within this thesis, the inauguration of the role of ATist to the SE community can be the catalyst for the positive change that is needed. Importantly, it also delivers the practical means - the person-centred TACTS Framework (Appendix E.30) - as a pathway resource to encourage and support their introduction. Suggested implementation approaches for TACTS are presented in Chapter 5, and the combination of different components deliver a flexible resource whose utility will be fascinating to explore further. It is this practical instrument that will realise the multiple synergies described in this thesis as proceeding from the ATist's presence in SE, and thereby facilitate meeting the enhancement of practices challenge posed in Section 1.1.1, Chapter 1 of this work.

6.3.1 Summary and Explanation of Contributions

As discussed above, the major contribution of this thesis is the development of a definitive, transferable framework for the ATist role in SE and the benefits that may accrue from their presence in the classroom. The results of these studies suggest that a very real requirement for the successful adoption and use by aided communicators of AAC technologies to their full potential may not be linked to attributes of the tools themselves. It may be about knowledge; about how responsively we deliver support; and how we adapt that tool to meet individual needs. It may also be about how we work with educators, and the wider community, to identify what they need the technology to do in order to deliver a mediated learning experience that will promote greater access to the social, learning, fiscal and health opportunities to which emerging communicators with highly complex needs are entitled.

It is a central tenet of this thesis that the large scale deployment of such practitioners within SE would be both transformational for the lives of thousands of CYP with CCN and their families, but also cost effective in the long term. It is thus hoped that the framework delivered here will encourage the formal establishment of the ATist as a recognised profession, and a routine presence in the SE classroom.

This work also delivers a number of secondary contributions, as follows:

1. The application of ethnographic methods and action research. Almost two years of immersive fieldwork (see Chapters 3 and 4) delivered a unique insight into the *modus operandi* of a current SE school, including the strategies, assessment instruments, and multimodal mix of no and low through to high tech AAC solutions in use. This factor is strongly related to the primary contribution described above: It is arguable that the ATist needs not only technical and pedagogical skills, but also those of the ethnographer. These allow he or she to apply a metaphorical magnifying glass to the domain, zooming in to get detail at a "microscopic" level; and becoming a part of the system to see and hear the individual voices of the people who populate that environment: the learners, the TATC, parents and carers, and other stakeholders. Such a practitioner must collaborate daily with their community partners, becoming an empowered problem solver by winning their trust. Only then can they observe closely enough to advise and co-design effective bespoke solutions. This approach was instrumental in the delivery of the framework presented as the major output for this project. The workflow of the framework model suggests that almost everything the ATist does proceeds from their being a part of the community they support. This is most lucidly evidenced in the limitations section of Chapter 4, which describes the many complications experienced by the embedded researcher arising as a result of their *not* being an acknowledged, enduring member of staff.

2. A contemporary focus on the demographic reality facing communities. This shows an increasing prevalence of people in society with CCN, the scale and urgency of the problem - and the inadequacy of current policies, procedures and infrastructures in place to support CYP with additional support needs. This issue is highlighted in Chapter 2, and reinforced by insights emerging from the qualitative ethnographic methods adopted by this project described above. It is difficult to overestimate the potentially distressing and costly societal implications of the apparent disconnect between trends in the growing number of citizens projected to need AAC supports, and deficits in current organisational practices - particularly services for vulnerable young emerging communicators - to scale up to meet these coming challenges.

3. The presentation of novel interview data. The data (in Chapters 3, 4 and 5) came from a mix of 18 educational practitioners and parents operating in SE, and 10 ATists operating in the FE sector (or related stakeholders)[2]. Overall, these data represent a diverse mixture of views, roles, circumstances and occasionally competing priorities offering fascinating insights into technology-mediated communication support efforts in both the SE and FE sectors.

6.4 Future Work

In the first instance, the use of an ethnographic approach (Study 1) was intended as an early, context gathering, stage of a planned UCD process. Yet what is perhaps most revealing about the results of that exploration is that traditional user centred aspects of technology design did not dominate. Instead, what we repeatedly saw was evidence of the value and influence of the community within which high tech AAC devices must operate; and the underpinning criticality of ensuring that an holistic approach giving equal status and consideration to this singular environment is adhered to. The efficacy of any AAC intervention or solution, in other words, appears inextricably bound in the symbiotic relationships between hardware, software, community partners, policies and individual user attributes - a sociotechnical system [29]. This insight is reflected in the future work outlined below.

6.4.1 Extending Longitudinal Study 2

The action research approach adopted for Study 2 (Chapter 4), and focusing around stakeholder inclusion and collaboration throughout, was aimed at engendering real and sustainable positive change. During the conduct of the study, there was clear evidence that practitioners were responding positively to the enhanced focus upon AAC championed by the ATist's presence. A follow up study to ascertain whether the ATist's deployment had any lasting impact on practitioners' day-to-day practices, and/or the adoption and support of AAC would be desirable. Contact has been maintained with key collaborators from Study 2 with that outcome in mind.

[2] See also Table 1.1, Chapter 1.

6.4.2 The TACTS Framework Implementation

The framework delivered by this research is a useful first step as a guide to the ATist's role in the SE classroom. To establish how well it works as a practical tool in the field would require further empirical exploration. The framework should be tested within the SE school ecosystem to optimise it, by gathering supplemental data on any strengths and weaknesses. (a) Is it clear enough for schools and practitioners to embed it into their daily routines? (b) How might it be sharpened and improved? (c) Does it have the correct balance of detail? (d) Will it promote the introduction of the role it supports into schools, with the ethnography-powered enhancements in EBP, adoption and sustained use of high tech AAC devices that this research conjectures will follow?

Piloting the implementation of the framework in other SE schools is the natural next step to pursue in promoting the work of the ATist within the SE environment.

6.4.3 Extending ATist Access to Home Setting

Holistic support is a concept that recurs in one form or another throughout this thesis. In Chapter 2 (Section 2.7) for example, it was noted that Savignon defined communicative competence as an interpersonal, as much as an intrapersonal trait. In Chapter 4 (Section 4.9.1) C01's carer expressed a desire for ATist support to extend to the home environment. This research further reinforces the perception that holistic support is important, and provides evidence that the presence of an ATist may enhance such support e.g., Study 3's *Promoting Holistic Support* sub-theme in Chapter 5.

Support for AAC should not begin and end at the classroom door. By definition an holistic approach should aim for parity between home and school settings. To achieve the number of communicative opportunities - 200 - highlighted by Baker et al. (see Chapter 2, Section 2.6.1), for example, requires consistent support to be maintained including outwith school hours. Although the author established and maintained constructive dialogue with parents/carers, such parity could not be a realistic investigative goal with the available resources. There is, however, nothing in theory preventing the framework model from being extended to apply outside the classroom, and indeed, generic terms such as "naturalistic setting" are used within the diagram partly to en-

hance flexibility. This is an area and issue that researchers have highlighted in the past [143, 72]. The work reported in this thesis supports and emphasises the indispensability of infusing aided communication interactions into the daily life of emerging aided communicators - and the potential example of the ATist's role to engineer that extended level of support. Such "joined up" service provision could be a prerequisite for the transformative potential of high tech AAC to be realised for their users. Further exploration of this hypothesis is needed.

6.4.4 Harnessing UCD Principles to Stimulate Transformational Systemic Change

Nothing about ISO 9241-210:2019 (see Figure 2.3 in Chapter 2) limits its application to digital product design. From the perspective of an HCI-focused computer scientist, however, jettisoning the development of a novel AAC device - having originally set out to build one - remains something of a departure. Nevertheless, the narrative emerging from these person-centred qualitative studies, strengthened by participant testimonies of inadequacy in the current system, makes one thing clear: The problem space identified in Chapter 1 - the broader "wicked problem" that this thesis also explores - may not be resolved simply by the addition of one novel role to any organisation, however well that practitioner performs in influencing the uptake and sustained use of AAC technologies.

What may be required is close to a paradigm shift [95]. On the strength of this work, the ATist is an important contribution in the right direction. However other factors related to service provision and support were identified as problematic. In other words, Light and McNaughton's [106] policy and practice barriers to effective AAC interventions appear largely intact, and sometimes ostentatiously *not* user-centred. The introduction of an ATist to SE is a disruptive attempt to ameliorate this situation, but may not significantly influence certain parameters that this research also highlights.

For example, in Study 1 participants made it clear that teaching their vulnerable learners requires considerably more time than for NT children (see P05's comments in *The Battle for Resources*, or P12's advice on patience in *Strategies for Engagement*, both Chapter 3).

There are numerous reasons for this - some a result of developmental delays, or situational life challenges. Technological challenges for children who use aided communication are also a significant factor. It is common for these emerging communicators to have physical impairments which require specialist access methods such as switches or eyegaze systems. Developing the skills to master these often demands a range of physical and cognitive competencies which may take years to learn.

An ATist's support for early intervention may gain time in this respect, but is that sufficient? The level of complexity highlighted by the adapted MLE (Figure 4.16, Chapter 4) might suggest otherwise. Extending the time available to CYP in primary and secondary education to accommodate this identified need should be further investigated as part of an holistic approach to service delivery and support within this sector - and for furthering the processes of valorisation discussed in Chapter 5.

6.5 Summary

This chapter provided an overview of the research conducted for this project, with a supporting summary of perceived contributions. An impact assessment highlighted the transformative influence that the widespread induction of the ATist role in SE could have. In support of this goal, a primary contribution of this research was identified as a practical framework defining the role of the ATist in SE, as established by, and anchored in, extensive qualitative research data collected in the field. Three related, secondary contributions arising from this work were also discussed - in one case highlighting the urgency of finding lasting solutions to the focal problem under investigation. Finally, options for future work aimed at contributing further to resolving the overarching problem that this thesis explores were identified and discussed.

Chapter 7

Conclusions

7.1 Introduction

This chapter presents a final summary of the work conducted over the course of this thesis, and assesses whether the problem identified in Chapter 1 has been resolved.

7.2 A Narrative Summary of this Investigation

The introduction to this thesis states that this work is "primarily concerned with supporting children and young people with severe speech, language and communication needs who require help... to interact effectively with others". There is a problem with the system we currently have in place - at least in the English speaking world - to achieve that goal. It appears, simply, not fit for purpose. This is why the overwhelming majority of people with complex communication needs never attain functional literacy [54], never experience the agency and attendant joy of extended reciprocal conversation. So what is actually occurring here? In undertaking this research an important narrative began to emerge.

First, despite an army of developers at work around the globe developing many and varied technical tools, their efforts are frustratingly underperforming in the field, with poor adoption and suboptimal sustained use of their products. This was recognised in

the literature review of this project (part one of Phase I - Immersive Contextualisation).

The second part of Phase I, Study 2, was a novel 21.5 week ethnographic study in a SE school. This was intended as the UCD context gathering stage for an innovative high tech AAC device. What was revealed (described in Chapter 3) radically changed the direction of this research. Despite a vigorously motivated focal community in this school, adoption of high tech AAC was found by the embedded researcher to be critically low[1]. Amongst practitioners and other stakeholders both the awareness of high tech AAC, and expertise in how to assess and support children who use it were fragmented, with training non-existent, ad hoc or problematic to arrange. As a result, in most cases technology mediated communication was not being leveraged effectively as a means of achieving vital pedagogical goals in the classroom. Consequently it was recognized that delivering another technical tool to the children in this environment was not an effective way of addressing the problem under investigation.

The focus of the research therefore shifted to service delivery, involving a new role and a new way of thinking: The introduction of a trained, technically adept professional - the ATist - to mediate between educator, learner, technology and task to stimulate support for the implementation of effective bespoke AAC solutions. Exploring this role within SE was the rationale for Phase II, Study 2. It is this phase that represents the core of this investigation. Over the course of a 19.5 week hybrid ethnographic/action research study, close collaboration with educators and other stakeholders convincingly demonstrated the value of a coordinated, evidence-based support structure for these learners. Dovetailed as a part of the multidisciplinary team, the researcher, acting as an ATist, performed as an important catalyst toward that success. Qualitative investigative methods were significant in driving both the means of undertaking the role (e.g., participant observation; field notes) and in gauging and articulating the results (e.g., end of study interviews with stakeholders; content analysis). In this way, Phase II demonstrated the principal contributions ATists can make towards improved levels of support within the SE ecosystem, and therefore the potential for positive systemic change such an embedded practitioner might represent. This delivered a proof of concept that

[1]That is to say, significantly fewer than might reasonably be expected if the benefits of these devices were acknowledged and the infrastructure was in place to support their optimal use.

underpins the central tenet of this thesis: It is argued that large scale deployment of ATists within SE would be transformational for the lives of thousands of CYP with CCN.

Phase III of this research concentrated on validating the results of Phases I and II, with a view to delivering a generalisable framework of the ATist's role in SE. This is the prominent deliverable arising from the thesis, and is designed as a summative guide to precipitate the induction of ATists into other SE communities. This is a key part of the valorisation process discussed in Chapter 5 - promoting EBPs beyond academia to encourage wider societal and cultural change. Interviews with ATists in FE and related subject matter experts, and an expert panel review verified the rigour of the research, and the draft framework was further refined by the input of these informants' testimonies. The final framework is provided as Appendix E.30.

7.3 Is the Thesis Problem Solved?

In Chapter 1, Section 1.1.1 of this work, the problem this thesis aims to address was presented:

How can the special education environment be enhanced to promote the effective introduction and support of high tech AAC solutions into the lives of children and young people with complex communication needs?

The same chapter also acknowledged the formidable "wicked problem" nature of the problem space [73]. This term refers to challenges that are difficult - or even impossible - to resolve because of an interrelated and exacting mix of often fluid parameters generating complex patterns of behaviour. From the researcher's perspective, where an uninterrupted dysfunctional status quo is the alternative - with such significant negative connotations for many (and increasing) numbers of people [39, 104, 139] - the problem must be approached and anchored in the premise of being rectifiable.

Section 7.2 summarises the path that this research took. From that account it can be seen that the technology is de facto already in SE schools. However, levels of penetration and available support mean that it is simply not being used in any way close

to its full advantage for the benefit of emerging communicators. This work serves to verify the hypothesis that an ATist in SE can significantly improve that situation. The adapted MLE model (Figure 5.2), a significant contribution to the field, demonstrates:

- The complexity of implementing meaningful pedagogical interventions with emerging aided communicators.
- The unique contribution the ATist can make within the MLE toward boosting pedagogical outcomes for students.

In addition, the practical framework (Appendix E.30) which was developed based upon the data gathered for this research is a simple practical tool that allows SE institutions to visualise the role of the ATist within the SE ecosystem. From this emerges a clear job description - and a blueprint for how the ATist should work *in situ*. Both the school and any newly inducted ATist can use it to clarify where that appointee fits within organisational structures, and what their duties and responsibilities might extend to. It is intended as a starting point with room for improvement - but may still act as a practical tool for every SE school to have.

It may also be conjectured that the holistic support enhancements that would follow the universal instatement of ATists into SE schools would lead to, for example:

- Increased awareness, and implementation, of EBPs by and among community partners.
- Improved coordination between disciplines and stakeholders (in both school and home environments).
- More effective, needs-based implementation of multi-modality interventions, with high tech AAC support enhancements leading to greater uptake and fewer incidents of abandonment.
- A reinvigorated MLE with an elevated capacity to infuse bespoke literacy, numeracy, and language development into daily interactions through the joint, recursive efforts of teacher, ATist and student.

- Synergistic advantages arising from increased class engagement as peers' communication competencies advance e.g., the reciprocal group dynamic discussed in Section 4.9.2 (*Impact Upon Learners - Other Students*), a side effect of C01's increasingly responsive presence in class.

- Potential synergistic advantages wrought by the presence of a familiar technical expert "in-house" in user-driven design developments for assistive technologies, partnered with external vendors. The ATist could act as a major bridge between these two worlds (i.e., otherwise hard-to-access users and device developers), leading to improvements in the UCD of AAC solutions.

These entirely plausible claims are based on the documented experiences of the researcher-as-ATist, and many similar potential advantages could accrue as a more mindful and effective support mechanism takes hold in a school. The results - particularly in tandem with contingent adjustments highlighted in Section 6.4.4 - could be transformative, for example:

1. Educators being more free to focus on pedagogical goals for individual pupils, and with heightened awareness of competencies, interaction targets and modelling; and

2. Learners being at the heart of an informed, coordinated 24/7 support network, nurtured in an environment where they are rarely or never deprived of their voice.

These vital changes have a potential to secure for aided emerging communicators a literate, self-confident transition into adulthood - in stark contrast to the dependency characterised by the problem space described in the introduction to this thesis (Section 1.1). For any child with CCN, the picture painted here represents a more responsive, purposeful system geared to provide optimal support for their individual needs. The ATist role as defined within this project is an essential enabler of this vision.

However, the nature of this "wicked problem" means that the full blossoming of any transformative outcomes - dealing, as we are, with the development of sensitive and vulnerable human beings - are unlikely to be seen for a number of years. Any large

cohort of trained ATists starting work in the SE environment today may have an extended wait[2], alongside their community partners, to witness the full fruits of their labours. Nonetheless this remains a transformation, however gradual in delivering its results. Pursuing the future work described in Section 6.4 is recommended as a means of establishing a momentum that the evidence from this research suggests may well make a meaningful difference to many people's lives.

7.4 Closing Remarks

We live in an era with decades of antidiscrimination legislation in effect around the world. Bodies such as the WHO are focused upon promoting sustainable development for all. Today, in 2021, we are 70 years into the modern age of AAC research and practice. UCD processes have been informing product design for around 40 years. High tech AAC devices - and since circa 2010, apps - are legion, and available with myriad shapes, sizes, access methods and price points. And yet, up to 90 percent of those with congenital CCN fail to acquire functional literacy [54]. This thesis's problem space description of a life of passive dependency for many people without functional speech is distressingly accurate, particularly against the backdrop of recent movement by modern societies to accommodate the diverse needs of their citizens. In a very tangible way, and despite these efforts, people with CCN continue to experience disenfranchisement.

This research represents an attempt to promulgate a responsive support infrastructure in SE that will foster earlier, more purposeful interventions; and introduce a novel, evidence-based approach to the pedagogical support of young emerging communicators in the MLE. At its centre is the child learner with special educational needs. Embedded in the environment, closely observing how that child communicates, and assessing their individual requirements, is a new practitioner in SE: the Assistive Technologist (ATist). Collaborating with the class teacher, and fellow members of the TATC and extended community, he or she will act as a catalyst - through the application of their technical, ethnographic and action research expertise - to foment an enhanced level of holistic support. The hypothesis, supported by the empirical evidence provided here, is

[2]This feeling may be offset by the many satisfying "quick wins" experienced by the author during Study 2, and similarly supported by testimony from P01 in Study 3 (*Sub-theme: A Rewarding Career*).

that such support - promoting EBPs, freeing educators to educate, boosting the adoption and daily use of high tech AAC - could be transformative. It could be the missing piece of the puzzle that complements the technical and societal advances described in the paragraph above, finally empowering people with communicative disabilities to attain their full potentials.

The main output from this work is a novel framework to encourage and promote the instatement of ATists in SE institutions throughout the world (Appendix E.30).

References

[1] Ablenet. n.d. BIGmack single message dedicated SGD. (n.d.). https://www.ablenetinc.com/bigmack. Accessed: 2017-09-20.

[2] Anna A Allen, Ralf W Schlosser, Kristofer L Brock, and Howard C Shane. 2017. The effectiveness of aided augmented input techniques for persons with developmental disabilities: A systematic review. *Augmentative and Alternative Communication* 33, 3 (2017), 149–159.

[3] Meghan Allen, Joanna McGrenere, and Barbara Purves. 2008. The field evaluation of a mobile digital image communication application designed for people with aphasia. *ACM Transactions on Accessible Computing (TACCESS)* 1, 1 (2008), 1–26.

[4] Gopala K Anumanchipalli, Josh Chartier, and Edward F Chang. 2018. Intelligible speech synthesis from neural decoding of spoken sentences. *bioRxiv* (2018), 481267.

[5] David Armstrong, Ann Gosling, John Weinman, and Theresa Marteau. 1997. The place of inter-rater reliability in qualitative research: an empirical study. *Sociology* 31, 3 (1997), 597–606.

[6] Jose F Arocha and Vimla L Patel. 2008. Methods in the study of clinical reasoning. *Clinical reasoning in the health professions. 3rd edn. Elsevier, Philadelphia, PA* (2008), 193–211.

[7] Kim Baker, Debbie Carrillo, and Freda Stanton. 2011. 200 a day the easy way:

Putting it into practice. *Perspectives on Augmentative and Alternative Communication* 20, 4 (2011), 125–133.

[8] Vanessa Hus Bal, Terry Katz, Somer L Bishop, and Kate Krasileva. 2016. Understanding definitions of minimally verbal across instruments: Evidence for subgroups within minimally verbal children and adolescents with autism spectrum disorder. *Journal of Child Psychology and Psychiatry* 57, 12 (2016), 1424–1433.

[9] Beata Batorowicz, Kristine Stadskleiv, Gregor Renner, Annika Dahlgren Sandberg, and Stephen von Tetzchner. 2018. Assessment of aided language comprehension and use in children and adolescents with severe speech and motor impairments. *Augmentative and Alternative Communication* 34, 1 (2018), 54–67. DOI: http://dx.doi.org/10.1080/07434618.2017.1420689

[10] Susan Baxter, Pam Enderby, Philippa Evans, and Simon Judge. 2012a. Barriers and facilitators to the use of high-technology augmentative and alternative communication devices: A systematic review and qualitative synthesis. *International Journal of Language & Communication Disorders* 47, 2 (2012), 115–129.

[11] Susan Baxter, Pam Enderby, Philippa Evans, and Simon Judge. 2012b. Interventions using high-technology communication devices: a state of the art review. *Folia Phoniatrica et Logopaedica* 64, 3 (2012), 137–144.

[12] Fiona Beauchamp, Helen Bourke-Taylor, and Ted Brown. 2018. Therapists' perspectives: supporting children to use switches and technology for accessing their environment, leisure, and communication. *Journal of Occupational Therapy, Schools, and Early Intervention* 11, 2 (2018), 133–147. DOI:http://dx.doi.org/10.1080/19411243.2018.1432443

[13] Ann R Beck, Julia B Stoner, and Marcia L Dennis. 2009. An investigation of aided language stimulation: Does it increase AAC use with adults with developmental disabilities and complex communication needs? *Augmentative and Alternative Communication* 25, 1 (2009), 42–54.

[14] Mariette Bengtsson. 2016. How to plan and perform a qualitative study using

content analysis. *NursingPlus Open* 2 (2016), 8–14.

[15] Joann P Benigno and John W McCarthy. 2012. Aided Symbol-Infused Joint Engagement. *Child Development Perspectives* 6, 2 (2012), 181–186.

[16] Paul Benneworth and Ben W Jongbloed. 2010. Who matters to universities? A stakeholder perspective on humanities, arts and social sciences valorisation. *Higher education* 59, 5 (2010), 567–588.

[17] Laura Benton and Hilary Johnson. 2015. Widening participation in technology design: A review of the involvement of children with special educational needs and disabilities. *International Journal of Child-Computer Interaction* 3 (2015), 23–40.

[18] John Bercow. 2008. The Bercow Report: A review of services for children and young people (0-19) with speech, language and communication needs. (2008).

[19] David R Beukelman and Pat Mirenda. 2013. *Augmentative and alternative communication: Supporting children and adults with complex communication needs*. Paul H. Brookes Pub.

[20] Elizabeth E Biggs, Erik W Carter, and Carly B Gilson. 2018. Systematic review of interventions involving aided AAC modeling for children with complex communication needs. *American Journal on Intellectual and Developmental Disabilities* 123, 5 (2018), 443–473.

[21] Elizabeth E Biggs, Erik W Carter, and Carly B Gilson. 2019. A Scoping Review of the Involvement of Children's Communication Partners in Aided Augmentative and Alternative Communication Modeling Interventions. *American journal of speech-language pathology* 28, 2 (2019), 743–758.

