PERSPECTIVES OF KEY STAKEHOLDERS ABOUT PRACTICES RELATING TO USING IPADS FOR AUTISTIC PUPILS' SOCIAL COMMUNICATION AND EMOTIONAL REGULATION

by

ALEXIA ACHTYPI

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ABSTRACT

This thesis explores key stakeholders' perspectives about practices relating to using iPads for autistic pupils' Social Communication (SC) and Emotional Regulation (ER). It focuses on investigating the interaction between digital technology, context and individuals and understanding and evaluating the impact of context on how iPads are implemented in-situ for SC and ER.

To achieve these aims, the study drew upon Bronfenbrenner's Ecological Systems theory (1979) and Abbott's concept of 'E-inclusion' (2007) as conceptual lenses to situate the use of iPads in context. It followed a mixed-methods design which involved an online survey completed by 55 educators of primary schools across England and two case studies conducted in a Special school and a Mainstream (Autism Resource Base) setting. Data in the two schools were gathered through interviews from key stakeholders (practitioners, parents, autistic pupils) and a document analysis of computing and E-safety policies.

The key findings of the study revealed that practitioners applied iPads across the curriculum as multi-modal learning tools, focusing on child-centred pedagogies and targeting more than one skill. Educators prioritised using iPads for developing autistic pupils' SC, with ambiguity existing in ER-related terminology and practices. Contrary to that, the findings from interviews that were conducted with parents and children highlighted that tablet implementation at home focused on recreation and ER, with other uses involving behaviour management, relaxation and communication. In line with these points, the study found differences in the manner and scope of iPad use at school and home, illustrating a communication gap between educators and parents.

In addition, the thesis examined the various ways in which iPads were implemented for autistic pupils' SC and ER in the two different school contexts. The results identified a combination of organisational, technological and personal aspects that influenced the way in which educators used iPad in the two schools. The reported differences shed light on the role that enhanced systemic support (such as training), technological infrastructure and educators' confidence can have on the successful iPad integration into learning.

Based on these findings, the thesis provides implications for practice about the contextual factors that create the conditions required to enable iPads to enhance autistic pupils' SC and ER in the classroom. It also highlights issues around pedagogy and teaching methods, offering insights into what drives teachers to make decisions and the importance of supporting them to develop skills in technology and understanding of pedagogy. Finally, the thesis suggests pointers to practice illustrating the role of iPads as behaviour management tools and enablers of learning through ER.

Dedication

To my husband Spyros for standing by my side

in good times and in bad.

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ABBREVIATIONS

AAC	Augmentative and Alternative Communication
ADE	Apple Distinguished Educator
APA	American Psychiatric Association
AR	Augmented Reality
ASC	Autism Spectrum Condition
ASD	Autism Spectrum Disorder
AT	Assistive Technology
BiH	Brain in Hand
BOS	Bristol Online Survey
CAI	Computer Assistive Instruction
CAL	Computer-Assisted Learning
COVID-19	Coronavirus
CPD	Continuous Professional Development
CVE	Collaborative Virtual Environment
DfE	Department for Education
DLD	Developmental Language Disorder
DoH	Department of Health and Social Care
DSM-5	Diagnostic and Statistical Manual of Mental Disorders
ETC	Educational Technology Coordinator
EdTech	Educational Technology
EFL	English as a Foreign Language
EHCPs	Education Health Care Plans
ER	Emotional Regulation
ETC	Educational Technology Coordinator
HEA	Higher Education Academy
HEFCE	Higher Education Funding Council for England
ibid.	In the Same Source

ICD-11	International Classification of Diseases and Related Health Problems
ICT	Information and Communications Technology
JA	Joint Attention
JE	Joint Engagement
MPI	Multiple Perspectives Interviews
NAS	National Autistic Society
n.d.	No Date
Ofcom	Office of Communications
Ofsted	Office for Standards in Education
PSHE	Personal, Social, Health and Economic
PR	Participatory Research
RCT	Randomised Control Trial
SC	Social Communication
SENCO	Special Educational Needs Coordinator
SEND	Special Educational Needs and/or Disability
SENAR	Special Educational Needs Assessment and Review team
SRP	Specially Resources Provision
TD	Typically Developing
TEL	Technology Enhanced Learning
UK	United Kingdom
UN	United Nations
USA	United States of America
VR	Virtual Reality
WHO	World Health Organisation

DEFINITION OF TERMS

Several terms have been conceptualised throughout this thesis, based on the research topic of the study. A definition of the terms is presented below.

Autistic Individual or Individual with Autism: According to the American Psychiatric Association (APA, 2013), autism is characterised *by "persistent deficits in social communication and social interaction across multiple contexts, including deficits in social reciprocity, nonverbal communicative behaviors used for social interaction, and skills in developing, maintaining, and understanding relationships"* (p.31, see also DSM-5).

In the literature, there is not unanimity on how autism should be described. Amongst the most used terms include Autism Spectrum Condition (ASC), Autism Spectrum Disorder (ASD), autistic individuals and individuals with autism (Charman 2015, NAS 2017). Throughout this thesis, 'autism' and 'autism spectrum' is used to refer to the whole spectrum, while the terms used to describe individuals diagnosed with autism are 'autistic learner' and 'learner with autism'.

Key Stakeholders: Throughout the thesis, this term describes individuals who can affect/be affected by or have an interest in the researched phenomenon, such as educators, parents and autistic pupils.

Parents: In this thesis, this term is used to describe the parents, adoptive parents and carers of autistic pupils.

Educational Technology Coordinator: In this thesis, this term refers to the technology specialist who was responsible for developing and implementing a school strategy for instructional use of technology. The role responsibilities involve meeting, planning, training and co-teaching with classroom teachers using various educational technologies.

Lead ICT technician: This term refers to the Lead ICT technician responsible for maintaining/upgrading software and hardware, training teachers/ students and ensuring internet systems are secure to offer complete child protection.

Context: According to Rosenberg and Koehler (2015), context refers to elements that are *"woven together with the object of study and are unable to be separated from it"* (p. 440). Throughout this thesis, the term describes the unique features of homes and schools, capturing their environmental, pedagogical, cultural, material and social aspects.

Social Communication (SC): According to DSM-5 (APA, 2013), deficits in SC and social interactions across multiple contexts might involve challenges in a) social emotional reciprocity, b) nonverbal communicative behaviours, c) developing, maintaining, and understanding relationships. This thesis adopts the broader SC definition of Prizant et al. (2007), to refer to "*the development of spontaneous, initiated, functional communication, the development of secure and trusting relationships with children and adults, and an understanding of the conventions of different social situations"* (p.1).

Emotional Regulation (ER): Throughout this thesis, ER is used to refer to "*the development of the ability to maintain a well-regulated emotional state to cope with everyday stress, and to be most available for learning and interacting" (*Prizant et al., 2007, p.1).

Assistive Technology (AT): Following the term provided by GOV.UK (2021), AT is used in this thesis to describe *“products or systems that support and assist individuals with disabilities, restricted mobility or other impairments to perform functions that might otherwise be difficult or impossible”.*

Computer-Assisted Learning (CAL) or Computer Assisted Instruction (CAI): This term refers to the use of computers to educate and improve the skills of learners (Pellecchia et al., 2020).

Information and Communication Technologies (ICT): This study uses the term ICT to describe the *“diverse set of technological tools and resources used to transmit, store, create, share or exchange information. These technological tools and resources include computers, the Internet (websites, blogs and emails), live broadcasting technologies (radio, television and webcasting), recorded broadcasting technologies (podcasting, audio and video players and storage devices) and telephony (fixed or mobile, satellite, visio/video-conferencing, etc.)”* (UNESCO, 2021).

Technology Enhanced Learning (TEL): The term is used to describe *“the application of information and communication technologies to teaching and learning”* (Kirkwood et al., 2014, p. 6). In this study, the term captures the broader dimensions of technology as an enabler/enhancer of learning, focusing on the role of context and user.

School A: In this thesis, this term is used to describe the primary state Special school for cognition and learning where one of the case studies was conducted**.**

School B: In this thesis, this term is used to describe the Academy primary Mainstream school where the second case study was conducted. At the time of the data collection, the school site had two autism units for children diagnosed with autism and Developmental Language Disorder (DLD). The students of the units only visited the mainstream classes of the school for a few lessons. The term *“Autism Resource Base”* is the one that the school used to describe the designated classes/specialist facilities where autistic pupils spent most of their school time. Hence, in this study, the term ‘Mainstream (Autism Resource Base)’ will be used to describe the context of School B.