[22] Cathy Binger and Janice Light. 2007. The effect of aided AAC modeling on the expression of multi-symbol messages by preschoolers who use AAC. *AAC: Augmentative and Alternative Communication* 23, 1 (2007), 30–43. DOI:http://dx.doi.org/10.1080/07434610600807470

[23] Sarah W Blackstone and David P Wilkins. 2009. Exploring the importance of

emotional competence in children with complex communication needs. *Perspectives on Augmentative and Alternative Communication* 18, 3 (2009), 78–87.

[24] Blippar. n.d. Blippar augmented reality app. (n.d). https://blippar.com/en/. Accessed: 2017-09-30.

[25] Doreen Blischak, Linda Lombardino, and Alice Dyson. 2003. Use of speech-generating devices: In support of natural speech. *Augmentative and Alternative Communication* 19, 1 (2003), 29–35.

[26] Virginia Braun and Victoria Clarke. 2006. Using thematic analysis in psychology. *Qualitative research in psychology* 3, 2 (2006), 77–101.

[27] Virginia Braun, Victoria Clarke, and Nikki Hayfield. 2019. 'A starting point for your journey, not a map': Nikki Hayfield in conversation with Virginia Braun and Victoria Clarke about thematic analysis. *Qualitative Research in Psychology* (2019), 1–22.

[28] Amber G Candela. 2019. Exploring the function of member checking. *The Qualitative Report* 24, 3 (2019), 619–628.

[29] Pascale Carayon. 2006. Human factors of complex sociotechnical systems. *Applied ergonomics* 37, 4 (2006), 525–535.

[30] Jessica Caron, Janice Light, and Kathryn Drager. 2016. Operational demands of AAC mobile technology applications on programming vocabulary and engagement during professional and child interactions. *Augmentative and Alternative Communication* 32, 1 (2016), 12–24.

[31] Peter Checkland and Sue Holwell. 1998. Action research: its nature and validity. *Systemic practice and action research* 11, 1 (1998), 9–21.

[32] Christine Cheepen. 1988. *The predictability of informal conversation.* Pinter Pub Ltd.

[33] Ji Young Cho and Eun-Hee Lee. 2014. Reducing confusion about grounded theory

and qualitative content analysis: Similarities and differences. *The qualitative report* 19, 32 (2014), 1.

[34] Malgorzata Ciesielska, Katarzyna W Boström, and Magnus Öhlander. 2018. Observation methods. In *Qualitative methodologies in organization studies*. Springer, 33–52.

[35] Stefanie Cirilli. 2014. *Teacher practices and resources for preparing teachers to assist students with Autism Spectrum Disorder in inclusive, primary classrooms*. Ph.D. Dissertation. Jones International University.

[36] Louis Cohen, Lawrence Manion, and Keith Morrison. 2002. *Research methods in education*. Routledge.

[37] William Collins. 2012. Collins English Dictionary. (2012). https://www.dictionary.com/browse/communication?s=t. Accessed: 2018-11-03.

[38] Pyramid Educational Consultants. n.d. Mayer-Johnson Picture Exchange Communication System. (n.d.). https://mayer-johnson.com/. Accessed: 2017-08-12.

[39] Sarah Creer, Pamela Enderby, Simon Judge, and Alex John. 2016. Prevalence of people who could benefit from augmentative and alternative communication (AAC) in the UK: determining the need. *International journal of language & communication disorders* 51, 6 (2016), 639–653.

[40] Cynthia J Cress and Christine A Marvin. 2003. Common questions about AAC services in early intervention. *Augmentative and Alternative Communication* 19, 4 (2003), 254–272.

[41] Annika Dahlgren Sandberg, Martine Smith, and Maria Larsson. 2010. An analysis of reading and spelling abilities of children using AAC: Understanding a continuum of competence. *Augmentative and Alternative Communication* 26, 3 (2010), 191–202.

[42] Christina Davidson. 2009. Transcription: Imperatives for qualitative research. *International journal of qualitative methods* 8, 2 (2009), 35–52.

[43] Caroline De Lamo White and Lixian Jin. 2011. Evaluation of speech and language assessment approaches with bilingual children. *International Journal of Language & Communication Disorders* 46, 6 (2011), 613–627.

[44] Derbyshire-Language-Scheme. (????). https://www.derbyshire-language-scheme.co.uk/cgi-bin/live/ecommerce.pl?site=derbyshire-language-scheme.co.uk&state=page&page=splash&suppress_header=yes. Accessed: 2017-11-20.

[45] Ruth Deutsch and Yvonne Reynolds. 2000. The use of dynamic assessment by educational psychologists in the UK. *Educational Psychology in Practice* 16, 3 (2000), 311–331.

[46] Aimee Dietz, Wendy Quach, Shelley K. Lund, and Miechelle McKelvey. 2012. AAC assessment and clinical-decision Making: The impact of experience. *AAC: Augmentative and Alternative Communication* 28, 3 (2012), 148–159. DOI:http://dx.doi.org/10.3109/07434618.2012.704521

[47] Owen Doody and Catriona M Doody. 2015. Conducting a pilot study: Case study of a novice researcher. *British Journal of Nursing* 24, 21 (2015), 1074–1078.

[48] Kathryn Drager, Janice Light, and David McNaughton. 2010. Effects of AAC interventions on communication and language for young children with complex communication needs. *Journal of pediatric rehabilitation medicine* 3, 4 (2010), 303–310.

[49] Kathryn DR Drager, Janice C Light, JoHannah Curran Speltz, Karen A Fallon, and Lauren Z Jeffries. 2003. The performance of typically developing 21/2-year-olds on dynamic display AAC technologies with different system layouts and language organizations. *Journal of Speech, Language, and Hearing Research* (2003).

[50] Dave L Edyburn. 2004. Rethinking assistive technology. *Special Education Technology Practice* 5, 4 (2004), 16–23.

[51] Anne Emerson and Jackie Dearden. 2013. The effect of using "full"language when working with a child with autism: adopting the "least dangerous assumption".

Child Language Teaching and Therapy 29, 2 (2013), 233–244.

[52] Jennifer Fereday and Eimear Muir-Cochrane. 2006. Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International journal of qualitative methods* 5, 1 (2006), 80–92.

[53] Reuven Feuerstein, Pnina S Klein, and Abraham J Tannenbaum. 1991. *Mediated learning experience (MLE): Theoretical, psychosocial and learning implications*. Freund Publishing House Ltd.

[54] B Foley and Julie A Wolter. 2010. Literacy intervention for transition-aged youth: What is and what could be. *Language, Literacy, and AAC Issues for Transition-Age Youth* (2010), 35.

[55] Lorna K Fraser, Deborah Gibson-Smith, Stuart Jarvis, Paul Norman, and Roger Parslow. 2020. Make Every Child Count - Estimating current and future prevalence of children and young people with life-limiting conditions in the United Kingdom. (2020).

[56] Donald Fuller and Lyle Lloyd. 1991. Toward a common usage of iconicity terminology. *Augmentative and Alternative Communication* 7, 3 (1991), 215–220.

[57] UN GA. 2015. Transforming our world: the 2030 Agenda for Sustainable Development. *Division for Sustainable Development Goals: New York, NY, USA* (2015).

[58] Caroline Gagnon and Valérie Côté. 2014. Learning from others: A five-year experience on teaching empathic design. (2014).

[59] Joseph Giacomin. 2014. What is human centred design? *The Design Journal* 17, 4 (2014), 606–623.

[60] John D Gould and Clayton Lewis. 1985. Designing for usability: key principles and what designers think. *Commun. ACM* 28, 3 (1985), 300–311.

[61] Scottish Government. 2012. A Right To Speak.

(2012). https://www.gov.scot/publications/right-speak-supporting-individuals-use-alternative-augmentative-communication/. Accessed: 2018-06-03.

[62] Ulla H Graneheim and Berit Lundman. 2004. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse education today* 24, 2 (2004), 105–112.

[63] Trisha Greenhalgh and Richard Peacock. 2005. Effectiveness and efficiency of search methods in systematic reviews of complex evidence: audit of primary sources. *Bmj* 331, 7524 (2005), 1064–1065.

[64] Davydd J Greenwood and Morten Levin. 2006. *Introduction to action research: Social research for social change*. SAGE publications.

[65] Mona Leigh Guha, Allison Druin, and Jerry Alan Fails. 2008. Designing with and for children with special needs: an inclusionary model. In *Proceedings of the 7th international conference on Interaction design and children*. 61–64.

[66] Johanna T. Gustafsson. 2017. Single case studies vs. multiple case studies: A comparative study.

[67] Justin Anthony Haegele and Samuel Hodge. 2016. Disability discourse: Overview and critiques of the medical and social models. *Quest* 68, 2 (2016), 193–206.

[68] Michael D Harris and Joe Reichle. 2004. The impact of aided language stimulation on symbol comprehension and production in children with moderate cognitive disabilities. *American Journal of Speech-Language Pathology* (2004).

[69] Gillian R. Hayes. 2010. The Relationship of Action Research to Human-Computer Interaction. *Annali della Scuola Normale - Classe di Scienze* 9, 4 (2010), 645–685. DOI: http://dx.doi.org/10.1145/1993060.1993065

[70] Tina Hellblom-Thibblin, Nina Klang, and Kerstin Åman. 2012. Biopsychosocial model and the ICF-CY in in-service training: general educators' reflections. *International Journal of Developmental Disabilities* 58, 1 (2012), 12–19.

[71] D Jeffery Higginbotham, Howard Shane, Susanne Russell, and Kevin Caves. 2007. Access to AAC: Present, past, and future. *Augmentative and alternative communication* 23, 3 (2007), 243–257.

[72] Suzanne Hodge. 2007. Why is the potential of augmentative and alternative communication not being realized? Exploring the experiences of people who use communication aids. *Disability & Society* 22, 5 (2007), 457–471.

[73] Catherine Holloway, Giulia Barbareschia, Felipe Ramos-Barajasa, Lucy Pannell, Dafne Morgado-Ramirez, Richard Frost, Iain McKinnon, Christopher Holmes, Maria Kett, Nora Groce, and Mark Carew. 2019. Exploring Novel Approaches to Addressing the Global Need for AT. In *Proceedings of the 15th international conference of the Association for the Advancement of Assistive Technology in Europe*. AAATE, 97–98.

[74] E Holmes and J Logue. 2003. *Fighting Hard: parents' experiences of accessing communication support for their child.* Scope.

[75] Christine Holyfield, Jessica Gosnell Caron, Kathryn Drager, and Janice Light. 2018. Effect of mobile technology featuring visual scene displays and just-in-time programming on communication turns by preadolescent and adolescent beginning communicators. *International journal of speech-language pathology* (2018), 1–11.

[76] Christine Holyfield, Jessica Gosnell Caron, Kathryn Drager, and Janice Light. 2019. Effect of mobile technology featuring visual scene displays and just-in-time programming on communication turns by preadolescent and adolescent beginning communicators. *International journal of speech-language pathology* 21, 2 (2019), 201–211.

[77] Anthony Hornof. 2008. Working with children with severe motor impairments as design partners. In *Proceedings of the 7th international conference on Interaction design and children*. ACM, 69–72.

[78] Thomas Huijbregts and James R Wallace. 2015. Talkingtiles: Supporting person-

alization and customization in an aac app for individuals with aphasia. In *Proceedings of the 2015 International Conference on Interactive Tabletops & Surfaces*. 63–72.

[79] Debra Humphris, Peter Littlejohns, Christina Victor, Paul O'halloran, and Janet Peacock. 2000. Implementing evidence-based practice: Factors that influence the use of research evidence by occupational therapists. *British Journal of Occupational Therapy* 63, 11 (2000), 516–522.

[80] Seray B Ibrahim, Asimina Vasalou, and Michael Clarke. 2018. Design Opportunities for AAC and Children with Severe Speech and Physical Impairments. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. ACM, 227.

[81] Linda Iris Rosa-Lugo and Jennifer Kent-Walsh. 2008. Effects of Parent Instruction on Communicative Turns of Latino Children Using Augmentative and Alternative Communication During Storybook Reading. *Communication Disorders Quarterly* 30, 1 (2008), 49–61. DOI:http://dx.doi.org/10.1177/1525740108320353

[82] ISO. 2010. 9241-210 Human-centred design processes for interactive systems. (2010). https://www.iso.org/standard/52075.html. Accessed: 2017-10-25.

[83] Yosef Jabareen. 2009. Building a conceptual framework: philosophy, definitions, and procedure. *International journal of qualitative methods* 8, 4 (2009), 49–62.

[84] Parham Sadeqi Javid. The Impact of Ideology on Political Translation. (????).

[85] Margareta Jennische, Annalu Waller, and Michael Ullman. n.d. Graphic augmentative and alternative communication in the framework of declarative and procedural memory. (n.d.).

[86] Jisc. 2020. Online Surveys. (2020). https://www.jisc.ac.uk/online-surveys. Accessed: 2019-13-15.

[87] Helene Joffe. 2012. Thematic analysis. *Qualitative research methods in mental health and psychotherapy: A guide for students and practitioners* 1 (2012), 210–223.

[88] W John and Plano Clark Creswell. 2000. Designing and conducting mixed methods research. SAG.

[89] Jeanne M Johnson, Ella Inglebret, Carla Jones, and Jayanti Ray. 2006. Perspectives of speech language pathologists regarding success versus abandonment of AAC. *Augmentative and Alternative Communication* 22, 2 (2006), 85–99.

[90] Susan S Johnston, Joe Reichle, and Joanna Evans. 2004. Supporting augmentative and alternative communication use by beginning communicators with severe disabilities. *American Journal of Speech-Language Pathology* 13, 1 (2004), 20–30.

[91] Simon Judge and Gillian Townend. 2013. Perceptions of the design of voice output communication aids. *International Journal of Language & Communication Disorders* 48, 4 (2013), 366–381.

[92] Eija Kärnä, Jussi Nuutinen, Kaisa Pihlainen-Bednarik, and Virpi Vellonen. 2010. Designing technologies with children with special needs: Children in the Centre (CiC) framework. In *Proceedings of the 9th International Conference on Interaction Design and Children*. ACM, 218–221.

[93] Camilla Kidner. 2011. Educational attainment of looked after children. (2011).

[94] Klaus Krippendorff. 2018. *Content analysis: An introduction to its methodology*. Sage publications.

[95] Thomas S Kuhn. 2012. *The structure of scientific revolutions*. University of Chicago press.

[96] Peter Lansley, Claudine McCreadie, and Anthea Tinker. 2004. Can adapting the homes of older people and providing assistive technology pay its way? *Age and Ageing* 33, 6 (2004), 571–576.

[97] Maria Larsson, Annika Dahlgren Sandberg, and Martine Smith. 2009. Early reading and spelling abilities in children with severe speech and physical impairment: A cross-linguistic comparison. *Research in developmental disabilities* 30, 1 (2009), 77–95.

[98] Kaisa Launonen and Nicola Grove. 2019. *Manual sign acquisition in children with developmental disabilities*. Nova science publishers.

[99] Public Law. 2004. Law 108-446. *Individuals With Disabilities Education Improvement Act of* (2004).

[100] Marcella Letto, Jan Bedrosian, and Elizabeth Skarakis-Doyle. 1994. Application of Vygotskian developmental theory to language acquisition in a young child with cerebral palsy. *Augmentative and Alternative Communication* 10, 3 (1994), 151–160.

[101] Janice Light. 1989. Toward a definition of communicative competence for individuals using augmentative and alternative communication systems. *Augmentative and Alternative Communication* 5, 2 (1989), 137–144.

[102] Janice Light. 1997. "Let's go star fishing": Reflections on the contexts of language learning for children who use aided AAC. *Augmentative and Alternative Communication* 13, 3 (1997), 158–171.

[103] Janice Light and Kathryn Drager. 2007. AAC technologies for young children with complex communication needs: State of the science and future research directions. *Augmentative and alternative communication* 23, 3 (2007), 204–216.

[104] Janice Light and David McNaughton. 2012. The changing face of augmentative and alternative communication: Past, present, and future challenges. (2012).

[105] Janice Light and David McNaughton. 2013. Putting people first: Re-thinking the role of technology in augmentative and alternative communication intervention. *Augmentative and Alternative Communication* 29, 4 (2013), 299–309.

[106] Janice Light and David McNaughton. 2014. Communicative competence for individuals who require augmentative and alternative communication: A new definition for a new era of communication? (2014).

[107] Janice Light and David Mcnaughton. 2015. Designing AAC research and intervention to improve outcomes for individuals with complex communication needs. (2015).

[108] J Lopez-Pison, MC Garcia-Jimenez, L Monge-Galindo, M Lafuente-Hidalgo, R Perez-Delgado, A Garcia-Oguiza, and JL Peña-Segura. 2014. Our experience with the aetiological diagnosis of global developmental delay and intellectual disability: 2006–2010. *Neurología (English Edition)* 29, 7 (2014), 402–407.

[109] Shelley K Lund and Janice Light. 2006. Long-term outcomes for individuals who use augmentative and alternative communication: Part I–What is a "good" outcome? *Augmentative and Alternative Communication* 22, 4 (2006), 284–299.

[110] Shelley K Lund, Wendy Quach, Kristy Weissling, Miechelle McKelvey, and Aimee Dietz. 2017. Assessment with children who need augmentative and alternative communication (AAC): Clinical decisions of AAC specialists. *Language, speech, and hearing services in schools* 48, 1 (2017), 56–68.

[111] Jennifer Mankoff, Gillian R Hayes, and Devva Kasnitz. 2010. Disability studies as a source of critical inquiry for the field of assistive technology. In *Proceedings of the 12th international ACM SIGACCESS conference on Computers and accessibility*. ACM, 3–10.

[112] Sarah Marsh. 2018. Neurotechnology, Elon Musk and the goal of human enhancement. *The Guardian* (2018).

[113] Liz Maudslay. 2015. DART Project. (2015). http://repository.jisc.ac.uk/6243/1/NATSPEC-report-Oct15.pdf. Accessed: 2017-11-13.

[114] Roxanna Mayer-Johnson. 1994. *The picture communication symbols: Combination book*. Mayer-Johnson Company.

[115] David McNaughton and Janice Light. 2013. The iPad and mobile technology revolution: Benefits and challenges for individuals who require augmentative and alternative communication. (2013).

[116] Rolf Molich, Brenda Laurel, Carolyn Snyder, Whitney Quesenbery, and Chauncey E Wilson. 2001. Ethics in HCI. In *CHI'01 Extended Abstracts on human factors in computing systems*. 217–218.

[117] Patricia A Morrissey and Robert Silverstein. 1989. The Technology Related Assistance for Individuals with Disabilities Act, 1988. *American Rehabilitation* 2 (1989), 15.

[118] Deanna R Morrow, Pat Mirenda, David R Beukelman, and Kathryn M Yorkston. 1993. Vocabulary selection for augmentative communication systems: A comparison of three techniques. *American Journal of Speech-Language Pathology* 2, 2 (1993), 19–30.

[119] Joan Murphy, Ivana Marková, Sarah Collins, and Eleanor Moodie. 1996. AAC systems: Obstacles to effective use. *International Journal of Language & Communication Disorders* 31, 1 (1996), 31–44.

[120] Sally Neaum. 2017. *What comes before phonics?* Learning Matters.

[121] Demetris Nicolaides. 2020. *In Search of a Theory of Everything: The Philosophy Behind Physics*. Oxford University Press.

[122] Don Norman. 2013. *The design of everyday things: Revised and expanded edition*. Constellation.

[123] Donald A Norman. 1986. Cognitive engineering. *User centered system design* 31 (1986), 61.

[124] Christopher S Norrie, Annalu Waller, and Elizabeth F S Hannah. 2021. Establishing Context: AAC Device Adoption and Support in a Special-Education Setting. *ACM Transactions on Computer-Human Interaction (TOCHI)* (2021). DOI: http://dx.doi.org/10.1145/3446205

[125] Samuel L Odom. 2003. *Early intervention practices around the world*. Brookes Pub.

[126] Children's Commissioner's Office. 2019. We need to talk. (2019). https://www.childrenscommissioner.gov.uk/wp-content/uploads/2019/06/cco-we-need-to-talk-june-2019.pdf. Accessed: 2019-11-09.

[127] Elizabeth R Oommen and John W McCarthy. 2015. Simultaneous natural speech

and AAC interventions for children with childhood apraxia of speech: lessons from a speech-language pathologist focus group. *Augmentative and Alternative Communication* 31, 1 (2015), 63–76.

[128] World Health Organisation. 2001. International Classification of Functioning, Disability and Health. (2001). https://www.who.int/classifications/icf/icf_more/en/. Accessed: 2019-06-05.

[129] World Health Organisation. 2011. Better Health for People with Disabilities. (2011). https://www.who.int/disabilities/facts/Infographic_en_pdf.pdf. Accessed: 2019-06-08.

[130] World Health Organisation. 2014. The GATE initiative. (2014). https://www.who.int/phi/implementation/assistive_technology/2206_infographic.pdf. Accessed: 2019-06-04.

[131] World Health Organisation. 2020. Disabilities. (2020). https://www.who.int/topics/disabilities/en/. Accessed: 2019-06-05.

[132] Malcolm Parlett and David Hamilton. 1972. " Evaluation as Illumination: A New Approach to the Study of Innovatory Programs". Occasional Paper. (1972).

[133] Rhea Paul. 1997. Facilitating transitions in language development for children using AAC. *Augmentative and Alternative Communication* 13, 3 (1997), 141–148.

[134] Bogi Perelmutter, Karla K McGregor, and Katherine R Gordon. 2017. Assistive technology interventions for adolescents and adults with learning disabilities: An evidence-based systematic review and meta-analysis. *Computers & education* 114 (2017), 139–163.

[135] Sarah Perez. 2016. Apple App Store hits 2M apps. (2016). https://techcrunch.com/2016/06/13/apples-app-store-hits-2m-apps-130b-downloads-50b-paid-to-developers/. Accessed: 2017-08-13.

[136] Alexandros Pino. 2014. Augmentative and Alternative Communication systems

for the motor disabled. In *Disability Informatics and Web Accessibility for Motor Limitations*. IGI Global, 105–152.

[137] J Prentice. 2000. With communication, anything is possible. *Speaking up and spelling it out* (2000), 207–214.

[138] QSR-International. n.d. NVivo qualitative data analysis software. (n.d). https://www.qsrinternational.com/. Accessed: 2017-10-13.

[139] Ann Ratcliff, Rajinder Koul, and Lyle L Lloyd. 2008. Preparation in augmentative and alternative communication: An update for speech-language pathology training. *American Journal of Speech-Language Pathology* 17, 1 (2008), 48–59.

[140] Toni Robertson and Jesper Simonsen. 2012. Participatory design. *Routledge international handbook of participatory design* (2012), 1.

[141] MaryAnn Romski and Rose A Sevcik. 2005. Augmentative communication and early intervention: Myths and realities. *Infants & Young Children* 18, 3 (2005), 174–185.

[142] MaryAnn Romski, Rose A Sevcik, and Lauren B Adamson. 1999. Communication patterns of youth with mental retardation with and without their speech-output communication devices. *American Journal on Mental Retardation* 104, 3 (1999), 249–259.

[143] Savignon J Sandra. 1983. *Communicative competence: Theory and classroom practice*. Reading, MA: Addison-Wesley (USA).

[144] Marcia Scherer, Jeffrey Jutai, Marcus Fuhrer, Louise Demers, and Frank Deruyter. 2007. A framework for modelling the selection of assistive technology devices (ATDs). *Disability and Rehabilitation: Assistive Technology* 2, 1 (2007), 1–8.

[145] Marcia J Scherer and Gerald Craddock. 2002. Matching person & technology (MPT) assessment process. *Technology and Disability* 14, 3 (2002), 125–131.

[146] Ralf W Schlosser. 2003. Roles of speech output in augmentative and alternative

communication: Narrative review. *Augmentative and Alternative Communication* 19, 1 (2003), 5–27.

[147] Ralf W Schlosser and Parimala Raghavendra. 2004. Evidence-based practice in augmentative and alternative communication. *Augmentative and Alternative Communication* 20, 1 (2004), 1–21.