Abbott’s concept of ‘E-inclusion’: According to Abbott (2007), ‘E-inclusion’ describes *“the use of digital technologies to enable inclusive learning practices for people with learning difficulties”* (p.6). Throughout this study, this concept is used as a basis for exploring how the interaction between people (educator/parents/autistic children)-digital technology (iPad)-context looked like in relation to autism and iPads in the classroom.

E-inclusive practices: Based on Abbott’s concept of ‘E-inclusion’ (2007), this term is used to describe the practices implemented by educators in the classroom to achieve inclusive learning with the use of technology.

Chapter 1: INTRODUCTION

1.1 Overview and Research Motivation

Technology affects almost every part of people's lives, including education. Over the past years, technology and specifically mobile devices have been considerably integrated into the classroom as additional learning tools. In the United Kingdom (UK) today, tablets are familiar elements of educators' practices and students' learning, providing opportunities for rich multimedia learning experiences and resources. The affordability and functionality of mobile devices make them more popular than technologies that have been previously used in educational contexts. However, understanding how they can best meet the needs of pupils remains a persistent challenge.

Universal access to technology has been recognised by UNESCO (2019) as an essential aim, supporting modern approaches to education. According to the Salamanca Statement and Framework for Action on Special Needs Education (UN, 1994), "*appropriate and affordable technology should be used when necessary to enhance success in the school curriculum and to aid communication, mobility and learning"* (section 33). Since the first launch of iPads in 2010, special schools have increased the use of tablets to teach pupils with developmental disabilities (Clark and Luckin 2013, Kagohara et al. 2013). Specifically, the field of autism research has seen a sharp rise in tablet use, with researchers reporting on autistic individuals' affinity to technology (Ploog et al., 2013).

With autism being characterised by difficulties with social communication (SC) and interaction, restrictive and repetitive activities, interests and sensory difficulties (APA, 2013; WHO, 2018) and its prevalence in the UK reaching 1 in every 100 people (BMA, 2020; NAS, 2012), the role of educational technology has been widely acknowledged in the literature. Thus, previous studies have been concerned with the use of mobile technologies to meet specific needs or address specific curriculum subjects (Aspiranti, Larwin and Schade, 2020; Petrov et al., 2017). Among the most frequently targeted areas for improving autistic individuals' outcomes with iPads have been academic and SC skills (Larwin and Aspiranti, 2019), while fewer studies have explored emotional regulation (ER) (Harrold et al., 2014).

Given that many studies on mobile technologies use experimental designs to capture outcomes mainly related to learning, research recommends that future studies include input from key stakeholders (Fletcher-Watson et al., 2016), explore their readiness to use mobile technology (Christensen and Knezek, 2017) and consider the role of context in the process (Tondeur al., 2017). In line with these points, this thesis shifts the attention to investigating the perspectives of key stakeholders regarding practices relating to using iPads in the classroom.

To provide a holistic view of the researched phenomenon, the study explores the views of practitioners, parents, and autistic pupils regarding iPads' use for SC and ER through two case studies in different educational contexts. The focus is to place technology and autism in-situ and understand the complex relationship between iPads, individuals and context. The aim is to contribute to previous research findings regarding iPad use for autistic pupils' SC and ER and inform practice about the contextual and practice-related elements required to maximise learning with tablets.

1.1.1 Research Context

This study involves research conducted in a Special and a Mainstream (Autism Resource Base) school in England. According to the Department for Education (DfE) statutory guidance, full-time education is compulsory in the UK (DfE, 2017a). Hence, all children between five to 16 years old are eligible to receive a free place at a mainstream state school. After 16, young people can be in full-time or part-time education or training until they turn 18 (European Commission, 2019). Most state schools in England are divided into a) community, b) foundation, c) academies, d) grammar schools and are funded either by the government or the local authorities.

Students whose needs cannot be met in mainstream schools due to their Special Educational Needs and/or Disabilities (SEND) attend special schools. Special schools can be maintained, academies or independent settings and accept children from three to 16 years of age (or even up to 25). In England, special schools with pupils aged 11 years old or older can specialise in one of the following areas a) communication and interaction, b) cognition and learning, c) social, emotional and mental health, d) sensory and physical needs schools (GOV.UK, n.d.-b). According to the SEND code of practice (DfE/DoH, 2015), most students with special needs can attend mainstream schools with additional school support or special schools as they can further focus on their needs.

In 2019, there were 646 state-funded and non-maintained special schools approved for autistic spectrum provision in England (DfE, 2019a). The settings which have facilities and training specifically for autistic children are called Autism Specialist schools. Also, alternative provision for autistic students can be provided in specialist facilities on mainstream school sites for a small number of students, namely

‘Specially Resources Provision’ (SRP) or ‘Designated Units’ (Units). In SPR, pupils spend most of their time in mainstream classes and only attend the special facilities for individual support or specific equipment (DfE, 2015). In the Units, pupils are mainly located in the designated classes and only join mainstream classes for a few lessons (ibid.). In this study all mainstream schools with specialist facilities for autistic pupils will be referred to as ‘Mainstream (Autism Resource Base)’ schools.

All maintained mainstream and special schools in England must follow the national curriculum subjects and standards. However, non-maintained settings have more flexibility to choose the areas they want to cover (DfE, 2019b). Special schools have the freedom to adapt the national curriculum to meet pupils’ needs making reasonable adjustments based on students’ Education, Health and Care Plans (EHCPs) or SEND statements (DfE, 2015). Depending on the SEND range to be accommodated in special schools, the core teaching subjects involve English, Mathematics and Science while religious education and personal, social, health and, economic education (PSHE) are also provided (DfE, 2013a).

In line with the structure of the national curriculum, among the foundation subjects is computing, which focuses on making pupils digitally literate (DfE, 2013b). However, computing is seen both as a subject to be taught and an additional learning tool. A broader approach involves the application of assistive technology in SEND as a strategic investment to ensure that pupils *“have the opportunities necessary to access, engage, and benefit from their educational experience and move beyond historical barriers that limit their potential”* (DfE, 2020b, p.9). In England, an initiative to help schools and colleges develop and include technology in learning is the ‘Realising the potential of technology in education: A strategy for education providers and the technology industry', commonly known as the Educational Technology (EdTech) strategy (DfE, 2019c), which focuses on actions to address the barriers to successful technology integration.

The role of mobile technology in the English education system has been rapidly evolving. Lately, the DfE (2021b) announced the provision of 1.3 million laptops and tablets to disadvantaged and SEND pupils and young people to support remote and face-to-face education during coronavirus (COVID-19). Similarly, in 2020 the 'EdTech Demonstrator programme' was launched to offer free support to practitioners in publicly funded schools or colleges for the effective use of technology in education (DfE, 2021a). Considering that schools and local authorities in England mostly make decisions about the Information and Communications Technology (ICT) strategy and spending (GSMA, 2011), leadership and coordination have been significant in stimulating and supporting technology innovation and adoption (McGarr and McDonagh, 2011).

For example, the roles of technology specialists in schools are usually assigned to Educational Technology Coordinators (usually mentioned as ICT Coordinators/Leads) and ICT technicians. Despite the early manifestation of the ICT Coordinators'/Leads' role in providing technical support, a second-dimension views them as suppliers of leadership and direction to technology use across the curriculum (McGarr and McDonagh, 2012). Hence, the responsibilities may involve keeping the school informed of emerging developments in educational technology, assisting teachers in using computers for educational reasons and conducting team training on new software. Contrary to that, the job of the ICT Technicians is usually approached as technical, revealing that their duties are confined to software/hardware maintenance, diagnostics, licensing deals, and network issues. Interestingly, although the ICT coordinators/Leads are recognised as necessary figures in schools to support teachers' technology implementation (Moreira, Rivero and Sosa Alonso, 2018), their role is often poorly valued (McDonagh, 2011).

Next, the following section presents the background of the researcher and justifies further why this thesis was carried out.