[148] Ralf W Schlosser and Oliver Wendt. 2008. Effects of augmentative and alternative communication intervention on speech production in children with autism: A systematic review. *American Journal of Speech-Language Pathology* 17, 3 (2008), 212–230.

[149] JB Schwartz and C Nye. 2006. Improving communication for children with autism: Does sign language work. *EBP Briefs* 1, 2 (2006), 1–17.

[150] Scope. 2018. Disability facts and figures. (2018). https://www.scope.org.uk/media/disability-facts-figures/. Accessed: 2019-08-09.

[151] Joseph Seabi. 2012. Feuerstein's mediated learning experience as a vehicle for enhancing cognitive functioning of Remedial school learners in South Africa. *Australian Journal of Educational and Developmental Psychology* 12, May (2012), 35–45. DOI: http://dx.doi.org/10.19160/e-ijer.33598

[152] Andrew Sears, Min Lin, Julie Jacko, and Yan Xiao. 2003. When computers fade: Pervasive computing and situationally-induced impairments and disabilities. In *HCI International*, Vol. 2. 1298–1302.

[153] Samuel C Sennott, Janice C Light, and David McNaughton. 2016. AAC modeling intervention research review. *Research and Practice for Persons with Severe Disabilities* 41, 2 (2016), 101–115.

[154] RA Sevcik, MA Romski, and LB Adamson. 2004. Research directions in augmentative and alternative communication for preschool children. *Disability and Rehabilitation* 26, 21-22 (2004), 1323–1329.

[155] Stephanie Y Shire and Nancy Jones. 2015. Communication partners supporting

children with complex communication needs who use AAC: A systematic review. *Communication Disorders Quarterly* 37, 1 (2015), 3–15.

[156] Jeff Sigafoos, Larah van der Meer, Ralf W Schlosser, Giulio E Lancioni, Mark F O'Reilly, and Vanessa A Green. 2016. Augmentative and Alternative Communication (AAC) in intellectual and developmental disabilities. In *Computer-Assisted and Web-Based Innovations in Psychology, Special Education, and Health*. Elsevier, 255–285.

[157] Rune J Simeonsson, Eva Björck-Åkessön, and Donald J Lollar. 2012. Communication, disability, and the ICF-CY. *Augmentative and Alternative Communication* 28, 1 (2012), 3–10.

[158] Gregory J Skulmoski, Francis T Hartman, and Jennifer Krahn. 2007. The Delphi method for graduate research. *Journal of Information Technology Education: Research* 6, 1 (2007), 1–21.

[159] Rohan Slaughter and Trevor Mobbs. 2014. The DART Project: improving assistive technology provision in further education. (2014). https://communicationmatters.org.uk/conference_abstracts/2014-the-dart-project-improving-assistive-technology-provision-in-further-education/. Accessed: 2018-08-08.

[160] Emma M Smith, Rosemary Joan Gowran, Hasheem Mannan, Brian Donnelly, Liliana Alvarez, Diane Bell, Silvana Contepomi, Liezel Ennion, Evert-Jan Hoogerwerf, Tracey Howe, and others. 2018. Enabling appropriate personnel skill-mix for progressive realization of equitable access to assistive technology. *Disability and Rehabilitation: Assistive Technology* 13, 5 (2018), 445–453.

[161] Martine M Smith and Nicola Clare Grove. 2003. Asymmetry in input and output for individuals who use AAC. *Communicative competence for individuals who use AAC: From research to effective practice* (2003), 163–195.

[162] Martha Snell. 2002. Using dynamic assessment with learners who communicate nonsymbolically. *Augmentative and Alternative Communication* 18, 3 (2002), 163–

176.

[163] Kappa Delta Pi (Honor society). 1980. The Dynamic Assessment of Retarded Performers: The Learning Potential Assessment Device, Theory, Instruments, and Techniques by Reuven Feuerstein et al. Baltimore, MD.: University Park Press, 1979. 413 pp. 24.50. *Kappa Delta Pi record.* 44, 4 (1980), 501.

[164] Janet M Sturm, Stephanie A Spadorcia, James W Cunningham, Kathleen S Cali, Amy Staples, Karen Erickson, David E Yoder, and David A Koppenhaver. 2006. What happens to reading between first and third grade? Implications for students who use AAC. *Augmentative and Alternative Communication* 22, 1 (2006), 21–36.

[165] Surveymonkey. n.d. Online survey software. (n.d). https://www.surveymonkey.com/. Accessed: 2018-03-03.

[166] Christine Szwed. 2010. Gender balance in primary initial teacher education: Some current perspectives. *Journal of Education for Teaching* 36, 3 (2010), 303–317.

[167] Michael Tomasello. 2003. Constructing a language: A usage-based approach to child language acquisition. *Cambridge (MA)* (2003).

[168] UN. 2006. Convention on the Rights of Persons with Disabilities. (2006). https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html. Accessed: 2018-02-03.

[169] UN. 2019. United Nations Population Fund. (2019). https://www.unfpa.org/world-population-trends. Accessed: 2019-05-03.

[170] Hans Van Balkom and Ludo Verhoeven. 2010. Literacy learning in users of AAC: A neurocognitive perspective. *Augmentative and Alternative Communication* 26, 3 (2010), 149–157.

[171] Domenique van Gennip. n.d. Transcription software. (n.d). https://dvangennip.github.io/transcriber/. Accessed: 2018-02-03.

[172] Gregg Vanderheiden and Jutta Treviranus. 2011. Creating a global public inclusive infrastructure. In *International Conference on Universal Access in Human-Computer Interaction*. Springer, 517–526.

[173] Gregg C Vanderheiden. 2003. A journey through early augmentative communication and computer access. *Journal of rehabilitation research and development* 39, 6; SUPP (2003), 39–53.

[174] Stephen Von Tetzchner and Nicola Grove. 2003. The development of alternative language forms. *Augmentative and alternative communication: Developmental issues* (2003), 1–27.

[175] Stephen von Tetzchner, Kaisa Launonen, Beata Batorowicz, Leila Regina d'Oliveira de Paula Nunes, Cátia Crivelenti de Figueiredo Walter, Judith Oxley, Munique Massaro, Kristine Stadskleiv, Chih Kang Yang, and Débora Deliberato. 2018. Communication aid provision and use among children and adolescents developing aided communication: an international survey. *AAC: Augmentative and Alternative Communication* 34, 1 (2018), 79–91. DOI: http://dx.doi.org/10.1080/07434618.2017.1422019

[176] Virginia L Walker, Kristin J Lyon, Sheldon L Loman, and Samuel Sennott. 2018. A systematic review of Functional Communication Training (FCT) interventions involving augmentative and alternative communication in school settings. *Augmentative and Alternative Communication* 34, 2 (2018), 118–129.

[177] Annalu Waller. 1992. *Providing narratives in an augmentative communication system.* Ph.D. Dissertation. University of Dundee.

[178] Annalu Waller. 2006. Communication access to conversational narrative. *Topics in Language Disorders* 26, 3 (2006), 221–239.

[179] Annalu Waller. 2009. Interpersonal communication. In *The Universal Access Handbook*. CRC Press, 47–1.

[180] Annalu Waller. 2019. Telling tales: unlocking the potential of AAC technologies.

International journal of language & communication disorders 54, 2 (2019), 159–169.

[181] Annalu Waller, Rolf Black, David A O'Mara, Helen Pain, Graeme Ritchie, and Ruli Manurung. 2009. Evaluating the standup pun generating software with children with cerebral palsy. *ACM Transactions on Accessible Computing (TACCESS)* 1, 3 (2009), 16.

[182] Michael B Williams, Carole Krezman, and David McNaughton. 2008. "Reach for the stars": Five principles for the next 25 years of AAC. *Augmentative and Alternative Communication* 24, 3 (2008), 194–206.

[183] Bencie Woll and Sarah Barnett. 1998. Toward a sociolinguistic perspective on augmentative and alternative communication. *Augmentative and alternative communication* 14, 4 (1998), 200–211.

[184] Marieke Zwaanswijk and Sandra van Dulmen. 2014. Advantages of asynchronous online focus groups and face-to-face focus groups as perceived by child, adolescent and adult participants: a survey study. *BMC research notes* 7, 1 (2014), 1–7.

Appendix A - Pedagogical Tools

This appendix contains a brief description of key pedagogical tools found to be in use at the partner school.

A.1: Pedagogical Instruments Reference Guide.

Pedagogical Instruments/Strategies/Programmes Reference Document

C.O.D.E.S Framework (Competency, Opportunities, Driving Communication Forward, Engagement, Skill Acquisition): A “a framework for measuring effective communication post assessment following discrete guides and identifying skill development over time”. More information may be found at:
https://codesframework.wordpress.com/

Derbyshire Language Scheme (DLS): This is a language intervention system designed to help children with communication disabilities to acquire language skills - providing an array of tests to allow recording and monitoring of individual progress. More information may be found at:
https://www.derbyshire-language-scheme.co.uk/programme

Intensive Interaction: A teaching approach aimed at CYP with ASD, PMLD or other learning disabilities - with a focus on promoting understanding of the fundamentals of communication. More information may be found at:
https://www.sense.org.uk/get-support/information-and-advice/communication/intensive-interaction/

Objects of Reference: Using representative, tangible objects as a meaningful, individualised sign or symbol of an activity or event. Tactile information may be more accessible for some CYP than visual or auditory information. More information may be found at:
https://www.kentcht.nhs.uk/wp-content/uploads/2017/02/Objects-of-reference-01042a-ITACC-v3.pdf

Picture Communication Symbols (PCS): Created in Boardmaker drawing software, Mayer-Johnson picture communication symbols are understood to be transparent (i.e. easily learned and understood by children with CCNs) and provide a gateway for aided communicators to see and familiarise themselves with the written words used widely within their own language and community. More information may be found at:
https://goboardmaker.com/pages/picture-communication-symbols

Routes for Learning (RfL): This is an assessment pack of posters and guidance materials that may be used to monitor and promote the progress of emerging

1

A.1: Pedagogical Instruments Reference Guide.

communicators with PMLD. More information may be found at:
https://progression-matters.com/routes-for-learning

SCERTS Model (Social Communication, Emotional Regulation and Transactional Support): A framework facilitating interventions for children and adults with Autism Spectrum Disorder (ASD). More information may be found at:
http://scerts.com/wp-content/uploads/SCERTS_2pg_3_16.pdf

SMART (Specific, Measurable, Achievable, Realistic, Time-related) and **SCRUFFY** (Student-led Creative Relevant Unspecified Fun For Youngsters)Targets: Educational programmes used by teachers to assist in meeting educational goals for CYP with PMLD. More information may be found at:
https://docs.google.com/viewer?a=v&pid=sites&srcid=Y2xpY2tzcGVjaWFsZWRuei5jb218c2Vuc29yeS1sZWFybmluZy1uenxneDoyNDdlYWE0NzhjOGFhMzY4

TEACCH (Treatment and Education of Autistic and Related Communication Handicapped[1] Children.): A programme originating from the University of North Caroline providing a wide range of clinical services and support for individuals with ASD. More information may be found at:
https://teacch.com/about-us/

Total Communication: This is a method of helping people with learning disabilities to communicate using multiple modes of communication, from symbols, gestures and signing (e.g. Makaton and/or Canaan Barrie, images, speech and the written word. More information may be found at:
https://www.icommunicatetherapy.com/child-speech-language/children-special-needs-learning-difficulties/key-guidelines-creating-total-communication-environment/

True Object Based Icon (TOBI): These are real world symbols made by cutting around the outline of a photograph or line drawing of an object. They are designed to be easily recognisable to CYP with CCN, both visually and through touch. May be useful as an interim stage between objects of reference, and photographs.

[1] TEACCH originated in the early 1970s, and it may be assumed that the term “handicapped” would not be acceptable were they to name the programme in 2020.

Appendix B - Ethical Approval Forms

This appendix contains the letters of approval from the University of Dundee Science and Engineering Research Ethics Committee, and the application for undertaking research from Dundee City Council.

B.2: University Ethical Approval.

UNIVERSITY OF DUNDEE

School of Science and Engineering

Head of Discipline:(Computing) Professor Annalu Waller

Ethics Committee
Convener
Professor Annalu Waller
Administrator
Mrs Kathleen Cummins

27 April 2017

Christopher Norrie
Computing
School of Science and Engineering
University of Dundee

Dear Christopher

Full title of study: Developing a novel system to support language acquisition in children with complex communication needs

SoCEC reference number: 17-003

Thank you for submitting an ethics application on 20 March. Your application has been reviewed by the Ethics committee.

Ethical issues arising from the proposed study

You have indicated that there are no significant ethical issues arising from this project. The Ethics Committee has approved this study.

Conditions of approval

By submitting an application to the Ethics Committee you confirm that you have read and understand the University of Dundee Guidelines for Ethical Practices in Research and the School of Science of Engineering Code of Practice for Research involving Human Participants and undertake to abide by these guidelines. Permission is therefore granted for you to proceed with the study.

Please inform the committee of any change in project methodology which may have ethical implications.

Best wishes for your research,

Yours sincerely

Annalu Waller MBCS MIPEM
Professor
Convener: School of Science and Engineering Ethics Committee

Administrator: Mrs Kathleen Cummins
email SSE-Ethics@dundee.ac.uk *telephone* 01382 386532

School of Science and Engineering
UNIVERSITY OF DUNDEE Dundee DD1 4HN Scotland UK *t* +44 (0)1382 388085
www.computing.dundee.ac.uk

B.3: City Council Approval.

DUNDEE CITY COUNCIL: EDUCATION DEPARTMENT
APPLICATIONS TO UNDERTAKE RESEARCH

NOTES OF GUIDANCE

Dundee City Council is anxious to encourage and support educational research. Normally, the Director of Education will give approval to proposals to undertake research in schools and other educational establishments in Dundee subject to the following conditions:

1 All relevant details of the research project are disclosed on the appropriate application form.

2 The involvement of all Council staff with research projects is understood to be entirely voluntary.

3 The methodology involved in conducting the research does not in any way impair the educational process for students.

4 Any research project which examines directly the attitudes, achievements or learning processes of young people may only take place if the written parental consent of each young person involved has been obtained.

5 All research staff working with young people in schools and educational establishments are required to disclose any criminal convictions and must have been cleared through the Criminal Records system.

DISCLOSURE OF CRIMINAL CONVICTIONS BY THOSE WITH ACCESS TO CHILDREN

The Rehabilitation of Offenders Act 1974 permits certain criminal convictions to be regarded as 'spent' after the lapse of a number of years. This means that no reference need be made to such convictions or any circumstances relating to them.

However, the Rehabilitation of Offenders Act 1974 (Exceptions) (Amendments) Order 1986 excepts from the provisions of Section 4(2) of the Act any office or employment concerned with the provision to persons under 18 years of age of accommodation, care, leisure and recreation facilities, schooling, social services, supervision or training, being an office or employment of such a kind as to enable the holder to have access in the course of his/her normal duties to such persons and any other office or employment, the normal duties of which are carried out wholly or partly on premises where such provision takes place. Researchers who intend working with young people in schools and educational establishments are excepted under Section 4(2) of the Act and are therefore not entitled to withhold information about previous convictions (or impending prosecutions). All "spent" and "unspent" convictions must be disclosed and may be taken into account when determining the application to undertake research.

6 No disclose to the findings of the research project is to take place before a date specified at the outset of the project, unless with the specific permission of the Director of Education.

7 A copy of the findings of the research project is to be made available, free of charge, to the Director of Education on completion of the report.

8 Strict observation of confidentiality must be respected and in particular the researcher must comply with the terms of the Data Protection Act.

9 Copyright for the published research project rests with the researcher.

Every effort will be made to convey a timeous decision to researchers regarding their application. In all circumstances, the approval of the Headteacher/Head of Establishment will be sought. The Head Teacher may also require to consult with the School Board if the project specifically relates to an area where they have a statutory function. There may therefore by an interval of several weeks between the submission of an application form and the intimation of the Council's decision.

16/05/2017 9:35 AM SMg24

B.3: City Council Approval.

APPLICATION FOR UNDERTAKING RESEARCH IN DUNDEE CITY COUNCIL'S EDUCATION DEPARTMENT

1 Title of Research Project:

Developing a novel system to support language acquisition in children with complex communication needs

2 Name and Address of corporate body you represent (if appropriate)

School of Science and Engineering(Computing) Tel: **01382 388223**

Perth Road, Dundee Fax: **n/a**

Postcode: DD1 4HN

3 Name(s) and designation(s) of individual(s) conducting the research (first name should be head of project)

Prof Annalu Waller, Head of Computing, University of Dundee

Mr Christopher Norrie, PhD Student, University of Dundee

4 Address and telephone number of research base (if different to 2 above)

---

5 Details of funding granted/~~applied for~~ (delete as appropriate)

PhD Studentship funded by the Engineering and Social Sciences Research Council Doctoral Training Programme at Dundee University

---

6 Please list all other agencies involved in the project, the nature of their involvement and a contact name. (This may be attached on a typewritten sheet).

REDACTED is happy to support this application – see letter attached

---

7 Anticipated timescale of project Start: **01 June 2017** Finish: **30 September 2018**

8 Synopsis of projects (including methodology) (***This may be attached in typewritten form***)

This PhD thesis is exploring a ways in which children with complex communication needs (CCN) might be better supported in developing vocabulary acquisition and literacy skills using high-tech assistive technologies.

This project seeks to lay the foundations for an assistive technology system for emerging communicators with CCN that can mimic the methods available to typically developing children in vocabulary acquisition, by enabling the independent lexical exploration of their environment. As such, the primary aim of this research is to gauge the efficacy of integrating computer vision technology – in the form of object detection and recognition functionality - into a visual scene display (VSD) system to determine whether machine automation, coupled with a more child-friendly contextualised interface for a voice output

16/05/2017 9:35 AM SMg24

B.3: City Council Approval.

communication aid (VOCA), might enable and encourage user exploration from an early age; and whether vital vocabulary acquisition might then be measurably accelerated.

Research questions that the project will attempt to answer are:
1. Can the automaticity of object recognition be harnessed within a VSD system to enable children to be more independent in exploring novel vocabulary?
2. If children have self-directed access to contextual vocabulary, will this positively influence their vocabulary acquisition rate?
3. Will children using such a system be more motivated to initiate conversation around the events of their daily lives?

In order to answer these, data collection will be divided into three discrete, consecutive phases – a preliminary exploration phase, an engineering phase, and a research phase - each precursor informing the succeeding phase to cumulatively build a richer picture of the domain under investigation.

Over the course of up to 18 months, three studies – mapped to the phases described in the preceding section - are envisioned, to take place in a school environment and involving the researcher PI working with children with communication difficulties, their supporting teachers, therapists and other relevant staff.

i) Phase 1: The preliminary explorative (ethnographic) study:

Purpose - to collect and analyse data on the means and efficacy of current practices in the participating school, to gain a comprehensive understanding of the domain and to establish control measurements for comparison during subsequent phases;

Duration – This phase is planned likely to last between three a number of and six weeks, and possibly some months depending upon the frequency of access gained;

Participant Time Commitment – The researcher will spend between two and three days per week in the school, depending on the school/staff schedule;

Method – participant observation, field notes, audio-recorded interviews with staff to understand context – the researcher will observe the children and staff during their day at school, using ethnographic tools such as still photography to document artefacts, and journal notes to record activities related to vocabulary acquisition and the support of literacy skills, identifying any assistive technologies utilised, and instruments used, in support of teaching.

Outcomes – Establishing a context within which the project will operate, building an understanding of current practices.

ii) Phase 2: The engineering (Participatory Action Research) study:

Purpose – to develop an 'intervention' to increase vocabulary acquisition – evaluating the nascent system (i.e., its efficiency, learnability and memorability) recursively, pursuing best practice within a user-centred design framework;

Duration – This phase is planned to last between four and six months, depending upon the frequency of access gained; again, a number of weeks - possibly some months;

Participant Time Commitment – The researcher will arrange up to six prototyping sessions with staff and children (at least two sessions will be with staff alone), depending on the school/staff schedule;

16/05/2017 9:35 AM SMg24

B.3: City Council Approval.

Method – Iterative design methodology, evolutionary prototyping. Initial sessions with staff will ensure that fundamental design issues have not been missed before introducing ideas to children. Activities and games which will engage children with different intellectual abilities will be designed in collaboration with staff. These activities will allow children to explore will be set tasks such as using the device to capture a photograph of an object or scene that interests them. Observations of how children engage to perform with the prototype under consideration and their reactions will recorded and be used as a basis for further refinement.

Outcomes – A proof of concept prototype for wider evaluation in Phase 3 (Study 3).

9 Describe the output of the project in terms of reports/theses/articles/books etc.

Results of the project will be submitted to relevant journals (e.g. AAC, Human-Computer Interaction International Conference Series, Educational Technology) and presented at relevant conferences (e.g. Communication Matters; Biennial International Conference of the International Society for Augmentative and Alternative Communication and Educational conferences)

10 Are you an undergraduate / ~~postgraduate~~? (delete as appropriate)

The PhD student will be supervised by Prof Annalu Waller.

If so, what course are you studying? **PhD**

11 Are you an employee of Dundee City Council ~~YES~~/NO (***delete as appropriate***)

If YES, please give your work address if different from 4 above.

_____ Tel: _____

_____ Fax: _____

_____

_____ Postcode: _____

12 Please list the access and facilities you require from Dundee City Council (describe data; names of establishments and categories of personnel as appropriate)

Christopher will be conducting the first two studies at the School. The level and duration of engagement will be agreed upon in consultation with staff at the School. Possible involvement in phase 3 will be decided upon later in the year.

Ethical approval has been granted by the University of Dundee's Non-Clinical Ethics Committee (attached). Informed consent will be sought from all participants (including staff and parents). Christopher has a PVG through the University for his PhD studies.

16/05/2017 9:35 AM SMg24

B.3: City Council Approval.

14 Criminal Convictions

Please give details of any prosecutions for which you, or any of the research team, have been found guilty. If NONE, please state "NONE".

Date	Details of Offence	Sentence
	NONE	

Rehabilitation of Offenders Act 1974 - Please read Note 5 in the Notes of Guidance.

15 Declaration by Applicant/Corporate Body

I certify that the information given in this application is accurate and complete and that I and all research staff working with young people in schools and educational establishments have been cleared through the Criminal Records system.

Signature _____ Date 15/05/2017

Signature and name of officer of corporate body

Signature _____

Name Prof Annalu Waller Date 15/05/2017

To be completed by Dundee City Council

16 Approval of research request

(a)	Approved without conditions	✓	(b)	Approved with conditions	
(c)	Undecided		(d)	Refused	

Please tick the appropriate box and give further details/reasons below for categories (b), (c) and (d).

Signature of Authorised Officer _____ Date 16/05/17

16/05/2017 9:35 AM SMg24

B.3: City Council Approval.

Please return this form to: Paul Clancy, Quality Improvement Manager, Dundee City Council, Education Department, Educational Development Service, Gardyne Road, Dundee.
Telephone (01382) 438110. E-mail. paul.clancy@dundeecity.gov.uk

16/05/2017 9:35 AM SMg24

B.3: City Council Approval.

"Developing a novel system to support language acquisition in children with communication impairments"

Dear (Head Teacher),

Thank you for showing interest in my research for the above project that I hope to carry out at your school.

"Developing a novel system..." is a research project that is the focus of my doctoral studies currently being undertaken at the University of Dundee. I am aiming to improve support for children with complex communication needs in their acquisition of vocabulary, with a view to improving communication and literacy outcomes in the longer term. I plan to do this by developing and evaluating a new electronic communication device that will allow children to explore the vocabulary of their environment in a more intuitive way than most current symbol-based AAC systems (including high-tech AAC devices).

I would like families, carers, teachers, therapists – and the children who will benefit from the device – to help me to design this device. To do so I need to understand the systems currently in place in your school, and the methods you use to gauge progress in vocabulary acquisition.