1.1.2 The Background of the Researcher

As a qualified Early Years teacher, holding a Bachelor of Arts degree from the University of Patras-Greece, I worked for over four years in various primary mainstream schools with children with mixed abilities. In 2012, my passion for autism motivated me to apply for a Master's degree in Special Needs at the University of Nottingham-UK. During this course, I focused on technology and autism, and I volunteered in special schools to explore how technology was implemented in practice. The knowledge that I gained and my interest in mobile devices prompted me to conduct a dissertation exploring the challenges and responses of autistic children with communication impairments to Augmentative and Alternative Communication (AAC) applications.

After my graduation, I worked for three years in mainstream and special schools in East and West Midlands. My professional experience provided me with insights into the various ways in which iPads were integrated into the classroom for autistic pupils' SC, academic skills and calmness. There I noticed differences in the applied practices relating to pupils' skills and how they depended on i) the school's values towards technology and ii) teachers' confidence. This observation drove my need for understanding the practices of implementing iPads for autistic children in-situ, intending to explore the complex relationship between context, individuals and technology use. Also, these schools had broad interests in using technology for developing autistic pupils' SC and ER. This motivated me even more, to focus on these two key developmental areas.

During my PhD, I was honoured to be awarded a two-year scholarship from the School of Education, University of Birmingham-UK. In addition, I gained valuable experience working at the Autism Centre for Education and Research (ACER) as a teaching associate for the online autism course (Distance Education-Year 1) and as a research fellow in various projects related to technology and autism. Finally, in the course of my PhD studies, I obtained a Postgraduate Certificate in Advanced Research Methods and Skills (PGCARMS) (2018) that certifies my academic development.

Overall, my aspiration to extend my knowledge in the field of autism and technology motivated me to pursue a PhD in this specific subject area, combining my professional and academic experience.

1.2 Research Aims and Objectives

The overall aim of the study is to explore how iPads are implemented in-situ for the SC and ER of autistic pupils by situating technology and autism in context. More specifically, the research objectives are to:

Objective 1: Capture and analyse practitioners', parents' and autistic pupils' perspectives about the practices relating to using iPads for SC and ER at school and home.

Objective 2: Understand and evaluate the impact of context on how iPads are implemented in the classroom.

Objective 3: Investigate and assess the various levels at which participants, iPads and context interact and the way they influence the practices adopted in the classroom.

1.3 Proposed Contributions

The aforementioned aims and objectives of the study can lead to the following contributions to the existing knowledge of iPads and autism in the following ways:

- Thoroughly review the literature on the subject of autism and technology and critically assess all the work done in previous studies on iPad use for SC and ER.
- Explore the perspectives of key stakeholders about practices relating to using iPads for SC and ER at school and home through the development of a comprehensive research design.
- Evaluate the impact of context on the practices implemented in the classroom and conduct an extensive analysis for iPads' use for SC and ER.
- Investigate the interaction between key stakeholders, technology (iPads) and context and the practices adopted in the classroom by employing certain theoretical frameworks.

- Provide educators', parents' and autistic pupils' perspectives regarding the in-situ (home and school) use of iPads for SC and ER, to inform the literature.
- Present implications for practice regarding iPads' use in-situ for autistic pupils' ER based on Abbott's conceptual framework of 'E-inclusion' (2007).
- Provide further understanding to the field and recommendations about the contextual elements that can enable or hinder the development of autistic pupils' SC and ER with iPads in school learning environments.

1.4 Structure of the Thesis

Chapter 1 (Introduction): comprises a brief overview of the research motivation, context and background of the researcher. It also presents the aims, objectives, proposed contributions and structure of the study.

Chapter 2 (Contextualising Autism and Technology in the Classroom): presents a review of the literature situating this thesis in context and identifying the gaps that need to be addressed. It provides a narrative covering a) educational technology, b) autism and technology as a field, c) specific technological support for SC and ER and d) autism and iPad use in the classroom by drawing on international literature.

Chapter 3 (Online Survey: A Snapshot of Autism and Technology in Practice): reports on the results of an online survey that was completed by 55 educators in Special and Mainstream (Autism Resource Base) schools in England. The survey provides a snapshot of the purposes for using iPads for SC and ER in different educational settings and educators' perspectives. The findings collect a synthesis of key messages elicited from practice that will be used to inform the main study of this thesis by identifying key points that need to be explored further.

Chapter 4 (Case Study Methodology): conceptualises the research questions and justifies the philosophical and theoretical underpinnings. It also explains the research design and methodology, discussing ethical issues. Finally, the chapter describes the data analysis process, which involved interviews with key stakeholders from two schools (a Special and Mainstream Autism Resource Base setting) and document analysis of the settings' computing and E-safety policies.

Chapter 5 (Findings School A): reports and discusses the findings from School A (Special school), which emerged from the analysis of the semi-structured interviews with ten practitioners, three parents and four autistic pupils. First, it situates School A in context and then presents the data from the document analysis of the computing and E-safety policies of the school. The chapter finishes by presenting an overview of the iPad practices for SC and ER that educators and parents implemented, the participants' perspectives and the reported contextual influences of iPad adoption at school and home.

Chapter 6 (Findings School B): situates School B (Mainstream Autism Resource Base setting) in context and reports and discusses the findings from the semi-structured interviews conducted with the participants. The interviewees involved five educators and four parents, while a document analysis was performed based on the E-safety policy of the school. The chapter concludes with a summary of the iPad practices for SC and ER that educators and parents employed, the participants' perspectives and the reported contextual influences of iPad adoption at school and home.

Chapter 7 (Discussion of Key Messages from Both Case Studies): discusses the key messages from both case studies. The chapter addresses the research questions by a) identifying similarities and differences in the way iPads for SC and ER were used in the two schools, b) discussing how the different school contexts influenced key stakeholders' perspectives regarding iPad use, c) exploring what the interaction of digital technology, context and individuals looks like in relation to autism and iPads in the classroom and d) presenting the different levels at which iPads, individuals and context interact.

Chapter 8 (Conclusions): provides a summary of the study and the steps followed to answer the overarching research question. It discusses the contributions and broader implications of the thesis to practice and expands on its strengths and limitations. The chapter presents proposals for future research and ends with major concluding points, recommendations and key messages for future work.

Chapter 2: AUTISM AND TECHNOLOGY IN CONTEXT

2.1 Introduction

This chapter reviews the relevant literature on autism and technology to position this thesis in context and identify gaps that need to be addressed. To achieve this, it captures several different key areas and synthesises diverse information that accompany this interdisciplinary field. The chapter follows an inverted pyramid approach (from general to specific) to provide an overview of educational technology, narrowing down the focus to iPads and autism. Hence it is divided into the following sections:

a) Technology terms and concepts

b) Educational technology

c) Autism and technology

d) Autism, iPads and the classroom

The chapter begins with a discussion of the technology definitions used over the years in autism research, justifying the term that best captures the aims of this study based on the position of the researcher. Next, it explores how teachers implement technology in the classroom and the related enablers and barriers to its use. The chapter then provides an overview of autism, focusing on Social Communication (SC), Emotional Regulation (ER) and the relevant research that has been conducted on technologies for these developmental areas. Finally, it takes a closer look at the use of iPads for autistic pupils' SC and ER, discussing the impact of the interaction between person, technology and context on technology use in-situ.

2.2 Technology Terms and Concepts

The development and integration of technology in our everyday lives has seen a sharp rise over the past decades. Thus, it has caught the attention of different fields and disciplines, as it has transformed the way people interact, engage and learn. However, there has been little critique in the literature of the terminologies referring to technology and their focus. Hence, this section investigates the complex terminology of ‘technology’ in education, looking at the various terms adopted by researchers over the years. It discusses how they have influenced the use of technology in practice and portrays the position of the researcher towards technology.

A growing number of studies have investigated the use of ‘technology’ in education for multiple purposes such as accessibility and inclusion (Dragomir et al., 2018; Lancioni and Singh, 2014; Almuwil, Weerakkody and El-Haddadeh, 2011; Abbott et al., 2011; Reichle, 2011). However, the focus has not always been the same, with some studies highlighting the role of technology as a tool (Charitaki, 2015; Bakola et al., 2019) and others providing a broader focus on its functions (Avramides et al., 2012).