The project will take the form of three discrete studies, each lasting a few weeks, distributed over a timeframe of around 18 months. Initially – in our exploratory first study - I will visit the school to find out more about day-to-day activities, speak to staff and children, and generally collect information that can help in the design of the new device. Later in, Study 2 of the project, I will – with the benefit of advice from staff – identify a small group of children and invite them to participate in the device's development phase. Towards the end of my project, during the course of Study 3, we will evaluate the efficacy of our prototype device in supporting vocabulary acquisition with the help of some of the children in the school.

I will ask all participants, including participating school staff, for their written consent. Participation will be strictly on a voluntary basis, with participants free to withdraw their assistance at any time. The consent form will explain what will be asked and what will happen to any information that is collected. The participants will be given a copy of this form to keep.

The project has ethical approval pending from the University of Dundee's Research Ethics Committee. If you would like to know more about this research and/or you have questions that cannot be answered by myself, please feel free to contact my supervisor, Professor Annalu Waller - you can find her contact details at the end of this form. In the meantime I would be most grateful if you would complete and return this form to me for our records. Many thanks,

Yours sincerely

Mr Chris Norrie
Computing PhD Candidate

B.3: City Council Approval.

"Developing a novel system to support language acquisition in children with communication impairments"

I confirm that I understand the nature of the "Developing a novel system..." project. I confirm that Mr Chris Norrie has permission to conduct interviews / evaluations at _____ School on the understanding that these visits will be undertaken according to the ethical approval obtained for this study.

School/Centre: _____ SCHOOL _____

Print Name _____

Your position at the school: HEAD TEACHER

Date: 16 / 03 / 2017 Signature: _____

How to contact us

If you have any questions or would like more information please contact Chris Norrie, the researcher or his supervisor Professor Annalu Waller, at the University of Dundee's Computing Department. You can reach both at the following contact details:

Contact:	Email:	Phone:
Mr Chris Norrie	c.s.norrie@dundee.ac.uk	01382 386527
Prof. Annalu Waller	a.waller@dundee.ac.uk	01382 388223

Write to:

School of Science and Engineering (Computing), University of Dundee, Queen Mother Building, Dundee DD1 4HN

C Norrie Study Permission School v1 Spring 2017

Appendix C - Study 1: Study Materials

This appendix contains material generated during Study 1 (presented in Chapter 3).

C.4: Study 1 Interview Guide.

Basic Discussion Guide Study 1
Adapted dynamically for each interviewee, depending upon responses.

Aim: *To gauge practitioners knowledge and understanding of high tech AAC in their school; and to ascertain the interest in developing a novel technical tool to enable vocabulary acquisition in emerging communicators with CCN.*

Highlight

- *All questions are optional.*
- *Your personal data will be kept confidential - no reference will be made to your identity in publication or other documents.*
- Your participation is voluntary and you are free to withdraw from the study at any time without giving any reason and without penalty.

Q1: Could you start by giving name title and describing role?

Q2: What AAC (unaided, aided, low or high tech) are you aware of being used in the School?

Q3: Which assessment tools or instruments are in use for vocabulary and/or language acquisition evaluation?

Describe proposed technical tool -
I aim to develop and evaluate the efficacy of a vsd-based technical tool that leverages computer vision automation to support and enhance vocabulary acquisition in children with CCN.

Q4: Do you think such a tool would be useful?

Q5: Do you have any advice for how best to go about eliciting feedback/user testing or working with children with CCN? What about PMLD?

Q6: Could you describe a participant profile as you see it from the pupils you are familiar with?

Q7: How might pupils benefit from the availability of such a device?

C.4: Study 1 Interview Guide.

Q8: Have you any ideas for future AAC research?

Q9: Are there any questions you'd like to ask me?

Thank you for allowing me this opportunity to speak with you, and for sharing your thoughts and ideas with me.

C.5: Headteacher Introduction Consent Form.

"Developing a novel system to support language acquisition in children with complex communication needs"

Dear (Head Teacher),

Thank you for showing interest in my research for the above project that I hope to carry out at your school.

"Developing a novel system..." is a research project that is the focus of my doctoral studies currently being undertaken at the University of Dundee. I am aiming to improve support for children with complex communication needs in their acquisition of vocabulary, with a view to improving communication and literacy outcomes in the longer term. I plan to do this by developing and evaluating a new electronic communication device that will allow children to explore the vocabulary of their environment in a more intuitive way than most current symbol-based AAC systems (including high-tech AAC devices).

I would like families, carers, teachers, therapists – and the children who will benefit from the device – to help me to design this device. To do so I need to understand the systems currently in place in your school, and the methods you use to gauge progress in vocabulary acquisition.

The project will take the form of three discrete studies, each lasting from a few weeks up to a few months, distributed over a timeframe of approximately 18 months in total. Initially – in our exploratory first study - I will visit the school to find out more about day-to-day activities, speak to staff and children, and generally collect information that can help in the design of the new device. Later in, Study 2 of the project, I will – with the benefit of advice from staff – identify a small group of children and invite them to participate in the device's development phase. Towards the end of my project, during the course of Study 3, we will evaluate the efficacy of our prototype device in supporting vocabulary acquisition with the help of some of the children in the school.

I will ask all participants, including participating school staff, for their written consent. Participation will be strictly on a voluntary basis, with participants free to withdraw their assistance at any time. The consent form will explain what will be asked and what will happen to any information that is collected. The participants will be given a copy of this form to keep.

The project has ethical approval pending from the University of Dundee's Research Ethics Committee. If you would like to know more about this research and/or you have questions that cannot be answered by myself, please feel free to contact my supervisor, Professor Annalu Waller - you can find her contact details at the end of this form. In the meantime I would be most grateful if you would complete and return this form to me for our records. Many thanks,

Yours sincerely

Mr Chris Norrie
Computing PhD Candidate

C.5: Headteacher Introduction Consent Form.

"Developing a novel system to support language acquisition in children with complex communication needs"

I confirm that I understand the nature of the "Developing a novel system..." project. I confirm that Mr Chris Norrie has permission to conduct interviews / evaluations at _____ School on the understanding that these visits will be undertaken according to the ethical approval obtained for this study.

School/Centre:_____

Print Name _____

Your position at the school:_____

Date: / / 2017 Signature: _____

How to contact us

If you have any questions or would like more information please contact Chris Norrie, the researcher or his supervisor Professor Annalu Waller, at the University of Dundee's Computing Department. You can reach both at the following contact details:

Contact:	Email:	Phone:
Mr Chris Norrie	c.s.norrie@dundee.ac.uk	01382 386527
Prof. Annalu Waller	a.waller@dundee.ac.uk	01382 388223

Write to:

C.5: Headteacher Introduction Consent Form.

School of Science and Engineering (Computing), University of Dundee, Queen Mother Building, Dundee DD1 4HN

C.6: Staff Information Form.

Project Title: Developing a novel system to support language acquisition in children with complex communication needs

Information for School Staff

"Developing a novel system..." is a research project that is the focus of my doctoral studies currently being undertaken at the University of Dundee. I am aiming to better support children with complex communication needs in their acquisition of vocabulary, and with a view to improving literacy outcomes in the longer term. I plan to do this by developing and testing a new electronic communication device that will allow children to explore the lexicon of their environment in a more intuitive way than most current, symbol-based AAC or assistive technology devices.

I would like families, carers, teachers, therapists – and the children who will benefit from the device – to help me to design it. To do so I need to better understand the systems currently in place in your school, and the methods you use to gauge progress in vocabulary acquisition.

The project will take the form of three discrete studies each lasting a few weeks to a few months, distributed over a period of approximately 18 months. Initially I will visit the school to find out more about the day to day activities, speak to staff and the children and generally collect information that can help us to design the new device. Later in the project I will – with the benefit of advice from school staff – identify a small group of children and invite them to participate in the project. I would like to invite teachers, classroom assistants and other members of staff to participate as well. I will approach members of staff who know the participating children to help us in the design of this new communication device. Towards the end of the project, during the course of the final study, I will evaluate a prototype device with the help of some of the children and staff in the school.

We would like you to help us!

I have some experience in communication aids and disability issues. But, in order to create this new device, I need to find out more about how children in the school gain vocabulary and language skills. In order to establish this information I would like to:

- talk to children, their family and their school teachers and therapists,
- join children during their day at school and
- involve all interested parties in the design of a prototype communication device.

What is important to know?

- This research is approved by the relevant ethics committees.
- All researchers involved have Enhanced Disclosure Scotland certification.
- We will make sure that all participants have full control over the information they
- give us.
- We will look after any data we collect during this study.
- We are not researching the school's or the children's performance.
- You can withdraw your help at any stage of the project if you change your mind.

It is important that participants understand that this is a research project and that a system like the one being developed may not be commercially available, although it is hoped that one day people may be able to buy a similar system. However, even if a system like this

C.6: Staff Information Form.

does not materialise, the help participants give us will provide important insights into how communication systems may be improved in the future.

How to contact us

If you have any questions or would like more information please contact Chris Norrie, the researcher or his supervisor Professor Annalu Waller, at the University of Dundee's Computing Department. You can reach both via the following contact details:

Contact:	Email:	Phone:
Mr Chris Norrie	c.s.norrie@dundee.ac.uk	01382 386527
Prof. Annalu Waller	a.waller@dundee.ac.uk	01382 388223

Write to:

School of Science and Engineering (Computing), University of Dundee, Queen Mother Building, Dundee DD1 4HN

C.7: Staff Consent Form.

"Developing a novel system to support language acquisition in children with complex communication needs" Project

INFORMED CONSENT FORM

Staff

Dear Staff Member,

Thank you for your interest in the "Developing a novel system to support language acquisition in children with complex communication needs" Project. These pages describe your participation in this research. Please read through them and then sign at the bottom to say that you understand and accept the conditions of this study. You will have received two copies of this document, please keep one copy for your own records. If you have any questions, please feel free to ask the researcher. You will find his contact details at the end of this document.

Your Participation

We will speak to you at school to explain the project and confirm that you would like to take part. We may then observe your work with the children for parts of the school day for several days in order to get a detailed understanding of communication systems or strategies in use to assist vocabulary acquisition.

Based on what we discover we will then work closely with the children and relevant staff to design a prototype new communication aid to support vocabulary acquisition. We may include you in the design process by asking for your ideas and feedback for different design stages during the process.

Please note that this study is not evaluating your, the children's, or the school's performance. Participants are not being tested – we are only gathering information to design a new communication tool. There are therefore no right or wrong responses.

Participation in this study is purely voluntary and you are free to leave the study at any time without penalty or giving reasons. No undue risk arises from participation in this study.

You may be videoed or photographed during some parts of the study to support the information gathering process. All the information given to us including personal images will be stored safely and kept separate from information about participants' identities. Access to the data will be restricted to the people involved in this research. If a participant's data is used for scientific publications or presentations, no reference to his/her identity will be made. Some video clips that show an important point may be used in presentations at research conferences and meetings or for teaching purposes. If a photograph or video clip is used for a presentation, the name of the participant will be changed.

C.7: Staff Consent Form.

With reference to video or photographic images of yourself and their use for research or teaching publications and presentations, please tick the following boxes as appropriate:

□ I **agree** to my being videoed or photographed during sessions for research purposes.

If you have agreed to the previous option, please tick one of the following options:

□ I **agree** that video or photographic images of myself can be used at research conferences and meetings or for teaching purposes.

□ I **do not agree** that video or photographic images of myself can be used at research conferences and meetings or for teaching purposes.

□ **I do not agree** to being videoed or photographed during sessions for research purposes.

It is important that participants understand that this is a research project and that a system like the one being developed may not be commercially available, although it is hoped that one day people may be able to buy a similar system. However, even if a system such as this does not materialise, the help participants give us will provide important insights into how communication systems may be improved in the future.

Please date and sign this page below to indicate that you understand and accept the conditions of this study. We would like to take the opportunity to thank you for your support.

Your Name:_____

Date: / / 2017 Signature: _____

Researcher's Name: Chris Norrie

Date: / / 2017 Signature: _____

C.7: Staff Consent Form.

How to contact us

If you have any questions or would like more information please contact Chris Norrie, the researcher or his supervisor Professor Annalu Waller, at the University of Dundee's Computing Department. You can reach both via the following contact details:

Contact:	Email:	Phone:
Mr Chris Norrie	c.s.norrie@dundee.ac.uk	01382 386527
Prof. Annalu Waller	a.waller@dundee.ac.uk	01382 388223

Write to:

School of Science and Engineering (Computing), University of Dundee, Queen Mother Building, Dundee DD1 4HN

C.8: Parent/Carer Information Form.

Project Title: Developing a novel system to support language acquisition in children with complex communication needs

Information for Parents / Guardians

"Developing a novel system..." is a research project that is the focus of my doctoral studies currently being undertaken at the University of Dundee. I am aiming to better support children with communication impairments in their acquisition of vocabulary, and with a view to improving literacy outcomes in the longer term. I plan to do this by developing and testing a new electronic communication device that will allow children to explore the vocabulary of their environment in a more intuitive way than most current, symbol-based AAC or assistive technology devices.

I would like families, carers, teachers, therapists – and the children who will benefit from the device – to help me to design it. To do so I need to better understand the systems currently in place in your school, and the methods you use to gauge progress in vocabulary acquisition.

The project will take the form of three discrete studies, each lasting from a few weeks up to a few months, distributed over a timeframe of approximately 18 months in total. Initially I will visit the school to find out more about the day to day activities, speak to staff and the children and generally collect information that can help us to design the new device. Later in the project I will – with the benefit of advice from school staff – identify a small group of children and invite them to participate in the project. I would like to invite teachers, classroom assistants and other members of staff to participate as well. I will approach members of staff who know the participating children to help us in the design of this new communication device. Towards the end of the project, during the course of the final study, I will evaluate a prototype device with the help of some of the children and staff in the school.

We would like you to help us!

I have some experience in communication aids and disability issues. But, in order to create this new device, I need to find out more about how children in the school gain vocabulary and language skills. In order to establish this information I would like to:

- talk to children, their family and their school teachers and therapists,
- join children during their day at school and
- involve all interested parties in the design of a prototype communication device.

What is important to know?

- This research is approved by the relevant ethics committees.
- All researchers involved have Enhanced Disclosure Scotland certification.
- We will make sure that all participants have full control over the information they
- give us.
- We will look after any data we collect during this study.
- We are not researching the school's or the children's performance.
- You can withdraw your help at any stage of the project if you change your mind.

It is important that participants understand that this is a research project and that a system like the one being developed may not be commercially available, although it is hoped that

C.8: Parent/Carer Information Form.

one day people may be able to buy a similar system. However, even if a system like this does not materialise, the help participants give us will provide important insights into how communication systems may be improved in the future.

How to contact us

If you have any questions or would like more information please contact Chris Norrie, the researcher or his supervisor Professor Annalu Waller, at the University of Dundee's Computing Department. You can reach both via the following contact details:

Contact:	Email:	Phone:
Mr Chris Norrie	c.s.norrie@dundee.ac.uk	01382 386527
Prof. Annalu Waller	a.waller@dundee.ac.uk	01382 388223

Write to:

School of Science and Engineering (Computing), University of Dundee, Queen Mother Building, Dundee DD1 4HN

C.9: Parent/Carer Consent Form.

"Developing a novel system to support language acquisition in children with complex communication needs" Project

INFORMED CONSENT FORM

Parents/Guardians

Dear Parent or Guardian,

Thank you for your interest in the "Developing a novel system to support language acquisition in children with complex communication needs" Project. These pages describe your participation in this research. Please read through them and then sign at the bottom to say that you understand and accept the conditions of this study. You will have received two copies of this document, please keep one copy for your own records. If you have any questions, please feel free to ask the researcher. You will find his contact details at the end of this document.

Your Participation

We will speak to your child at school to explain the project and confirm that he/she would like to take part. We may then observe your child for parts of the school day for several days in order to get a detailed understanding of communication systems or strategies in use to assist their vocabulary acquisition.

Based on what we discover we will then work closely with your child and his/her teachers or therapists to design a prototype communication aid to support your child's vocabulary acquisition. We may include you and your child in the design process by asking for your ideas and feedback to different design stages during the process.

Please note that this study is not evaluating your child's or the school's performance. Participants are not being tested – we are only gathering information to design a new communication tool. There are therefore no right or wrong responses.

Participation in this study is purely voluntary and you and your child can leave the study at any time without penalty or giving reasons. No undue risk arises from participation in this study.

Your child may be videoed or photographed during some parts of the study to support the information gathering process. All the information given to us including personal images will be stored safely and kept separate from information about participants' identities. Access to the data will be restricted to the people involved in this research. If a participant's data is used for scientific publications or presentations, no reference to his/her identity will be made. Some video clips that show an important point may be used in presentations at research conferences and meetings or for teaching purposes. If a photograph or video clip is used for a presentation, the name of the participant will be changed.

C.9: Parent/Carer Consent Form.

With reference to video or photographic images of your child and their use for research or teaching publications and presentations, please tick the following boxes as appropriate:

□ I **agree** to my child being videoed or photographed during sessions for research purposes.

If you have agreed to the previous option, please tick one of the following options:

□ I **agree** that video or photographic images of my child can be used at research conferences and meetings or for teaching purposes.

□ I **do not agree** that video or photographic images of my child can be used at research conferences and meetings or for teaching purposes.

□ **I do not agree** to my child being videoed or photographed during sessions for research purposes.

It is important that participants understand that this is a research project and that a system like the one being developed may not be commercially available, although it is hoped that one day people may be able to buy a similar system. However, even if a system like this does not materialise, the help participants give us will provide important insights into how communication systems may be improved in the future.

Please date and sign this page below to indicate that you understand and accept the conditions of this study. We would like to take the opportunity to thank you for your support.

Name of Participant:_____

Your Relationship to Participant _____

Your Name:_____

Date: / / 2017 Signature: _____

Researcher's Name: Chris Norrie

Date: / / 2017 Signature: _____

C.9: Parent/Carer Consent Form.

How to contact us

If you have any questions or would like more information please contact Chris Norrie, the researcher or his supervisor Professor Annalu Waller, at the University of Dundee's Computing Department. You can reach both via the following contact details:

Contact:	Email:	Phone:
Mr Chris Norrie	c.s.norrie@dundee.ac.uk	01382 386527
Prof. Annalu Waller	a.waller@dundee.ac.uk	01382 388223

Write to:

School of Science and Engineering (Computing), University of Dundee, Queen Mother Building, Dundee DD1 4HN

C.10: Child Participant Consent Form.

"Developing a novel system to support language acquisition in children with communication impairments" Project

ASSENT FORM

Thank you for your interest in our project!

I want to build a computer that will help you to learn words easily.

I would like to join you at school and see how you find out about words – and record how you learn them

Then I will show you some ideas about how we might make learning easier – and see what you think of them.

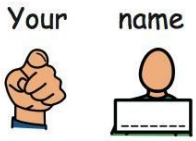
Do you want to help me?

C.10: Child Participant Consent Form.

Tick for "Yes"

May I video you?

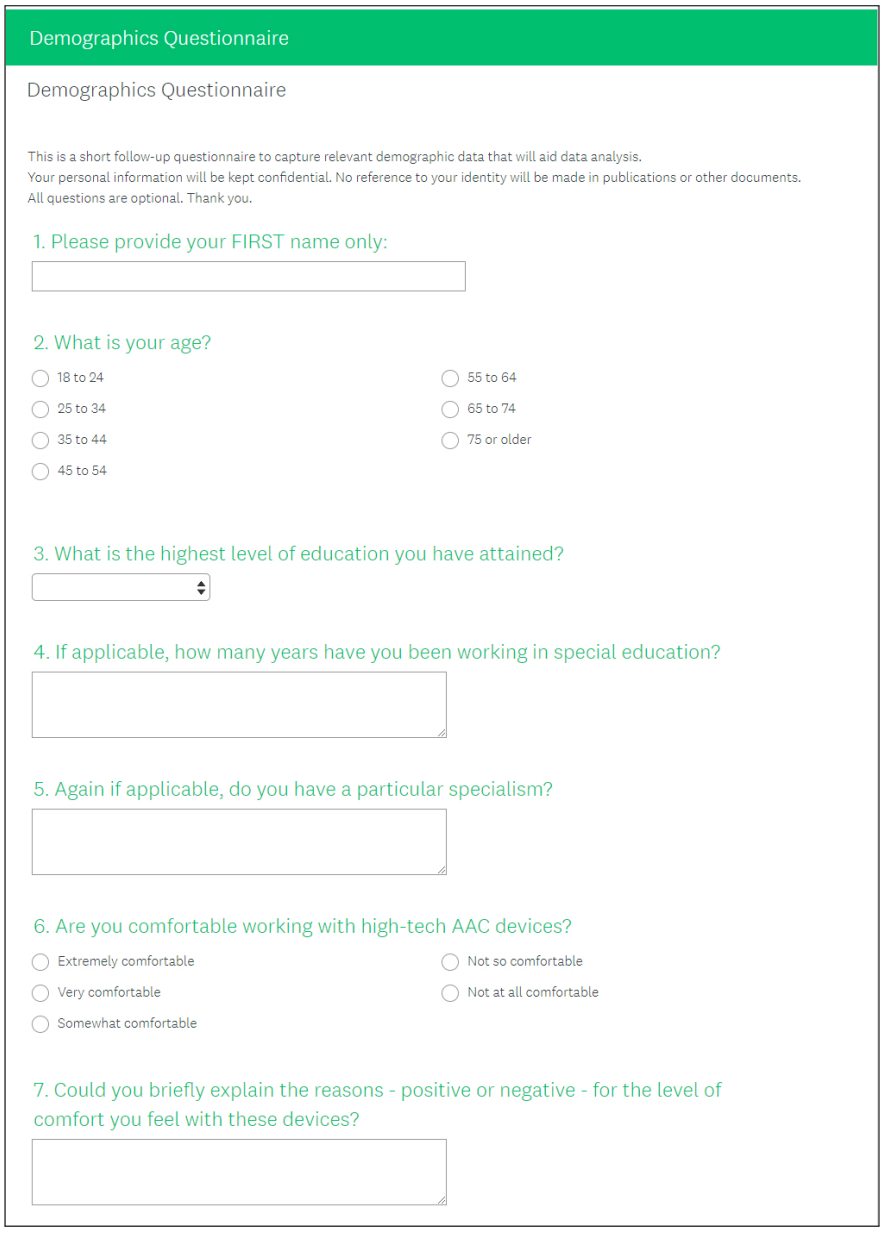
Tick for "Yes"



.....
Your name

.....
Your Signature

C.11: Study 1 Member Check Survey.



Demographics Questionnaire

Demographics Questionnaire

This is a short follow-up questionnaire to capture relevant demographic data that will aid data analysis.
Your personal information will be kept confidential. No reference to your identity will be made in publications or other documents.
All questions are optional. Thank you.

1. Please provide your FIRST name only:

2. What is your age?

- 18 to 24
- 25 to 34
- 35 to 44
- 45 to 54
- 55 to 64
- 65 to 74
- 75 or older

3. What is the highest level of education you have attained?

4. If applicable, how many years have you been working in special education?

5. Again if applicable, do you have a particular specialism?

6. Are you comfortable working with high-tech AAC devices?

- Extremely comfortable
- Very comfortable
- Somewhat comfortable
- Not so comfortable
- Not at all comfortable

7. Could you briefly explain the reasons - positive or negative - for the level of comfort you feel with these devices?

Appendix D - Study 2: Study Materials

This appendix contains material generated during Study 2 (presented in Chapter 4).

D.12: Staff Information Sheet Update.

Project Title: Supporting Augmentative and Alternative Communication (AAC) Technology in a Special Education Setting

Information for School Staff

"Supporting AAC..." is a research project that is the focus of my doctoral studies currently being undertaken at the University of Dundee. I am aiming to work with educators to enhance support for children with complex communication needs in their acquisition of communication skills, and with a view to improving pedagogical outcomes in the longer term. I plan to support staff so that they can help children get the best out of their AAC technology. This may involve developing easier ways to personalise these systems, bringing about an enhanced and more engaging learning experience.