Considering that autism scholars have attempted to study technology from multidisciplinary perspectives (Virnes et al., 2015), research papers show divergence on how the term has been approached. A closer examination of the literature shows variability in the terms used, focusing on different technology functions. For example, ‘Information and Communications Technology’ (ICT) has been used to highlight the role of technology as a tool. In contrast, ‘Assistive Technology’ (AT), ‘Computer-Assistive Learning’ (CAL) and ‘Technology Enhanced Learning’ (TEL) have been adopted to embody the broader dimensions of technology related to learning.

A range of studies have used ICT to emphasise the role of technology as a tool to deliver learning (Aresti-Bartolome and Garcia-Zapirain, 2014). According to Hardy et al. (2015), ICT works as an umbrella term to cover different devices, including a whole range of hardware and software associated with them. ICT can involve video, virtual environments, computers and any other type of communication technology to support the development or treatment of specific skills (Grossard et al., 2018; Shahid, 2015).

For example, Charitaki (2015) explored the effect of ICT on the emotional education of autistic individuals. The project, which involved five children aged between nine and 14, used the 'Mood Maker' software to teach pupils basic emotions. According to the findings, the ICT intervention had positive results on the emotional development of the participants, as it offered individual instruction and autonomous development. In this paper, the author approached ICT as a beneficiary intervention that significantly impacted the targeted skills. However, she did not refer to the type of hardware used or its association to the context where it was implemented.

Likewise, in a paper conducted by Grossard et al. (2018), the use of ICT was reviewed in two large projects ('JEMImE' and 'Michelangelo') for the development of specific skills of autistic children. In line with the paper mentioned above, the authors referred to ICT as a mean to teach and treat the skills of the participants, highlighting its role as a support tool. As it was reported, the 'JEMImE' project was used to teach emotions, including a serious game to train facial expression/production. Similarly, the 'Michelangelo' project involved the Nao robot in improving joint attention and imitation skills of autistic children. A comparison of the studies confirms that the use of ICT has often been perceived in the literature as a way to mitigate the difficulties of autistic individuals and improve their performance (Cole and Daniella, 2011) without exploring the technology's broader impact on the learning process.

Another term for technology that has been used by researchers is 'Assistive Technology' (AT). AT, which is a component of ICT (UNESCO, 2013), is a term that includes products or systems that are implemented to help and support people with disabilities to function in their daily living. AT has been closely associated with disabilities, as it describes all kinds of systems that can enable a person to perform a task (Ravneberg and Söderström, 2017).

According to the World Health Organisation (WHO, 2018), more than a billion people have some kind of disability. The increase in the disability numbers and the expansion in the percentage of elderly individuals have resulted in a growing demand for AT products (BusinessWire, 2017; WHO, 2016). The term has also been widely used in autism to describe the devices and strategies implemented to make complex learning processes simple and achieve learning objectives (Vullamparthi et al., 2013).

For example, in a study conducted by Fteiha (2017), AT was used to refer to a computerised training programme designed to enhance the reading skills of 12 autistic children (eight and 12 years old). This experimental study, which reported positive findings regarding pupils' skills, highlighted that AT worked as a reinforcer for the participants, enriching the learning environment with visual and auditory stimuli. Besides, it was stated that AT attracted the attention of students more than traditional teaching methods, simplifying the learning process. Thus, in this paper, the term was used to capture the broader functions of technology, highlighting its positive impact on the individuals' ability to focus and access learning.

Another technology term that has often used in the literature is ‘Computer-Assisted Learning’ (CAL). CAL and its variant ’Computer Assistive Instruction’ (CAI) refer to the use of computers to educate and improve the skills of learners (Pellecchia et al., 2020). In autism, CAL has been used to capture both the technology and its role in the learning process. An example of this is presented in a review conducted by Fletcher-Watson (2014), which used the term to encompass the educational and therapeutic computer-based practices and approaches used in papers with autistic individuals. Contrary to previous studies, the author referred not only to therapy but also to learning, providing insights into the entire implementation process.