I would like families, carers, teachers, therapists – and the children who will benefit from AAC technology – to help me. To do so I need to better understand the systems and strategies currently in place in your school, and the methods you use to gauge progress.

The project will take the form of a major study lasting up to six months, where I will be embedded in the classroom working closely with children who use AAC, and with their teachers and other professionals and support staff. Initially I will visit the school to find out more about the day to day activities, speak to staff and the children and generally collect information through observation and participation in teaching activities. As the project progresses I hope to enhance the use of AAC in the classroom by supporting personalisation and innovating timely interventions to assist children in meeting their teacher's learning intentions.

We would like you to help us!

I have some experience in communication aids and disability issues. However, in order to enhance support for children who use AAC, I need to find out more about how aided communicators in the school gain communication skills. In order to establish this information I would like to:

- talk to children, their family and their school teachers and therapists,
- join children during their day at school and
- work to develop a framework aiming to support staff to engage more easily with the technology in order to enhance children's learning opportunities.

What is important to know?

- This research is approved by the relevant ethics committees.
- All researchers involved have Enhanced Disclosure Scotland certification.
- We will make sure that all participants have full control over the information they
- give us.
- We will look after any data we collect during this study.
- We are not researching the school's or the children's performance.
- You can withdraw your help at any stage of the project if you change your mind.

How to contact us

If you have any questions or would like more information please contact Chris Norrie, the researcher or his supervisor Professor Annalu Waller, at the University of Dundee's Computing Department. You can reach both via the following contact details:

D.12: Staff Information Sheet Update.

Contact:	Email:	Phone:
Mr Chris Norrie	c.s.norrie@dundee.ac.uk	01382 386534
Prof. Annalu Waller	a.waller@dundee.ac.uk	01382 388223

Write to:

School of Science and Engineering (Computing), University of Dundee, Queen Mother Building, Dundee DD1 4HN

D.13: Staff Consent Form Update.

"Supporting Augmentative and Alternative Communication (AAC) Technology in a Special Education Setting" Project

INFORMED CONSENT FORM

Staff

Dear Staff Member,

Thank you for your interest in the "Supporting Augmentative and Alternative Communication (AAC) Technology in a Special Education Setting" Project. These pages describe your participation in this research. Please read through them and then sign at the bottom to say that you understand and accept the conditions of this study. You will have received two copies of this document, please keep one copy for your own records. If you have any questions, please feel free to ask the researcher. You will find his contact details at the end of this document.

Your Participation

We will speak to you at school to explain the project and confirm that you would like to take part. We may then observe your work with the children for parts of the school day for several days in order to get a detailed understanding of communication systems or strategies in use to assist communication skills acquisition.

Based on what we discover we will then work closely with the children and relevant staff to develop a framework aiming to support staff to engage more easily with AAC technology in order to enhance children's learning opportunities.

Please note that this study is not evaluating your, the children's, or the school's performance. Participants are not being tested – we are only gathering information to support the development of the framework. There are therefore no right or wrong responses.

Participation in this study is purely voluntary and you are free to leave the study at any time without penalty or giving reasons. No undue risk arises from participation in this study.

You may be videoed or photographed during some parts of the study to support the information gathering process. All the information given to us including personal images will be stored safely and kept separate from information about participants' identities. Access to the data will be restricted to the people involved in this research. If a participant's data is used for scientific publications or presentations, no reference to his/her identity will be made. Some video clips that show an important point may be used in presentations at research conferences and meetings or for teaching purposes. If a photograph or video clip is used for a presentation, the name of the participant will be changed.

D.13: Staff Consent Form Update.

With reference to video or photographic images of yourself and their use for research or teaching publications and presentations, please tick the following boxes as appropriate:

□ I **agree** to my being videoed or photographed during sessions for research purposes.

If you have agreed to the previous option, please tick one of the following options:

□ I **agree** that video or photographic images of myself can be used at research conferences and meetings or for teaching purposes.

□ I **do not agree** that video or photographic images of myself can be used at research conferences and meetings or for teaching purposes.

□ **I do not agree** to being videoed or photographed during sessions for research purposes.

Please date and sign this page below to indicate that you understand and accept the conditions of this study. We would like to take the opportunity to thank you for your support.

Your Name:_____

Date: / / 2018 Signature: _____

Researcher's Name: Chris Norrie

Date: / / 2018 Signature: _____

How to contact us

If you have any questions or would like more information please contact Chris Norrie, the researcher or his supervisor Professor Annalu Waller, at the University of Dundee's Computing Department. You can reach both via the following contact details:

Contact:	Email:	Phone:
Mr Chris Norrie	c.s.norrie@dundee.ac.uk	01382 386534
Prof. Annalu Waller	a.waller@dundee.ac.uk	01382 388223

D.13: Staff Consent Form Update.

Write to:

School of Science and Engineering (Computing), University of Dundee, Queen Mother Building, Dundee DD1 4HN

D.14: Parent/Carer Information Sheet Update.

Project Title: Supporting Augmentative and Alternative Communication (AAC) Technology in a Special Education Setting

Information for Parents / Guardians

"Supporting AAC..." is a research project that is the focus of my doctoral studies currently being undertaken at the University of Dundee. I am aiming to work with educators to enhance support for children with complex communication needs in their acquisition of communication skills, and with a view to improving pedagogical outcomes in the longer term. I plan to support staff so that they can help children get the best out of their AAC technology. This may involve developing easier ways to personalise these systems, bringing about an enhanced and more engaging learning experience.

I would like families, carers, teachers, therapists – and the children who will benefit from AAC technology – to help me. To do so I need to better understand the systems and strategies currently in place in your school, and the methods you use to gauge progress.

The project will take the form of a major study lasting up to six months, where I will be embedded in the classroom working closely with children who use AAC, and with their teachers and other professionals and support staff. Initially I will visit the school to find out more about the day to day activities, speak to staff and the children and generally collect information through observation and participation in teaching activities. As the project progresses I hope to enhance the use of AAC in the classroom by supporting personalisation and innovating timely interventions to assist children in meeting their teacher's learning intentions.

We would like you to help us!

- I have some experience in communication aids and disability issues. However, in order to enhance support for children who use AAC, I need to find out more about how aided communicators in the school gain communication skills. In order to establish this information I would like to:

- talk to children, their family and their school teachers and therapists,
- join children during their day at school and
- work to develop a framework aiming to support staff to engage more easily with the technology in order to enhance children's learning opportunities.

What is important to know?

- This research is approved by the relevant ethics committees.
- All researchers involved have Enhanced Disclosure Scotland certification.
- We will make sure that all participants have full control over the information they
- give us.
- We will look after any data we collect during this study.
- We are not researching the school's or the children's performance.
- You can withdraw your help at any stage of the project if you change your mind.

How to contact us

If you have any questions or would like more information please contact Chris Norrie, the researcher or his supervisor Professor Annalu Waller, at the University of Dundee's Computing Department. You can reach both via the following contact details:

D.14: Parent/Carer Information Sheet Update.

Contact:	Email:	Phone:
Mr Chris Norrie	c.s.norrie@dundee.ac.uk	01382 386534
Prof. Annalu Waller	a.waller@dundee.ac.uk	01382 388223

Write to:

School of Science and Engineering (Computing), University of Dundee, Queen Mother Building, Dundee DD1 4HN

D.15: Parent/Carer Consent Form Update.

"Supporting Augmentative and Alternative Communication (AAC) Technology in a Special Education Setting" Project

INFORMED CONSENT FORM

Parents/Guardians

Dear Parent or Guardian,

Thank you for your interest in the "Supporting Augmentative and Alternative Communication (AAC) Technology in a Special Education Setting" Project. These pages describe your participation in this research. Please read through them and then sign at the bottom to say that you understand and accept the conditions of this study. You will have received two copies of this document, please keep one copy for your own records. If you have any questions, please feel free to ask the researcher. You will find his contact details at the end of this document.

Your Participation

We will speak to your child at school to explain the project and confirm that he/she would like to take part. We may then observe your child for parts of the school day for several days in order to get a detailed understanding of communication systems or strategies in use to assist their communication skills acquisition.

Based on what we discover we may then work closely with your child and his/her teachers or therapists to develop a framework aiming to support staff in engaging more easily with AAC technology in order to enhance your child's learning opportunities.

Please note that this study is not evaluating your child's or the school's performance. Participants are not being tested – we are only gathering information to support the development of the framework. There are therefore no right or wrong responses.

Participation in this study is purely voluntary and you and your child may leave the study at any time without penalty or giving reasons. No undue risk arises from participation in this study.

Your child may be videoed or photographed during some parts of the study to support the information gathering process. All the information given to us including personal images will be stored safely and kept separate from information about participants' identities. Access to the data will be restricted to the people involved in this research. If a participant's data is used for scientific publications or presentations, no reference to his/her identity will be made. Some video clips that show an important point may be used in presentations at research conferences and meetings or for teaching purposes. If a photograph or video clip is used for a presentation, the name of the participant will be changed.

D.15: Parent/Carer Consent Form Update.

With reference to video or photographic images of your child and their use for research or teaching publications and presentations, please tick the following boxes as appropriate:

□ I **agree** to my child being videoed or photographed during sessions for research purposes.

If you have agreed to the previous option, please tick one of the following options:

□ I **agree** that video or photographic images of my child can be used at research conferences and meetings or for teaching purposes.

□ I **do not agree** that video or photographic images of my child can be used at research conferences and meetings or for teaching purposes.

□ **I do not agree** to my child being videoed or photographed during sessions for research purposes.

□ **I agree** to my child's pupil progress record (PPR) being accessed by the researcher to establish contextual data for the study.

□ **I do not agree** to my child's pupil progress record (PPR) being accessed by the researcher to establish contextual data for the study.

Please date and sign this page below to indicate that you understand and accept the conditions of this study. We would like to take the opportunity to thank you for your support.

Name of Participant:_____

Your Relationship to Participant _____

Your Name:_____

Date: / / 2019 Signature: _____

Researcher's Name: Chris Norrie

Date: / / 2019 Signature: _____

D.15: Parent/Carer Consent Form Update.

How to contact us

If you have any questions or would like more information please contact Chris Norrie, the researcher or his supervisor Professor Annalu Waller, at the University of Dundee's Computing Department. You can reach both via the following contact details:

Contact:	Email:	Phone:
Mr Chris Norrie	c.s.norrie@dundee.ac.uk	01382 386534
Prof. Annalu Waller	a.waller@dundee.ac.uk	01382 388223

Write to:

School of Science and Engineering (Computing), University of Dundee, Queen Mother Building, Dundee DD1 4HN

D.16: Child Participant Consent Form Update.

"Supporting Augmentative and Alternative Communication (AAC) Technology in a Special Education Setting" Project

ASSENT FORM

Thank you for your interest in our project!

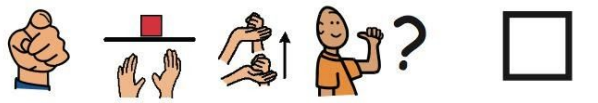
I want to work with your computer to help you learn words easily.

I would like to join you at school and see how you find out about words – and record how you learn them

Then I will show you some ideas about how we might make learning easier – and see what you think of them.

Do you want to help me?

D.16: Child Participant Consent Form Update.



Tick for "Yes"

May I video you?

Tick for "Yes"

.....
Your name

.....
Your Signature

D.17: Study 2 Interview Guide.

Discussion Guide

End of Study 2 Interviews

Aim: To gauge the perceptions of adult stakeholders regarding the researcher's intervention in class in the role of Assistive Technologist - and to document any perceived effect on the quality of support the role's presence in the classroom offered to emerging communicators using hi-tech AAC.

Highlight

- All questions are optional.
- Your personal data will be kept confidential - no reference will be made to your identity in publication or other documents.
- Your participation is voluntary and you are free to withdraw from the study at any time without giving any reason and without penalty.
- Our focus is upon obtaining different perspectives on the success or failure of embedding a specific role within the class. Please remember that the researcher's presence was part of a research study, and as such we may expect there will have been mistakes as well as "triumphs" - and this is your opportunity to share either with us.

ROLE: TEACHER

Demographics/Background

Age/Gender/ Level of Education/Level of Computer Literacy (captured via Demographics sheet)

Initial Impressions of Assistive Technologist Role

- I've been here for five months. What do you think I have been doing?
- How would you describe or name my role?
- The role I am exploring is that of the Assistive Technologist. As a teacher, are there any advantages that you have noticed from having me embedded in the classroom?

1

D.17: Study 2 Interview Guide.

- Are there any disadvantages that you have noticed from having me embedded in the classroom?
- Who, or which "group" within the class, do you think the Assistive Technologist helped to support most during the study (eg. the adult practitioners or the children?)
- Are you aware of any impact the presence of this role in your classroom may have had on the practices of allied professionals collaborating with your team and pupils?

C1 progress – and impact of device failure

Thinking now about C1 (our focus child participant/aided communicator):

- How would you characterise C1's progress since the beginning of the study?
- Have you noticed any change in C1's demeanour since the start of the study?
- Have you noticed any change in his communicative competencies? (i.e grammatical knowledge, as well as social knowledge about how and when to use utterances appropriately. For AAC users this also involves operational elements eg. the ability to navigate an SGD interface effectively).
    - If yes - what changes have you seen?
    - How would you explain these changes?
    - Are there any aspects of the Assistive Technologist's contribution in assisting C1 that you could pinpoint as being helpful or unhelpful?
        - If not helpful, [**prompt**] what do you think he should have done?
- Thinking particularly about the two month enforced hiatus from his device C1 experienced (when it was taken away for repair) - did you notice any effect, positive or negative, on the child's mood or behaviour? Again thinking in terms of progress or demeanour? And communicative competencies?
- In your opinion, did the presence of an Assistive Technologist help or hinder in addressing this unplanned deficit?
    - In what way?

High Tech AAC Candidacy and Assessment

Moving on to how we assess children as candidates for a high tech AAC device:

- Can you briefly summarise the procedures, as you understand them, in identifying a child in your class as a candidate for high tech AAC support?
- During the course of the study I noticed more children are being assessed for high

D.17: Study 2 Interview Guide.

tech AAC – is there a momentum to get more children supported in this way?
    - If yes, who do you think is driving that?
    - What input do you have?
    - Do you feel you have the resources to support more children in your class with high tech AAC?
    - How might an Assistive Technologist, in your opinion, contribute to meeting this challenge (if at all)?

Reflecting Further on the Role

I'd like to gauge your thoughts on the future for an Assistive Technologist role in SE schools:

- My time here has been very limited. Is there anything you are doing differently or intend to do differently as a result of our collaboration?
- What is your overall opinion of the experience of having an Assistive Technologist working with you these last few months?
- Do you foresee a future for the role of Assistive Technologist in your school?
    - If yes, and they do not elaborate [**prompt**] why?
    - If no, and they do not elaborate [**prompt**] why not?
- I'd like you to imagine you are writing a job description for the role in your school. What do you think would be mandatory skills? (Examples might be Makaton, or aided language stimulation).
- What would be desirable skills?
- What would be the most important duties? (Examples might be hardware maintenance, or online activity development)

Supporting Pedagogy for AAC Users

As a teacher, I'd like you to talk a little about pedagogical support within the class:

- How do you go about meeting pedagogical goals for children who use high tech AAC?
    - Can you list any tools, instruments, theoretical frameworks in use?
- What barriers do you face in this context?
- How do you go about overcoming these barriers?
- Has or had the Assistive Technologist role any contribution to make in this area?
- In this context, what do you think the primary focus of the Assistive Technologist role can or should be?

D.17: Study 2 Interview Guide.

Staff and Parent/Carer Training Opportunities

Thinking about training needs:

- Do you find the training opportunities available to you adequate for supporting high tech AAC users in terms of:
    - Pedagogical support? (If you do not understand this to be your responsibility, whose responsibility is it? Is the support they provide timely and effective?)
    - Software maintenance and support? (As above)
    - Hardware maintenance and support? (As above)
- Do you think training other team members in assistive technology skills should be a part of the Assistive Technologist's role?
    - Depending upon answer: **[Prompt]** Why or why not?

Finally

Are there any questions you would like to ask me?

Thank you for allowing me this opportunity to speak with you, and for sharing your thoughts and ideas with me. It has been a pleasure working with you.

D.17: Study 2 Interview Guide.

ROLE: Speech Language Therapist

Demographics/Background

Age/Gender/ Level of Education/Level of Computer Literacy (captured via Demographics sheet)

Initial Impressions of Assistive Technologist Role

- I've been embedded in class for five months. What do you think I have been doing?
- How would you describe or name my role?
- The role I am exploring is that of the Assistive Technologist. As an SLT, are there any advantages that you have noticed - or been otherwise made aware of since I know you have limited class contact time - from having me embedded in the classroom?
- As an SLT, are there any disadvantages that you have noticed from having me embedded in the classroom?
- Who, or which "group" within the class, do you think the Assistive Technologist helped to support most during the study (eg. the adult practitioners or the children?)
- Are you aware of any other impact the presence of this role in the classroom may have had on the practices of allied professionals collaborating with class team and pupils?

C1 progress – and impact of device failure

Thinking now about C1 (our focus child participant/aided communicator):

- How would you characterise C1's progress since the beginning of the study in October?
- Have you noticed any change in C1's demeanour since the start of the study?
- Have you noticed any change in his communicative competencies? (i.e grammatical knowledge, as well as social knowledge about how and when to use utterances appropriately. For AAC users this also involves operational elements eg. the ability to navigate an SGD interface effectively).
    - If yes - what changes have you seen?
    - How would you explain these changes?

5

D.17: Study 2 Interview Guide.

    - Are there any aspects of the Assistive Technologist's contribution in assisting C1 that you could pinpoint as being helpful or unhelpful?
        - If not, [**prompt**] what do you think he should have done?
- Thinking particularly about the two month enforced hiatus from his device C1 experienced (when it was removed for repair) - did you notice any effect, positive or negative, on the child's mood or behaviour? Again thinking in terms of progress or demeanour? And communicative competencies?
- In your opinion, did the presence of an Assistive Technologist help or hinder in addressing this unplanned deficit?
    - In what way?

Hi Tech AAC Candidacy and Assessment

Moving on to how we assess children as candidates for a high tech AAC device:

- I know you have shared information on this topic with me before but can you briefly summarise the procedures, as you understand them, in identifying a child in the school as a candidate for high tech AAC support?
- During the course of the study I noticed more children are being assessed for high tech AAC – is there a momentum to get more children supported in this way?
    - If yes, who do you think is driving that?
    - What input do you have?
    - Do you feel you have the resources to support more children in the school with high tech AAC?
    - How might an Assistive Technologist, in your opinion, contribute to meeting this challenge (if at all)?

Reflecting Further on the Role

I'd like to gauge your thoughts on the future for an Assistive Technologist role in SE schools:

- My time here has been very limited. Is there anything you are doing differently or intend to do differently as a result of our collaboration?
- What is your overall opinion of the experience of having an Assistive Technologist working with you these last few months?
- Do you foresee a future for the role of Assistive Technologist in special education?

D.17: Study 2 Interview Guide.

    - If yes, and they do not elaborate [**prompt**] why?
    - If no, and they do not elaborate [**prompt**] why not?
- I'd like you to imagine you are writing a job description for the role in your school. What do you think would be mandatory skills? (Examples might be Makaton, or aided language stimulation).
- What would be desirable skills?
- What would be the most important duties? (Examples might be hardware maintenance, or online activity development)

Supporting Pedagogy for AAC Users

Again, as an SLT, I'd like you to talk a little about pedagogical support within a class:

- How do you understand that the teachers go about meeting pedagogical goals for children who use high tech AAC?
- In what way - if at all - does your role contribute to this?
- Do you think an Assistive Technologist role has any contribution to make in this area?
- If so, what do you think the primary focus of the Assistive Technologist role can or should be?

Staff and Parent/Carer Training Opportunities

Thinking about training needs:

- In the context of high tech AAC, to what extent is training other staff and parents/carers a responsibility for you in your role?
- How would you characterise the training opportunities available to you for supporting other staff in this regard?
- Do you think training other team members in assistive technology skills should be a part of the Assistive Technologist's role?
    - Depending upon answer: [**Prompt**] Why or why not?

Finally

Are there any questions you would like to ask me?

Thank you for allowing me this opportunity to speak with you, and for sharing your thoughts and ideas with me. It has been a pleasure working with you.

7

D.17: Study 2 Interview Guide.

ROLE: Learning and Care Assistant

Demographics/Background

Age/Gender/ Level of Education/Level of Computer Literacy (captured via Demographics sheet)

Initial Impressions of Assistive Technologist Role

- I've been here for five months. What do you think I have been doing?
- How would you describe or name my role?
- The role I am exploring is that of the Assistive Technologist. As an LCA, are there any advantages that you have noticed from having me embedded in the classroom?
- Are there any disadvantages that you have noticed from having me embedded in the classroom?
- Who, or which "group" within the class, do you think the Assistive Technologist helped to support most during the study (eg. the adult practitioners or the children?)
- Are you aware of any impact the presence of this role in your classroom may have had on the practices of allied professionals collaborating with your team and pupils?

C1 progress – and impact of device failure

Thinking now about C1 (our focus child participant/aided communicator):

- How would you characterise C1's progress since the beginning of the study?
- Have you noticed any change in C1's demeanour since the start of the study?
- Have you noticed any change in his communicative competencies? (i.e grammatical knowledge, as well as social knowledge about how and when to use utterances appropriately. For AAC users this also involves operational elements eg. the ability to navigate an SGD interface effectively).
    - If yes - what changes have you seen?
    - How would you explain these changes?
    - Are there any aspects of the Assistive Technologist's contribution in assisting C1 that you could pinpoint as being helpful or unhelpful?
        - If not, [**prompt**] what do you think he should have done?

8

D.17: Study 2 Interview Guide.

- Thinking particularly about the two month enforced hiatus from his device C1 experienced (when it was taken away for repair) - did you notice any effect, positive or negative, on the child's mood or behaviour? Again thinking in terms of progress or demeanour? And communicative competencies?
- In your opinion, did the presence of an Assistive Technologist help or hinder in addressing this unplanned deficit?
    - In what way?

High Tech AAC Candidacy and Assessment

Moving on to how we assess children as candidates for a high tech AAC device:

- Can you briefly summarise the procedures, as you understand them, in identifying a child in your class as a candidate for high tech AAC support?
- During the course of the study I noticed more children are being assessed for high tech AAC – is there a momentum to get more children supported in this way?
    - If yes, who is driving that?
    - What input do you have?
    - Do you feel you have the resources to support more children in your class with high tech AAC?
    - How might an Assistive Technologist, in your opinion, contribute to meeting this challenge (if at all)?

Reflecting Further on the Role

I'd like to gauge your thoughts on the future for an Assistive Technologist role in your school:

- My time here has been very limited. Is there anything you are doing differently or intend to do differently as a result of our collaboration?
- What is your overall opinion of the experience of having an Assistive Technologist working with you these last few months?
- Do you foresee a future for the role of Assistive Technologist in your school?
    - If yes, and they do not elaborate **[prompt]** why?
    - If no, and they do not elaborate **[prompt]** why not?
- I'd like you to imagine you are writing a job description for the role in your school. What do you think would be mandatory skills? (Examples might be Makaton, or aided language stimulation).
- What would be desirable skills?
- What would be the most important duties? (Examples might be hardware

D.17: Study 2 Interview Guide.

maintenance, or online activity development)

Supporting Pedagogy for AAC Users

Again, as an LCA, I'd like you to talk a little about pedagogical support within the class:

- How do you go about meeting pedagogical goals for children who use high tech AAC?
  - Can you list any tools, instruments, theoretical frameworks in use?
- What barriers do you face in this context?
- How do you go about overcoming these barriers?
- Has or had the Assistive Technologist role any contribution to make in this area?
- In this context, what do you think the primary focus of the Assistive Technologist role can or should be?

Staff and Parent/Carer Training Opportunities

Thinking about training needs:

- Do you find the training opportunities available to you adequate for supporting high tech AAC users in terms of:
  - Pedagogical support? (If you do not understand this to be your responsibility, whose responsibility is it? Is the support they provide timely and effective?)
  - Software maintenance and support? (As above)
  - Hardware maintenance and support? (As above)
- Do you think training other team members in assistive technology skills should be a part of the Assistive Technologist's role?
  - Depending upon answer: [**Prompt**] Why or why not?

Finally

Are there any questions you would like to ask me?

Thank you for allowing me this opportunity to speak with you, and for sharing your thoughts and ideas with me. It has been a pleasure working with you.

D.17: Study 2 Interview Guide.

ROLE: PARENT/CARER (Of focal aided communicator)

Demographics/Background

Age/Gender/ Level of Education/Level of Computer Literacy (captured via Demographics sheet)

Initial Impressions of Assistive Technologist Role

- I've been working with C1 for five months. What do you think I have been doing?
- How would you describe or name my role?
- The role I am exploring is that of the Assistive Technologist. As a parent or carer, are there any advantages that you have noticed from having me embedded in the classroom?
- Are there any disadvantages that you have noticed from having me embedded in the classroom?
- Who, or which "group" within C1's class, do you think the Assistive Technologist helped to support most during the study (eg. the adult practitioners or the children?)
- Are you aware of any impact the presence of this role in C1's classroom may have had on the practices of allied professionals collaborating with your team and pupils?

C1 progress – and impact of device failure

Thinking now about C1 (our focus child participant/aided communicator):

- How would you characterise your child's progress since the beginning of the study in October?
- Have you noticed any change in your child's demeanour since the start of the study?
- Have you noticed any change in his communicative competencies? (i.e grammatical knowledge, as well as social knowledge about how and when to use utterances appropriately. For AAC users this also involves operational elements eg. the ability to navigate an SGD interface effectively).
    - If yes - what changes have you seen?
    - How would you explain these changes?

11

D.17: Study 2 Interview Guide.

    - Are there any aspects of the Assistive Technologist's contribution in assisting your child that you could pinpoint as being helpful or unhelpful?
        - If not, [**prompt**] what do you think he should have done?
- Thinking particularly about the two month enforced hiatus from his device your child experienced (when it was taken away for repair) - did you notice any effect, positive or negative, on your child's mood or behaviour? Again thinking in terms of progress or demeanour? And communicative competencies?
- In your opinion, did the presence of an Assistive Technologist help or hinder in addressing this unplanned deficit?
    - In what way?
- Is there anything else you would like to share on our work with C1 since October?

High Tech AAC Candidacy and Assessment

Moving on to how we assess children as candidates for a high tech AAC device:

- Can you briefly summarise the procedures, as you understand them, in how C1 was identified as a candidate for high tech AAC support?
- During the course of the study I noticed more children are being assessed for high tech AAC – what is your opinion of that?
    - Can you see any challenges as numbers of high tech users increase within the school?
- How might an Assistive Technologist, from what you have seen, contribute to meeting this challenge (if at all)?

Reflecting Further on the Role

I'd like to gauge your thoughts on the future for an Assistive Technologist role in your child's school:

- My time here has been very limited. Is there anything you are doing differently or intend to do differently as a result of our collaboration?
- What is your overall opinion of the experience of having an Assistive Technologist working with you these last few months?
- Do you foresee a future for the role of Assistive Technologist in your child's school?
    - If yes, and they do not elaborate [**prompt**] why?
    - If no, and they do not elaborate [**prompt**] why not?
- I'd like you to imagine you are writing a job description for the role in your child's school. What do you think would be mandatory skills? (Examples might be

D.17: Study 2 Interview Guide.

Makaton, or aided language stimulation).
- What would be desirable skills?
- What would be the most important duties? (Examples might be hardware maintenance, or online activity development)

Supporting Pedagogy for AAC Users

Again, as a parent or carer, I'd like you to talk a little about pedagogical support within the class:

- Have you discussed with the teacher or SLT how they go about identifying and meeting C1's pedagogical goals?
    - Can you list any tools, instruments, theoretical frameworks that they use?
- What barriers - if any - do you think they face in this context?
- How do you think they go about overcoming these barriers?
- Do you think the Assistive Technologist role has any contribution to make in this area?
- In this context, what do you think the primary focus of the Assistive Technologist role can or should be?

Staff and Parent/Carer Training Opportunities

Thinking about training needs:

- Do you find the training opportunities available to you adequate for supporting C1 in terms of:
    - Pedagogical support? (If you do not understand this to be your responsibility, whose responsibility is it? Is the support they provide timely and effective?)
    - Software maintenance and support? (As above)
    - Hardware maintenance and support? (As above)
- Do you think training staff or parents/carers in assistive technology skills should be a part of the Assistive Technologist's role?
    - Depending upon answer: **[Prompt]** Why or why not?

Finally

Are there any questions you would like to ask me?

Thank you for allowing me this opportunity to speak with you, and for sharing your thoughts and ideas with me. It has been a pleasure working with you.

D.18: Study 2 Staff Survey.

Supporting Augmentative and Alternative Communication (AAC) Technology in a Special Education Setting 1 a

Page 1: Page 1

We would like to invite you to take part in our research study by completing this short survey. Before you decide if you wish to take part, we would like you to understand why the research is being undertaken and what it will involve.

Please read the information sheet at this link: https://drive.google.com/open?id=1tvqwHnt0rrfcH9OyQN_lGlTq8klXLHYE

Chris Norrie
Email: c.s.norrie@dundee.ac.uk

Thank you for taking the time to read this information sheet and for your interest in this study. All information collected for this survey is completely anonymous.

By completing this questionnaire, I agree to my data being used for the research project and I agree that I am 18 years of age or older.*

* By clicking the Next button below you consent to these terms.

1 / 7

D.18: Study 2 Staff Survey.

Page 2: Demographic Information

All Questions Are Optional
Your personal information will be kept confidential No reference will be made to your identity in publications or other documents.
Your participation is voluntary and you are free to withdraw from the study at any time without giving reason and without penalty.

1. Age

- ☐ 18 - 24
- ☐ 25 - 34
- ☐ 35 - 44
- ☐ 45 - 54
- ☐ 55 - 65

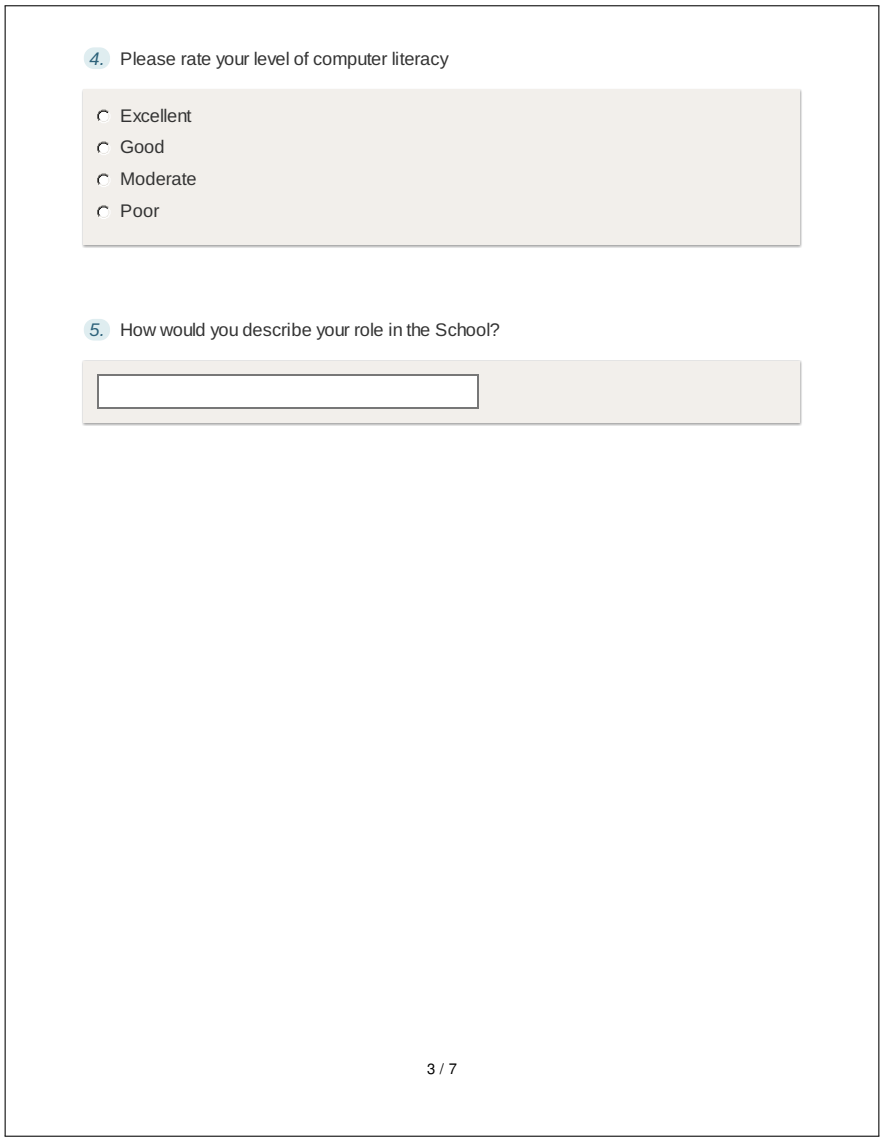
2. Gender

3. Highest level of education

- ○ High school
- ○ College
- ○ University
- ○ Other

2 / 7

D.18: Study 2 Staff Survey.



4. Please rate your level of computer literacy

- Excellent
- Good
- Moderate
- Poor

5. How would you describe your role in the School?

3 / 7

D.18: Study 2 Staff Survey.

Page 3: High Tech Communication Aids

All Questions Are Optional
Your personal information will be kept confidential No reference will be made to your identity in publications or other documents.
Your participation is voluntary and you are free to withdraw from the study at any time without giving reason and without penalty.

6. Are you familiar with high tech communication aids e.g. the speech generating devices used by some of the children in the School?

- ☐ Yes
- ☐ No

7. In special education, how well do you think we support children who use these communication aids?

8. Is there anything you think we should do to improve or extend access to these devices?

4 / 7

D.18: Study 2 Staff Survey.

Page 4: Our Researcher's Presence in the School

All Questions Are Optional
Your personal information will be kept confidential No reference will be made to your identity in publications or other documents.
Your participation is voluntary and you are free to withdraw from the study at any time without giving reason and without penalty.

9. Were you aware of our researcher's (Chris Norrie's) presence in the School?

- ○ Yes
- ○ No

10. If you were aware of our researcher's presence, what is your understanding of the role they had within the classroom? (If you were unaware of the researcher's presence, please write N/A)

5 / 7

D.18: Study 2 Staff Survey.

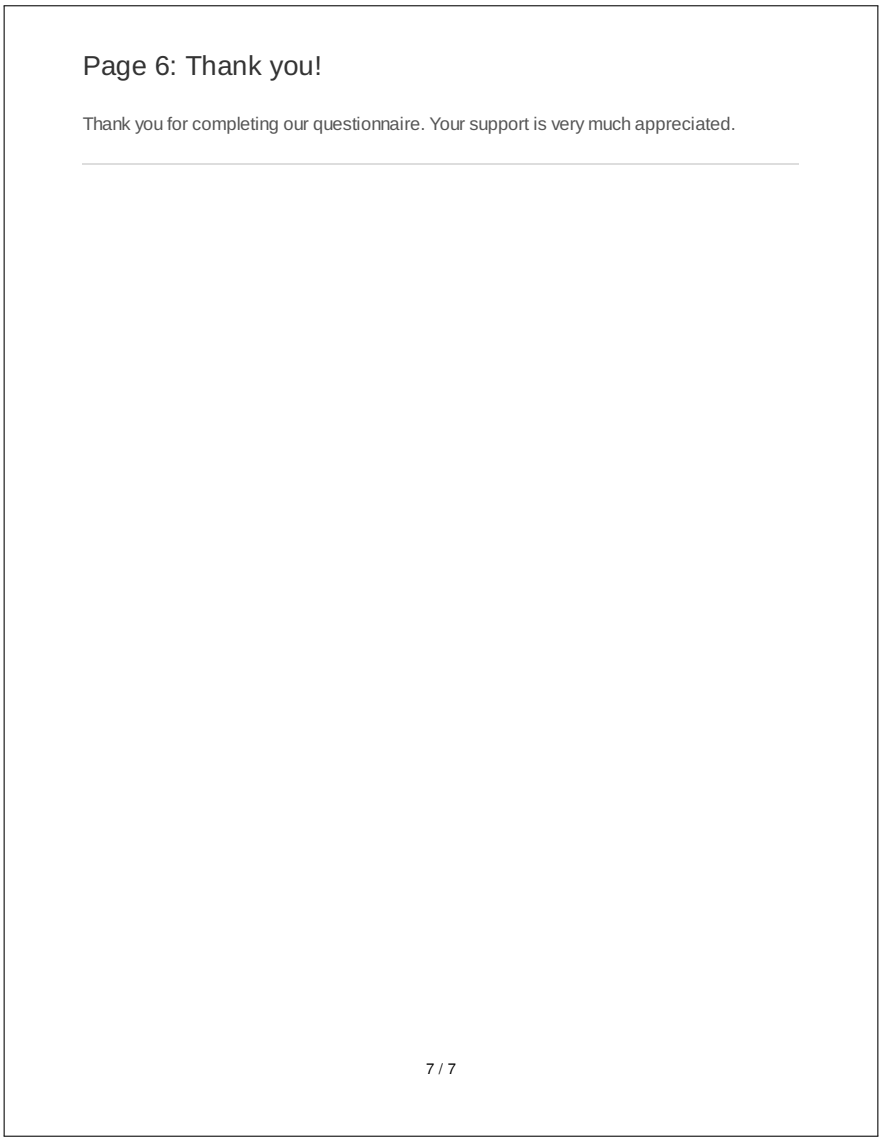
Page 5: Our Researcher's Presence in the School continued

11. If you were aware of the researcher in the School, did you find their presence helpful or unhelpful? Please feel free to explain your opinion in detail.

12. Has the researcher's presence in the School influenced your practice or approach to your role in any way? Please explain.

6 / 7

D.18: Study 2 Staff Survey.



Page 6: Thank you!

Thank you for completing our questionnaire. Your support is very much appreciated.

7 / 7

D.19: Study 2 Class Timetable.

Class Timetable 2018 - 2019

Monday	**8.45 - 9.45** Postural management Personal care IDL activity	**10.00 - 11.15** PE	**10.00 - 11.15** Break Postural management Personal care	**11.15 - 12.15** IDL activity	**12.15 - 1.00** **LUNCH**	**1.00 - 1.30** Tooth Brushing, Personal care, Postural Manage-ment	**1.15 - 2.15** Art	**2.15 - 3.00** Home prep
Tuesday	**8.45 - 9.45** Postural management Personal care IDL activity	**9.45 - 11.30** Learning in the community/IDL activity	**11.30 - 12.15** Postural management Personal care IDL activity				**1.15 - 1.40** IDL activity	**1.40 - 3.00** Sensory Theatre Home prep
Wednesday	**8.45 - 11.00** Swimming	**11.00 - 11.15** Break	**11.15 - 12.15** IDL activity				**1.15 - 2.15** IDL activity	Home prep
Thursday	**8.45 - 9.20** Postural management Personal care IDL activity	**9.20 - 10.40** Music	**10.40 - 11.15** Break Postural management Personal care	**11.15 - 12.15** IDL activity			**1.15 - 2.15** IDL activity	**1.40 - 3.00** Soft Play Home prep
Friday	**8.45 - 9.20** Postural management Personal care IDL activity	**9.20 - 10.20** Primary assembly	**10.40 - 11.15** Break Postural management Personal care	**11.15 - 12.15** IDL activity			**1.15 - 2.15** IDL activity	Home prep

D.20: End of Study 2 Interviews Demographics Form.

Study 2 Demographics Form

This information will be managed according to the data protection act. Information will be stored securely on a password protected university server and updated on an annual basis. All questions are optional.

- Participant No_____
- Age _____
- Gender: Male ☐ Female ☐ Other ☐ _____ Prefer not to say ☐
- Highest level of education:

High School	☐
College	☐
University Undergraduate	☐
University Masters	☐
University Doctoral	☐
Prefer not to say	☐

- Experience in your role:

  Number of years _____

- Please rate your level of computer literacy:

Novice	☐
Moderate	☐
Good	☐
Expert	☐
Prefer not to say	☐

School of Science & Engineering (Computing), UNIVERSITY OF DUNDEE, Dundee DD1 4HN, Scotland, phone: 01382 386534

D.21: Timeline of Interactions During Indi Malfunction.

The Catastrophic Failure* of the Indi During Device Matching Trial - A Timeline			
Study Day	**Moment of Interest**	**ATist Interaction**	**Result**
26	C1 Indi device DOA. Charger not supplied.	Liaise with P02/P04	Charger dispatched from home via Taxi.
"	Indi will not charge. No access to vendor support - Seek SLT advice	Approach two SLTs; agree charger may be at fault, or battery.	SLTs retain device for further inquiries.
"	Tobii Dynavox insists device RTB via courier; no indicator of hiatus timespan, or backup procedures.	Tobii Dynavox via P05; P02.	Advise P02 to seek reassurance in writing for time estimate of disruption, and backup arrangement.
"	Crisis management discussion with P02	P02/P04	Agree route to retrieving/rebuilding personalisation work - based on Study notes. Write note to P04 advising situation.
"	Begin search for temp replacement, email request for stopgap iPad.	School management	No immediate response.
27	C1 has iPad from (abandoned) trial of Liberator GoTalk 9+. ATist plans attempt at installing Snap & Core First on this device.	P04/P02/School Technician (for wifi access).	Council runs a firewall that cannot be breached. Take iPad to University - Snap & Core First requires IOS 11 but iPad can only upgrade to IOS 10; Email P02 to advise request School for newer device.
28	P02 is already noticing differences in C1's demeanor since losing his "voice". He appears grumpier, and more withdrawn.	P02/C1	Agree to monitor situation.

1

D.21: Timeline of Interactions During Indi Malfunction.

Study Day	Moment of Interest	ATist Interaction	Result
30	Continue to chase stopgap iPad from School.	P02/School management	No appropriate device can be sourced.
31	Since device failure, have returned to low tech communication book.	C1	C1 appears less prone to use this independently; will not engage.
35	Evidence of Indi loss impact in asynchronous comms notepad.	P04 (parent/carer)	“Have really missed Indi. Book has been used but not the same”
36	Indi has returned (but not to C1 - destined for a new client) but the personalised content has been saved.	SLT	Wait for C1’s own device begins.
38	C1 does not have his communication book with him (a simple human error, no criticism inferred).	-	The previous day, the ATist had consoled C1 during an activity he disliked by modelling “finished” on his comms book. Today his isolation will be greater.
43	New Indi arrives at School	P05	An SLT will take the device to backup the personalisation (now stored on “The Cloud”) on their home wifi.
44	Indi returned to C1; ATist responsible for checking personalisation is intact.	P05/P02	Device is OK, though the pin is not initially provided. C1 laughs with delight upon receiving his “voice” back.

**From 08/01/19 to 06/03/19 during the Indi trial period, C1 was deprived of his device when it had to be returned to the vendors in Sweden for repair. The ATist’s advocacy for the child’s access to an alternative device, promoting/negotiating support paths to minimise the impacts of the hardware failure, and fostering a joined up approach between stakeholders, may have bolstered the School’s response to this crisis event.*

2

D.22: Describing Key Classroom Roles.

Describing Key TATC Classroom Roles	
Title	**Description**
Core Classroom Staff	
Teacher	A SEN teacher works with children who require additional support; delivers teaching to students on an individual or small class basis; prepares lessons and teaching materials; undertakes assessments of schoolwork; liaises with other professionals, and parents/carers; adapts conventional teaching methods to meet individual children's needs; undertakes admin and record keeping; coordinates work of LCAs and other support staff; attends to pupil welfare (physical, emotional); focus on setting and achieving pedagogical goals.
Learning and Care Assistant	A classroom support member of staff, AKA as a classroom or teaching assistant; assists teacher in preparing learning materials; works with children in small groups or individually to achieve pedagogical goals set by teacher; attends to pupil welfare (physical, emotional).
Healthcare Support and Allied Professionals	
Speech and Language Therapist	* Speech and language therapists deliver treatment, care and support for people who have impairments affecting their communication, eating, drinking and/or swallowing.
Occupational Therapist	* Occupational therapists deliver support to help people overcome the effects of disability caused by illness, ageing or accidents so that they may carry out activities for daily living. In class OTs would, for example, be involved in helping to adapt seating and positioning to best meet the needs of individual children.
Physiotherapist	* Physiotherapists support people impaired by injury, illness or disability through exercise, manual therapy, education and advice. They help clients and patients in pain management and the prevention of disease.
Other Healthcare	These might include general practitioners, consultants, psychologists, registered nurses. Nurses were daily visitors (at regular intervals) to the classroom during the studies, most commonly to support children who were tube fed.

1

D.22: Describing Key Classroom Roles.

Other Support Staff	
Technician	The School Technician occupied a role fielding general IT and electrical-related maintenance issues. This individual was restricted in access to the computer network (administered by the local authority), but did have a troubleshooting role supporting IT peripherals and problems with devices including high tech AAC in the classroom.

* Adapted respectively from:

- Royal College of Speech and Language Therapists (RCSLT)
- Royal College of Occupational Therapists (RCOT)
- Chartered Society of Physiotherapy (CSP)

2

Appendix E - Study 3: Study Materials and Framework Actualisation

This appendix contains material generated during Study 3, and the final framework development and validation process (presented in Chapter 5).

E.23: ATist Job Description Draft.

ROLE PROFILE[1]

JOB TITLE: Assistive Technologist in Special Education

PURPOSE:

The overall purpose of the job is to provide training, advice, guidance and support to staff and pupils, to identify novel solutions and maximise the use of existing technology and AT/AAC equipment, improving outcomes by increasing the impact and benefits for users. This role is also responsible for extending good practice, advice and guidance throughout the School by providing training, briefings and preparing and delivering CPD training to colleagues. As a collaborative role, fulfilling a dual function, you will have significant knowledge, skills and experience in AT and a sharing ethos that benefits colleagues, parents and pupils through modelling, knowledge transfer and communicating good practice.

PRINCIPAL DUTIES:

- To support the development and maintenance of assistive technology equipment across the School including specialist equipment.
- To ensure that support is delivered in accordance with IT policies, departmental procedures and priorities, and legislative Acts.
- To promote, train and support learners and staff in the use of specialist equipment and software.
- To support staff in developing computer based learning materials which support individual pupils learning needs and adapting technology for use by specific students.
- To liaise with keyworkers to ensure they are familiar with specialist equipment used to meet a learner's individual needs.
- To provide advice and guidance about the development and use of assistive technology to colleagues from other disciplines and the Senior Management Team.

[1] Adapted from Scope/Beaumont College & Natspec Job Descriptions

E.23: ATist Job Description Draft.

- To undertake assistive technology assessments in conjunction with educational, therapy and communication staff.
- To support the learning of pupils/service users by effective use of IT. This could include setting up special access equipment for use in various sessions, and encouraging uptake and guiding best practice for sustained and successful interventions.
- In conjunction with other multidisciplinary team members to conduct the risk assessment, provision and maintenance of the mounting of communication aid/technology equipment onto wheelchair.
- Provide a rapid and friendly first line response to IT problems encountered by service users and staff.
- To participate with teaching and other TAC staff in developing interactive and web based programmes.
- To undertake other duties as required in support of IT and Assistive Technology at the School.

PERSON SPECIFICATION

Area	ESSENTIAL	DESIRABLE
Education/ Qualifications	• Educated to degree level with a relevant professional qualification, preferably in related AT/IT fields.	• ATist or AAC qualification. • Basic teaching qualification such as 7307/7407 or PTTLS.
Skills, Knowledge, Abilities	• Significant experience of using AT to benefit individuals with a wide range of disabilities. • Excellent interpersonal skills, with the ability to work confidently with senior staff and stakeholders. • Strong communication skills both verbally and in writing. • Skills in planning, running and	• Familiarity with pedagogical theory and practices.

E.23: ATist Job Description Draft.

	facilitating both face to face and on-line workshops. ● Ability to teach a range of professionals, people with disabilities and other partners, to use mainstream and assistive technology solutions. ● Knowledge of current 'best **evidence-based** practice' in the assessment of, provisioning of and support of assistive technology solutions, inclusive of computer access and Augmentative Alternative Communication (AAC) systems. ● Knowledge and understanding of equal opportunities policies and commitment to implementation. ● Direct experience of current assistive / access technology and AAC Technology. ● Outstanding IT skills inclusive of functional software and hardware troubleshooting skills.	
Experience	● Experience of working in a role delivering education and assistive technology support. ● Experience of supporting staff and pupils to use software, ICT resources and assistive technology equipment. ● Experience of working with children with complex communication needs, learning and physical disabilities. ● Experience of working in or with special education using technology. ● Experience of delivering against targets and preparing reports.	● Experience of building classroom teaching activities and resources in inclusive learning technology packages.
Attributes & Competencies	● A positive attitude with a high level of personal motivation and pride in work. ● Ability to work on own initiative and self-manage.	● Ability and insight to work with and across multiple disciplines seamlessly.

E.23: ATist Job Description Draft.

	• Good attention to detail. • Understanding of need for confidentiality as required. • Demonstrates commitment to own learning and continuous improvement through training and development. • Passionate about how AT/IT can change lives and support learning and independence. • Ability to work under pressure, organise and prioritise a varied workload. • Ability to manage challenging situations and interdisciplinary divergency positively.	

E.24: ATist Interview Schedule.

Discussion Guide

Assistive Technologist (ATist) Interviews
Aim: To gauge the perceptions of ATists regarding the role generally, and to evaluate the framework for ATists in special education under development as output arising from the current research.

Highlight

- All questions are optional.
- Your personal data will be kept confidential - no reference will be made to your identity in publication or other documents.
- Your participation is voluntary and you are free to withdraw from the study at any time without giving any reason and without penalty.
- Our focus is upon obtaining different perspectives on the role of ATist, in an effort to further define person specifications, responsibilities and contributions such an appointment may offer within a special educational setting.

ROLE: ASSISTIVE TECHNOLOGIST

Demographics/Background

Age/Gender/ Level of Education/Level of Computer Literacy (captured via Demographics sheet)

Initial Impressions of Assistive Technologist Role

- How would you describe your role?
- What experience did you have before taking on the ATist role?
    - Do you have a teaching pedagogical qualification?
    - Do you have a technical/computing qualification?
    - Which do you think is more useful for this role?
- What about personal qualities? Are there any that you would identify as essential?
- Does your work involve people with complex communication needs?

1

E.24: ATist Interview Schedule.

    - If so: Aided? Unaided? Low/High Tech?
    - Do you have a focus on any particular competence eg operational? Linguistic? Social? Strategic?
    - If not: What sort of assistance are you providing?
- What do you perceive the advantages to be of having an ATist in the classroom or workplace?
- Are there any disadvantages?
- What hurdles do you encounter?
- Do you have specific strategies or do you respond to problems as they arise?
- Who, or which "group" within your place of work, do you think the Assistive Technologist helps to support most (eg. adult practitioners or students/pupils/clients/service users?)
- Are you aware of any impact the presence of your role may have had on the practices of allied professionals collaborating with your team and/or students/pupils/clients/service users?

High Tech AAC Candidacy and Assessment

Moving on to how we assess individuals as candidates for AT:

- Can you briefly summarise the procedures, as you understand them, in identifying for example a child in your class/client/ervice user as a candidate for high tech AAC support? (Or whatever AT they are supporting.)
- What input do you have?
    - How might an Assistive Technologist, in your opinion, contribute to meeting this challenge (if at all)?

Reflecting Further on the Role

I'd like to gauge your thoughts on the future for an Assistive Technologist role:

- What is your overall opinion of the experience of working as an Assistive Technologist?
- Do you foresee a future for the role of Assistive Technologist in a wider context?
    - If yes, and they do not elaborate [**prompt**] why?
    - If no, and they do not elaborate [**prompt**] why not?

Supporting Pedagogy

E.24: ATist Interview Schedule.

I'd like you to talk a little about pedagogical support within a class:

- How do you go about supporting educators in meeting pedagogical goals for AT/ AAC users?
    - Can you list any tools, instruments, theoretical frameworks in use?
- What barriers do you face in this context?
- How do you go about overcoming these barriers?
- In this context, what do you think the primary focus of the Assistive Technologist role can or should be?

Training Opportunities

Thinking about training needs:

- How would you assess the level of knowledge/training demonstrated by non-ATist colleagues?
- Does the ATist have any contribution to make in the training of others?
- Would this include:
    - Software maintenance and support? (As above)
    - Hardware maintenance and support? (As above)
    - Which is more important in your view?
- Do you think training other team members in assistive technology skills should be a part of the Assistive Technologist's role?
    - Depending upon answer: [**Prompt**] Why or why not?

Evaluating the Framework

AT Role Profile impressions:

- What are your first thoughts?
- Is there anything you would add?
- Or remove?
- What do you think would be mandatory skills? (Examples might be Makaton, or aided language stimulation).
- What would be desirable skills?
- What would be the most important duties? (Examples might be hardware maintenance, or online activity development)
- I do have a lot of specifics that emerged from my study, but they do not really fit

E.24: ATist Interview Schedule.

with a jd and will be part of the overarching framework eg.

Policy and resourcing strategies...

- Learners to have access to their own devices or strategies at all times if required to enable learning.

- AT will therefore be at the forefront of leading and promoting training in all staff who have a role interacting with children on a daily basis. This to include interactions outwith the classroom eg at lunch, in PE, swimming, assembly, on field trips, walks etc.

- AT to promote awareness that comprehension, as well as expression, is key, and that initiation as well as reaction is to be encouraged.

- All staff interacting with children should be aware of the need to engage aided communicators 200 times a day, and to engineer communicative opportunities through play and other quotidian events throughout the school day.

Finally

I'd like your impressions of this model that we have been developing, the assistive technologist's role in the mediated learning experience.

https://docs.google.com/presentation/d/e/2PACX-1vTSqCknaqDqN5202YDkutmHmGNCFuJ6HLv8-TdyA6vHx6riRBjQ4m4RHlo9nXXIv_KfH2dovXFFfb5S/pub?start=false&loop=false&delayms=60000

Thank you for allowing me this opportunity to speak with you, and for sharing your thoughts and ideas with me.

4

E.25: ATist Information Sheet.

Project Title: Supporting Augmentative and Alternative Communication (AAC) Technology in a Special Education Setting

Information for Assistive Technologists

"Supporting AAC..." is a research project that is the focus of my doctoral studies currently being undertaken at the University of Dundee. I am aiming to work with educators to enhance support for children with complex communication needs in their acquisition of communication skills, and with a view to improving pedagogical outcomes in the longer term. I plan to support special education (SE) school staff so that they can help children get the best out of their AAC technology. This may involve developing easier ways to personalise these systems, bringing about an enhanced and more engaging learning experience.

This is the second study of the project, the first being an ethnographic study that highlighted low adoption rates and excessive abandonment of high tech AAC in SE. I wish to explore and develop a framework for the role of Assistive Technologist (AT) as a means of encouraging evidence based practice and enhanced coordination between disciplines in school as a potential solution.

We would like you to help us!

I have some experience in communication aids and disability issues. However, in order to construct a meaningful understanding of the AT's role, I would like to talk with you to learn from your experiences of working to support aided communicators. This will involve:

- Semi-structured interview(s) (telephone, video conference or in person).
- An opportunity for you to view the proposed framework under construction, and share any feedback you may have.

I anticipate this will take no more than an hour for each of these activities, concurrently or on different days as circumstances dictate, so approximately two hours of your time in total.

What is important to know?

- This research is approved by the relevant ethics committees.
- All researchers involved have Enhanced Disclosure Scotland certification.
- We will make sure that all participants have full control over any information provided.
- We will look after any data we collect during this study.
- We are not researching any individual's personal performance.
- You can withdraw your help at any stage of the project if you change your mind.

How to contact us

If you have any questions or would like more information please contact Chris Norrie, the researcher or his supervisor Professor Annalu Waller, at the University of Dundee's Computing Department. You can reach both via the following contact details:

Contact:	Email:	Phone:
Mr Chris Norrie	c.s.norrie@dundee.ac.uk	(+44)1382 386534

E.25: ATist Information Sheet.

Prof. Annalu Waller a.waller@dundee.ac.uk (+44)1382 388223

Write to:

School of Science and Engineering (Computing), University of Dundee, Queen Mother Building, Dundee DD1 4HN

E.26: ATist Consent Form.

"Supporting Augmentative and Alternative Communication (AAC) Technology in a Special Education Setting" Project

INFORMED CONSENT FORM

Assistive Technologists (ATs)

Dear AT,

Thank you for your interest in the "Supporting Augmentative and Alternative Communication (AAC) Technology in a Special Education Setting" Project. These pages describe your participation in this research. Please read through them and then sign at the bottom to say that you understand and accept the conditions of this study. You will have received two copies of this document, please keep one copy for your own records. If you have any questions, please feel free to ask the researcher. You will find his contact details at the end of this document.

Your Participation

We will speak to you online or in person to explain the project and confirm that you would like to take part. We may then ask you to take part in a semi-structured interview in order to gain a detailed understanding of the role of the AT role based upon your contribution, and the experiences of others working in the field.

Based on what we discover we hope to develop a framework that will help to form and develop the role of AT as an enabler for educators to engage more easily with AAC technology in order to enhance children's learning opportunities.

Please note that this study is not evaluating your, or any school or support staff member's performance. Participants are not being tested – we are only gathering information to support the development of the framework. There are therefore no right or wrong responses.

Participation in this study is purely voluntary and you are free to leave the study at any time without penalty or giving reasons. No undue risk arises from participation in this study. We anticipate participation will take no more two hours of your time in total.

You may be videoed, audio recorded or photographed during some parts of the study to support the information gathering process. All the information given to us including personal images will be stored safely and kept separate from information about participants' identities. Access to the data will be restricted to the people involved in this research. If a participant's data is used for scientific publications or presentations, no reference to his/her identity will be made. Some video clips that show an important point may be used in presentations at research conferences and meetings or for teaching purposes. If a photograph or video clip is used for a presentation, the name of the participant will be changed.

E.26: ATist Consent Form.

With reference to video or photographic images of yourself and their use for research or teaching publications and presentations, please tick the following boxes as appropriate:

□ I **agree** to my being videoed, audio recorded or photographed during sessions for research purposes.

If you have agreed to the previous option, please tick one of the following options:

□ I **agree** that video, audio or photographic files of myself can be used at research conferences and meetings or for teaching purposes.

□ I **do not agree** that video, audio or photographic files of myself can be used at research conferences and meetings or for teaching purposes.

□ **I do not agree** to being video/audio recorded or photographed during sessions for research purposes.

Please date and sign this page below to indicate that you understand and accept the conditions of this study. We would like to take the opportunity to thank you for your support.

Your Name:_____

Date: / / 2018 Signature: _____

Researcher's Name: Chris Norrie

Date: / / 2018 Signature: _____

How to contact us

If you have any questions or would like more information please contact Chris Norrie, the researcher or his supervisor Professor Annalu Waller, at the University of Dundee's Computing Department. You can reach both via the following contact details:

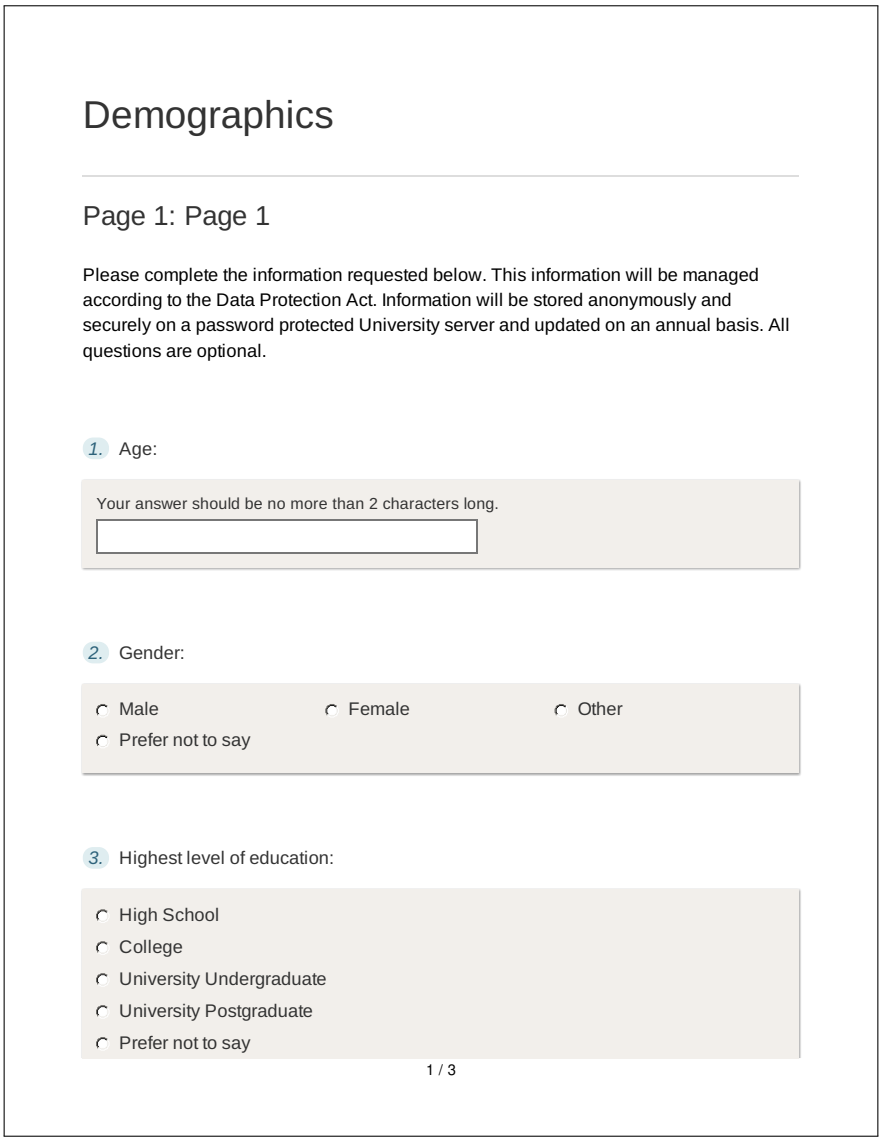
Contact:	Email:	Phone:
Mr Chris Norrie	c.s.norrie@dundee.ac.uk	(+44)1382 386534
Prof. Annalu Waller	a.waller@dundee.ac.uk	(+44)1382 388223

E.26: ATist Consent Form.

Write to:

School of Science and Engineering (Computing), University of Dundee, Queen Mother Building, Dundee DD1 4HN

E.27: ATist Demographics Form.



Demographics

Page 1: Page 1

Please complete the information requested below. This information will be managed according to the Data Protection Act. Information will be stored anonymously and securely on a password protected University server and updated on an annual basis. All questions are optional.

1. Age:

Your answer should be no more than 2 characters long.

2. Gender:

Male Female Other
Prefer not to say

3. Highest level of education:

High School
College
University Undergraduate
University Postgraduate
Prefer not to say

1 / 3

E.27: ATist Demographics Form.

4. Number of years' experience on your role:

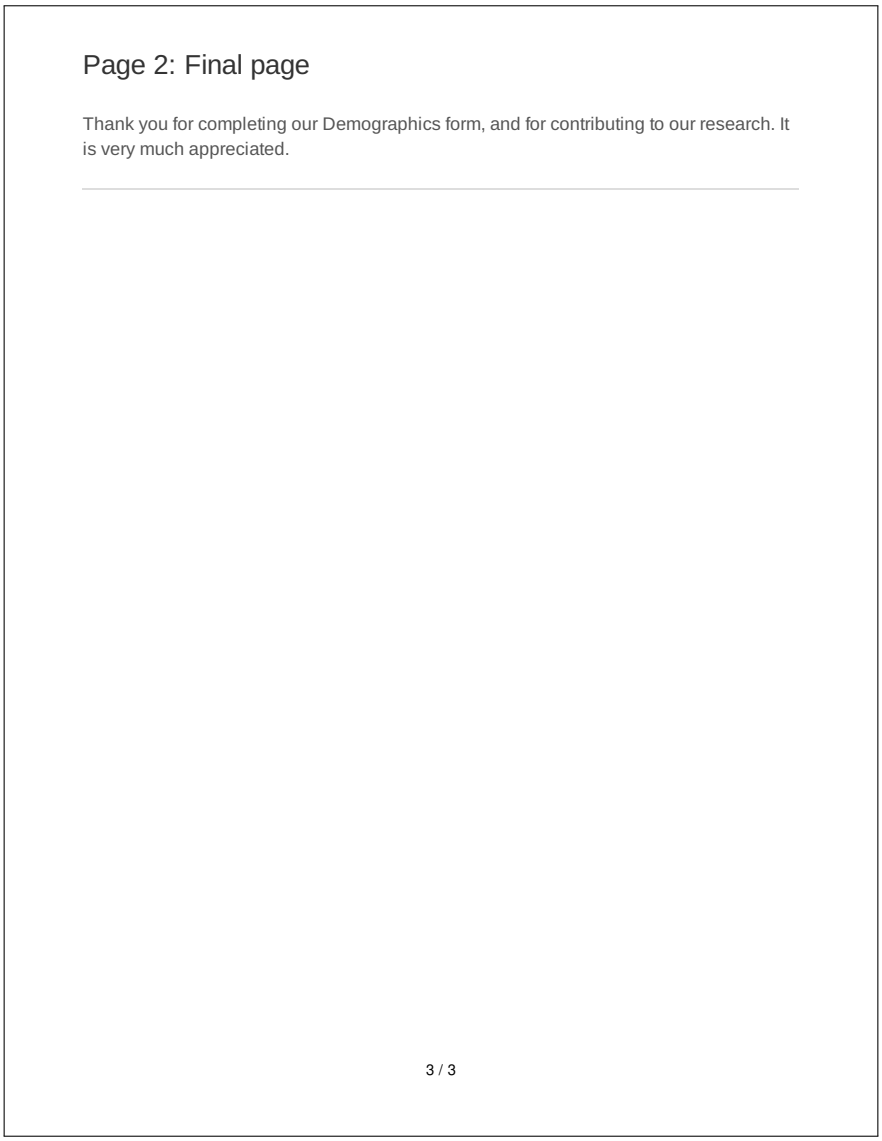
Your answer should be no more than 2 characters long.

5. Please rate your level of computer literacy:

- Novice
- Moderate
- Good
- Expert
- Prefer not to say

2 / 3

E.27: ATist Demographics Form.



Page 2: Final page

Thank you for completing our Demographics form, and for contributing to our research. It is very much appreciated.

3 / 3

E.28: Amended ATist Job Description Draft.

(AMENDED) ROLE PROFILE

JOB TITLE: Assistive Technologist in Special Education

PURPOSE:

The overall purpose of the job is to provide training, advice, guidance and support to staff and pupils, to identify bespoke solutions and maximise the use of existing technology and AT/AAC equipment, improving outcomes by increasing the impact and benefits for users. This role is also responsible for extending good practice, advice and guidance throughout the School by providing training, briefings and preparing and delivering CPD training to colleagues. As a collaborative role, fulfilling a dual function, you will have significant knowledge, skills and experience in AT and a sharing ethos that benefits colleagues, parents and pupils through modelling, knowledge transfer and communicating good practice.

PRINCIPAL DUTIES:

- To support the development and maintenance of assistive technology equipment across the School including specialist equipment.
- To ensure that support is delivered in accordance with IT policies, departmental procedures and priorities, and legislative Acts.
- To promote, assess, train and support learners and staff in the use of specialist equipment and software.
- To support staff in developing computer based learning materials which support individual pupils learning needs and adapting technology for use by specific students.
- To liaise with keyworkers to ensure they are familiar with specialist equipment used to meet a learner's individual needs.
- To provide advice and guidance about the development and use of assistive technology to colleagues from other disciplines and the Senior Management Team.
- To undertake assistive technology assessments in conjunction with educational, therapy and communication staff.
- To support the learning of pupils/service users by effective use of IT. This could include setting up special access equipment for use in various sessions, and encouraging uptake and guiding best practice for sustained and successful

E.28: Amended ATist Job Description Draft.

interventions.

- In conjunction with other multidisciplinary team members to conduct the risk assessment, provision and maintenance of the mounting of communication aid/technology equipment onto wheelchairs.
- To proactively work to agree and support meeting pedagogical and therapeutic aims in conjunction with other multidisciplinary team members.
- Provide a rapid and friendly first line response to IT problems encountered by service users and staff.
- To participate with teaching and other TAC staff in developing interactive and web based programmes.
- To create, maintain and update records on individual pupil requirements, within the bounds of GDPR, to ensure consistent support and mitigate against risk.
- To undertake other duties as required in support of IT and Assistive Technology at the School.

PERSON SPECIFICATION

AREA	ESSENTIAL	DESIRABLE
Education/ Qualifications	• Educated to degree level with a relevant professional qualification, preferably in related AT/IT fields.	• ATist or AAC qualification. • Basic teaching qualification such as 7307/7407 or PTTLS.
Skills, Knowledge, Abilities	• Significant experience of using AT to benefit individuals with a wide range of disabilities. • Excellent interpersonal skills, with the ability to work confidently with senior staff and stakeholders throughout the community. • Strong communication skills both verbally and in writing. • A competent and diplomatic negotiator, with the ability to secure and implement effective solutions. • Skills in planning, running and	• Familiarity with pedagogical theory and practices.

E.28: Amended ATist Job Description Draft.

	facilitating both face to face and on-line training workshops and activities. • Ability to teach a range of professionals, people with disabilities and other partners, to use mainstream and assistive technology solutions. • Knowledge of current 'best evidence-based practice' in the assessment, provisioning and support of assistive technology solutions, inclusive of computer access and Augmentative Alternative Communication (AAC) systems. • Knowledge and understanding of equal opportunities policies and commitment to implementation. • Direct experience of current assistive / access technology and AAC Technology. • Outstanding IT skills inclusive of functional software and hardware troubleshooting skills.	
Experience	• Experience of working constructively as part of a multidisciplinary team. • Experience of working in a role delivering education and assistive technology support alongside SLTs/OTs/teaching staff. • Experience of supporting staff and pupils to use software, ICT resources and assistive technology equipment. • Experience of working with children with complex communication needs, learning and physical disabilities. • Experience of working in or with special education using technology. • Experience of delivering against targets and preparing reports.	• Experience of building classroom teaching activities and resources in inclusive learning technology packages.
Attributes & Competencies	• A positive attitude with a high level of personal motivation and pride in work. • Ability to work on own initiative and	• Ability and insight to work with and across multiple disciplines seamlessly.

E.28: Amended ATist Job Description Draft.

	self-manage. • Good attention to detail. • Understanding of the need for confidentiality as required. • Demonstrates commitment to own learning and continuous improvement through training and development. • Passionate about how AT/IT can change lives and support learning and independence. • Ability to work under pressure, organise and prioritise a varied workload. • Ability to manage challenging situations and interdisciplinary divergency positively.	• A good listener, who will work jointly with colleagues and pupils to find solutions to barriers they encounter.

E.29: Person Specification Comparison Exercise.

PERSON SPECIFICATION (mapped to the Practical Framework)

AREA	ESSENTIAL	DESIRABLE
Expert Knowledge	• Educated to degree level with a relevant professional qualification, preferably in related AT/IT fields. • Knowledge of current 'best evidence-based practice' in the assessment, provisioning and support of assistive technology solutions, inclusive of computer access and Augmentative Alternative Communication (AAC) systems. • Knowledge and understanding of equal opportunities policies and commitment to implementation.	• ATist or AAC qualification. • Basic teaching qualification such as 7307/7407 or PTTLS.
Experience	• Significant experience of using AT to benefit individuals with a wide range of disabilities. • Direct experience of current assistive / access technology and AAC Technology. • Outstanding IT skills inclusive of functional software and hardware troubleshooting skills.	• Familiarity with pedagogical theory and practices.
Generative Knowledge	• A good listener, who will work jointly with colleagues and pupils to find solutions to barriers they encounter. • Strong communication skills both verbally and in writing. • A competent and diplomatic negotiator, with the ability to secure and implement effective solutions. • A positive attitude with a high level of personal motivation and pride in work. • Ability to work on own initiative and self-manage. • Good attention to detail. • Understanding of the need for confidentiality as required. • Demonstrates commitment to own learning and continuous improvement through training and development. • Passionate about how AT/IT can change	• Ability and insight to work with and across multiple disciplines seamlessly.

E.29: Person Specification Comparison Exercise.

	lives and support learning and independence. ● Ability to work under pressure, organise and prioritise a varied workload. ● Ability to manage challenging situations and interdisciplinary divergency positively.	
Experience	● Experience of person-centred design processes. ● Ethnography/Action Research/Dynamic Assessment	
Knowledge Implementation	● Excellent interpersonal skills, with the ability to work confidently with senior staff and stakeholders throughout the community. ● Skills in planning, running and facilitating both face to face and on-line training workshops and activities. ● Ability to teach a range of professionals, people with disabilities and other partners, to use mainstream and assistive technology solutions.	
Experience	● Experience of working constructively as part of a multidisciplinary team. ● Experience of working in a role delivering education and assistive technology support alongside SLTs/OTs/teaching staff. ● Experience of supporting staff and pupils to use software, ICT resources and assistive technology equipment. ● Experience of working with children with complex communication needs, learning and physical disabilities. ● Experience of working in or with special education using technology. ● Experience of delivering against targets and preparing reports.	● Experience of building classroom teaching activities and resources in inclusive learning technology packages.

E.30: ATist (TACTS) Framework.

Version 1.0

TACTS Framework

Transforming Assistive Communication Technologies Support

—

A person-centred framework for Assistive Technologists within special education

INTRODUCTION

This document is a practical resource for individuals within the education sector wishing to provide evidence-based support for young emerging communicators with complex communication needs (CCN). The focus is a roadmap for schools instating, or candidates embarking upon, the novel role of the Assistive Technologist (ATist) within special education (SE) - its application and use, however, may have wider relevance e.g. to further education institutions, or other communities seeking to boost their support for diversity.

Document Structure

The following components are presented:

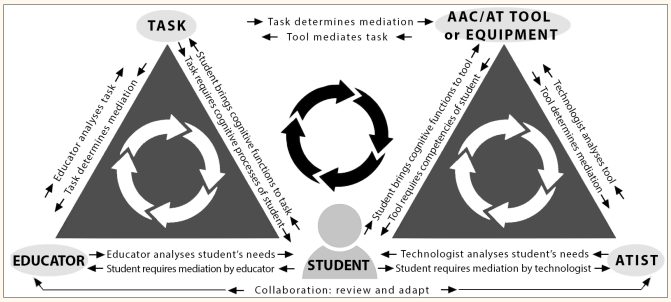
- An adapted mediated learning experience (MLE) model to document the added complexity of accommodating the meeting of pedagogical goals for learners with CCN, and to define and raise awareness of the ATist's role in the classroom.

E.30: ATist (TACTS) Framework.

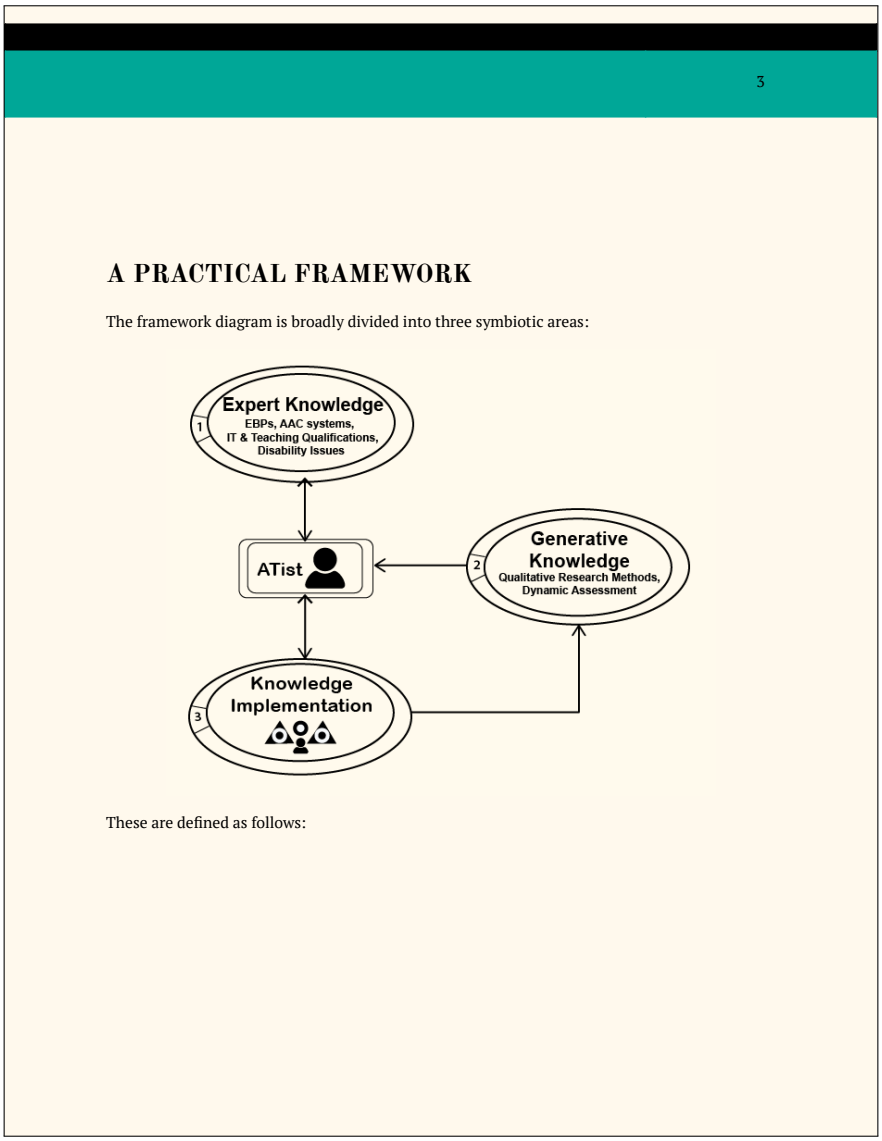
- A practical framework diagram illustrating the knowledge, philosophies, practices and workflow of the role of an ATist supporting learners and the wider community of stakeholders within a special education setting.
- A role profile / job description for the role of ATist within special education.
- A list of definitions for abbreviations used within this document.

ADAPTED MLE

Feuerstein's (1991) student-centred mediated learning experience (MLE) is congruent with with the work of Vygotsky and his socio-cultural theory of child development (Daniels, 1996) and the idea that a child learns actively, relying on a more knowledgeable other (MKO) such as a parent or teacher to guide them through a critical zone of proximal development (ZPD). Here, it is adapted for the Assistive Technology (AT) MLE. The addition of a second mediator - the ATist - to this SE setting is significant. Such a practitioner will not only promote EBP and the benefits of enhanced technological know-how to the classroom, but their collaborative presence will also free or support the teacher to maintain their primary focus: the meeting of pedagogical goals.



E.30: ATist (TACTS) Framework.



E.30: ATist (TACTS) Framework.

1. **Expert Knowledge - "These are the things I know about supporting Assistive Technology"**

   Intrinsic underpinning knowledge - technological, pedagogical, methodological, analytical, clinical, strategic - that is fundamental to an ATist's role as a collaborator with a diversity of colleagues and clientele, providing a substrata for their worldview and workflow approach. A base for effective knowledge sharing and implementation. Ongoing review - e.g. horizon scanning/EBPs - is a vital element.

2. **Generative Knowledge - "These are the things I can find out about the learner"**

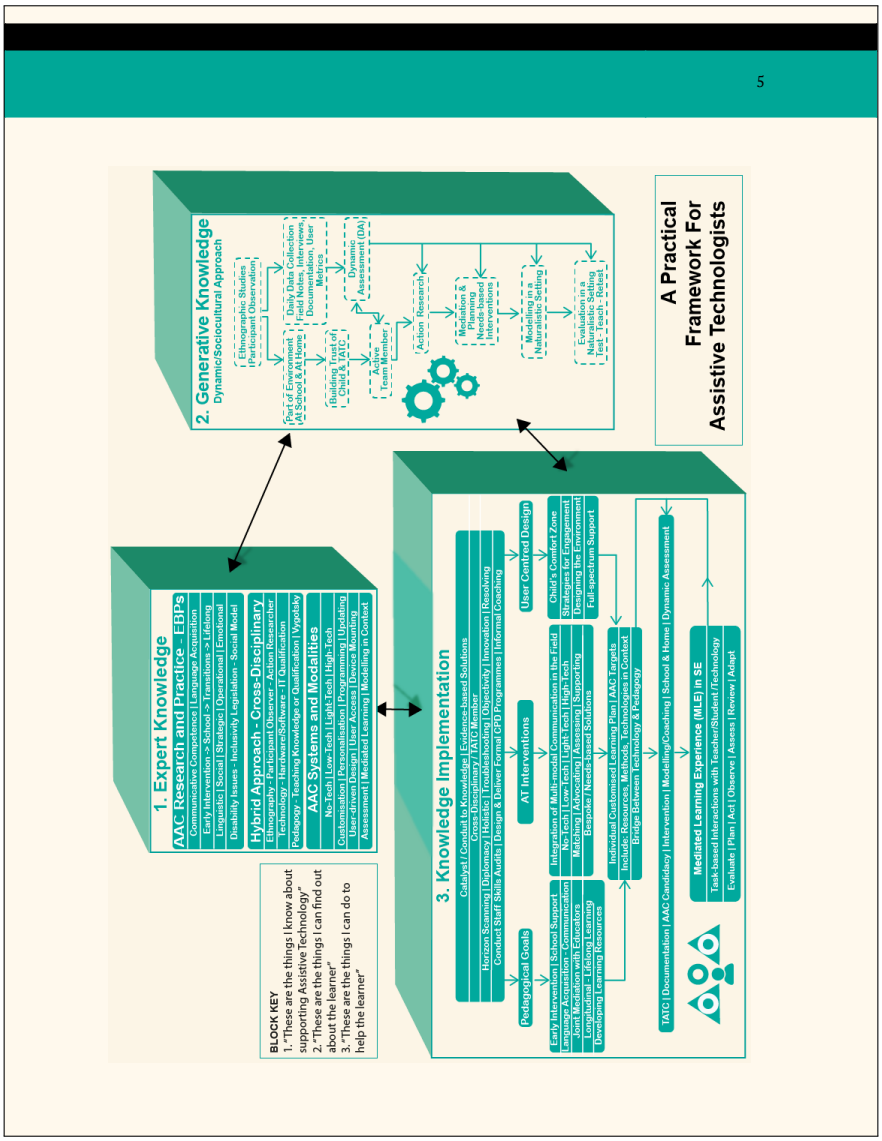
   Needs-based knowledge actively and recursively acquired in the field by the ATist as a participant observer through appropriate application of philosophies, methodologies and processes such as ethnography, action research, dynamic assessment (DA), UCD. This dynamic data flow is harnessed to personalise, further inform, evaluate, review and adapt the knowledge implementation process. A key means of enabling the achievement of task-driven goals, and extending communicative competencies.

3. **Knowledge Implementation - "These are the things I can do to help the learner"**

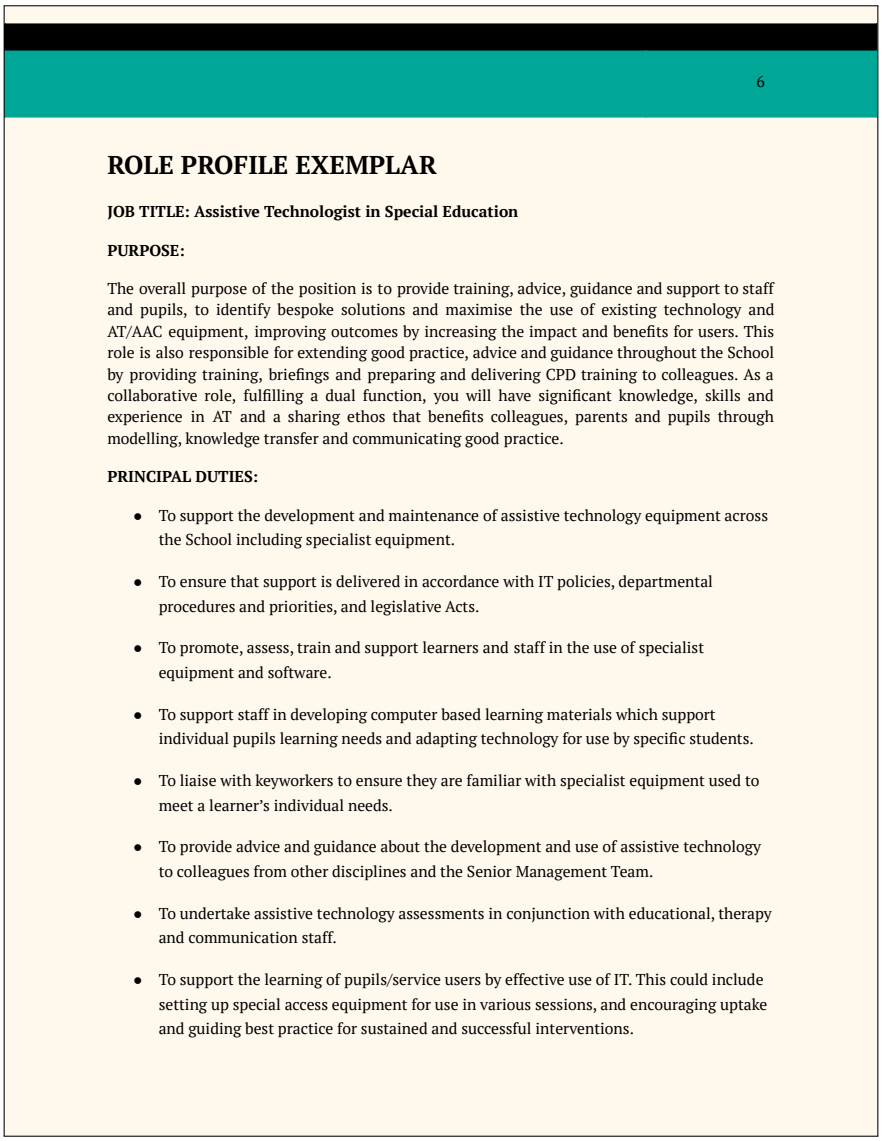
   The application - typically decision-making - in the field of the knowledge flowing from the Expert Knowledge and Generative knowledge sources. The tasks and responsibilities that the ATist executes on a daily basis to support fellow TATC members and emerging communicators in the SE classroom e.g. knowledge of research methods, or about assistive technology systems. Incorporates the ATist's contribution to the MLE.

The full framework diagram is presented on the next page.

E.30: ATist (TACTS) Framework.



E.30: ATist (TACTS) Framework.



ROLE PROFILE EXEMPLAR

JOB TITLE: Assistive Technologist in Special Education

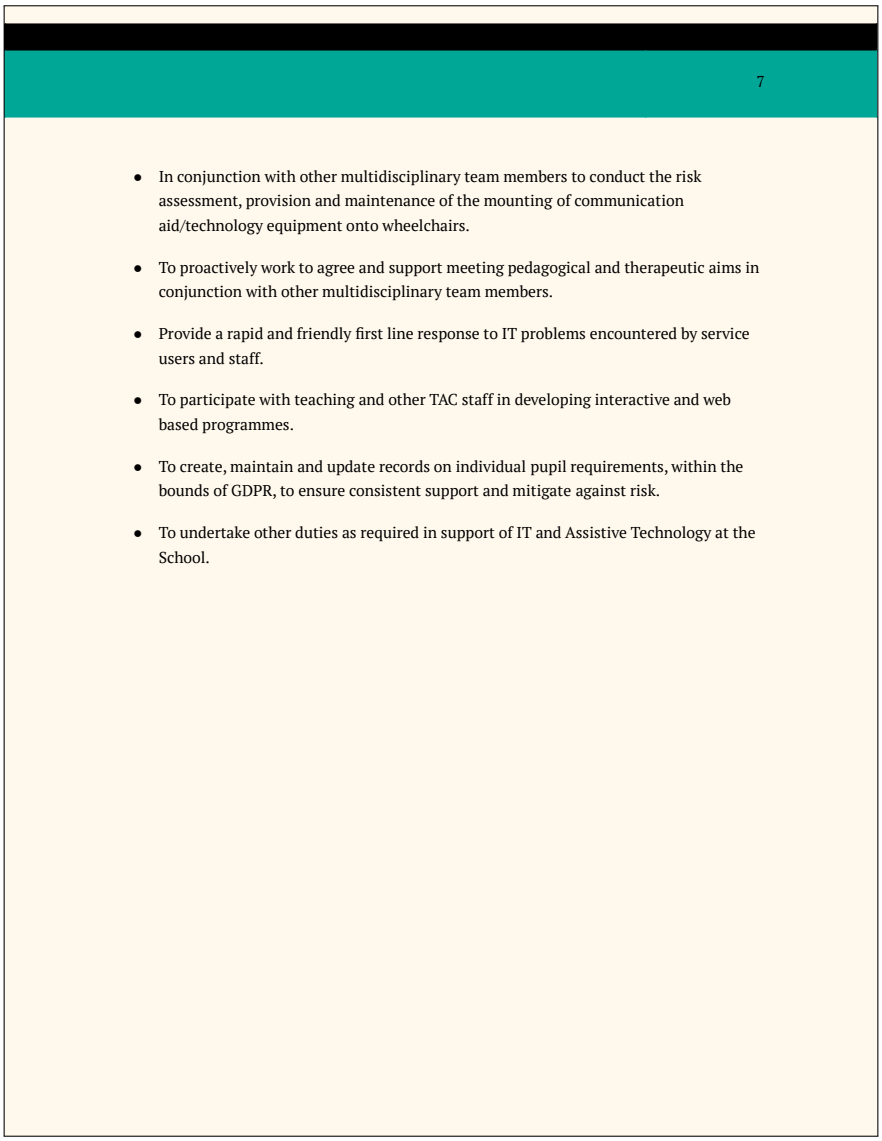
PURPOSE:

The overall purpose of the position is to provide training, advice, guidance and support to staff and pupils, to identify bespoke solutions and maximise the use of existing technology and AT/AAC equipment, improving outcomes by increasing the impact and benefits for users. This role is also responsible for extending good practice, advice and guidance throughout the School by providing training, briefings and preparing and delivering CPD training to colleagues. As a collaborative role, fulfilling a dual function, you will have significant knowledge, skills and experience in AT and a sharing ethos that benefits colleagues, parents and pupils through modelling, knowledge transfer and communicating good practice.

PRINCIPAL DUTIES:

- To support the development and maintenance of assistive technology equipment across the School including specialist equipment.
- To ensure that support is delivered in accordance with IT policies, departmental procedures and priorities, and legislative Acts.
- To promote, assess, train and support learners and staff in the use of specialist equipment and software.
- To support staff in developing computer based learning materials which support individual pupils learning needs and adapting technology for use by specific students.
- To liaise with keyworkers to ensure they are familiar with specialist equipment used to meet a learner's individual needs.
- To provide advice and guidance about the development and use of assistive technology to colleagues from other disciplines and the Senior Management Team.
- To undertake assistive technology assessments in conjunction with educational, therapy and communication staff.
- To support the learning of pupils/service users by effective use of IT. This could include setting up special access equipment for use in various sessions, and encouraging uptake and guiding best practice for sustained and successful interventions.

E.30: ATist (TACTS) Framework.



E.30: ATist (TACTS) Framework.

PERSON SPECIFICATION

AREA	ESSENTIAL	DESIRABLE
Education/ Qualifications	• Educated to degree level with a relevant professional qualification, preferably in related AT/IT fields.	• ATist or AAC qualification. • Basic teaching qualification such as 7307/7407 or PTTLS.
Skills, Knowledge, Abilities	• Significant experience of using AT to benefit individuals with a wide range of disabilities. • Excellent interpersonal skills, with the ability to work confidently with senior staff and stakeholders throughout the community. • Strong communication skills both verbally and in writing. • A competent and diplomatic negotiator, with the ability to secure and implement effective solutions. • Skills in planning, running and facilitating both face to face and on-line training workshops and activities. • Ability to teach a range of professionals, people with disabilities and other partners, to use mainstream and assistive technology solutions. • Knowledge of current 'best evidence-based practice' in the assessment, provisioning and support of assistive technology solutions, inclusive of computer access and Augmentative Alternative Communication (AAC) systems. • Knowledge and understanding of equal opportunities policies and commitment to implementation. • Direct experience of current assistive / access technology and	• Familiarity with pedagogical theory and practices.

E.30: ATist (TACTS) Framework.

	AAC Technology. • Outstanding IT skills inclusive of functional software and hardware troubleshooting skills.	
Experience	• Experience of working constructively as part of a multidisciplinary team. • Experience of working in a role delivering education and assistive technology support alongside SLTs/OTs/teaching staff. • Experience of supporting staff and pupils to use software, ICT resources and assistive technology equipment. • Experience of working with children with complex communication needs, learning and physical disabilities. • Experience of working in or with special education using technology. • Experience of delivering against targets and preparing reports.	• Experience of building classroom teaching activities and resources in inclusive learning technology packages.
Attributes & Competencies	• A positive attitude with a high level of personal motivation and pride in work. • Ability to work on own initiative and self-manage. • Good attention to detail. • Understanding of the need for confidentiality as required. • Demonstrates commitment to own learning and continuous improvement through training and development. • Passionate about how AT/IT can change lives and support learning and independence. • Ability to work under pressure, organise and prioritise a varied workload. • Ability to manage challenging situations and interdisciplinary divergency positively.	• Ability and insight to work with and across multiple disciplines seamlessly. • A good listener, who will work jointly with colleagues and pupils to find solutions to barriers they encounter.

E.30: ATist (TACTS) Framework.

A LIST OF ABBREVIATION DEFINITIONS

Abbreviation	Unabridged
AAC	Augmentative and Alternative Communication
ALgS	Aided Language Stimulation
AT	Assistive Technology
ATist	Assistive Technologist
CCN	Complex Communication Needs
DA	Dynamic Assessment
EBP	Evidence-based Practice
EI	Early Intervention
FE	Further Education
MDT	Multi-disciplinary Team
MKO	More Knowledgeable Other
MLE	Mediated Learning Experience
SE	Special Education
SGD	Speech Generating Device
SLT	Speech Language Therapist
TATC	Team Around The Child
UCD	User Centred Design
ZPD	Zone of Proximal Development

E.30: ATist (TACTS) Framework.

REFERENCES

Reuven Feuerstein, Pnina S Klein, and Abraham J Tannenbaum. 1991. Mediated learning experience (MLE): Theoretical, psychosocial and learning implications. Freund Publishing House Ltd.

Daniels, Harry, ed. An introduction to Vygotsky. 1996. Taylor & Francis US.

About the TACTS Framework

This framework was developed as part of a doctoral research project undertaken at the University of Dundee, Scotland, and supervised by Professor Annalu Waller and Dr Beth Hannah. If you have any questions or would like more information, please contact the author Christopher Norrie in the first instance at: c.s.norrie@dundee.ac.uk | @chrisnorrie

The project was supported by EPSRC funding.

An electronic version of this document (PDF format) may be downloaded from the following link: **https://tinyurl.com/yyfb2ar6**