However, other papers suggest that CAL/CAI has been mainly used to measure the development of specific skills of autistic individuals (Pennington, 2010; Sansosti et al., 2015; Root et al., 2016). In a systematic literature review conducted by Root et al. (2016), the authors identified 24 single-case studies between 1995-2015 that used CAL/CAI to teach academic skills to autistic individuals. Interestingly, the context of instruction was not thoroughly explored in any of these studies, creating limitations to the effectiveness of the practices implemented. The diverse examples presented above indicate that although the terms CAL/CAI have been used to emphasise the potential of technology as an assistive learning tool, the role of the context has not been prioritised in papers.

Notably, the literature shows that researchers in the field of autism have gone above and beyond the idea of using technology as an assistive device (Parsons et al., 2015c). A growing understanding of how learning is socially constructed and situated (Wenger, 2000) has encouraged the use of technology as an enabler of learning, highlighting the need to explore its interaction with the user and the context (Abbott, 2007). Thus, during the past decade there has been a rise in the literature in the use of the term ‘Technology Enhanced Learning’ (TEL) (Bayne, 2015).

While there is no consensus on what the definition entails (Kirkwood and Price, 2013), TEL has been used as a ‘lingua franca’ to emphasise the need to connect technology with changes in pedagogy and practice to enhance learning (Scanlon et al., 2013). The term, which was adopted by the Higher Education Funding Council for England (HEFCE, 2009) and the UK Higher Education Academy (HEA, 2009), maps the shift to the enhancement value of technology and the need to focus on the pedagogical support of any technology-related practice (Borg and Cefai, 2013).

TEL has become widely accepted in the UK and Europe, and many scholars in autism have used it to capture the broader functions of technology. For example, a study conducted by Parsons et al. (2015a) explored how TEL could be innovatively embedded in school classrooms for autistic individuals. The researchers used digital stories to capture the participants’ reflections of the project technologies and record children’s interactions with them. One of the points that stood out from this project was that it provided a different approach to how TEL should be perceived. More specifically, it contributed to the field by giving a new understanding of the role of context-technology-user in the learning process.

In the same vein, Scanlon et al. (2013) state that it is necessary to capture how learning can be enhanced with the use of TEL by focusing on its implementation. This approach sheds light on the role of the educational context for the identification of evidence-based mechanisms for implementing TEL in autism practice (Guldberg et al., 2017). It also highlights that technology practices are unlikely to be successful unless embedded in a broader pedagogy (Abbott, 2007). Thus, considering that pedagogy brings together teaching and learning (James and Pollard, 2011), TEL should not be seen in isolation from the context.

The role of pedagogy has also been included in a paper by Avramides et al. (2012), where they reviewed state-of-the art TEL research to support the development of SC skills of autistic children. Interestingly, in their paper, the authors approached TEL from three different perspectives focusing on pedagogical foundations, the technology itself, and the involvement of the user. One of the points raised was the need to consider the contextual factors and pedagogy of TEL practices to produce findings that can be generalised. Thus, it was suggested that TEL can be influenced by naturalistic factors and should not be implemented as a prescribed activity.

In line with the points mentioned above and the broader concept of TEL, this thesis studies iPads by exploring the broader dimensions of technology on learning. More specifically, it situates iPads and autism in-situ, focusing on the interplay between technology, user and context. This means that technology is not seen separately from social practice but is approached as a social object (Hamilton and Friesen, 2013). Therefore, iPads and education are explored as two dynamic protagonists entangled in the broader environment of pupils as enhancers and enablers of learning. It should also be noted that this study is not constrained to using any of the definitions mentioned above but uses the broader term of ‘technology’ to refer to iPads and their role in enhancing/enabling learning.

2.3 Educational Technology

2.3.1 Technology Adoption by Teachers

The technological evolution in education has become one of the most significant and widely researched phenomena globally and has transformed many education systems and processes (Kalolo, 2019). With studies indicating that the learning performance of students increases when they are taught with digital technologies, this field holds great promise (Liao and Lai, 2018; Scardamalia and Bereiter, 2015). Over the past decade, new technological devices and pedagogies have emerged in educational settings, and technology has been widely used in teaching and learning (Voogt et al., 2018). However, identifying ways to support teachers to integrate technology effectively in the classroom remains an issue due to the fast-paced evolution of technological innovation (Bloomberg, 2015). Hence, this section analyses how teachers have adopted technology by exploring the related legislative initiatives developed in the United Kingdom (UK) and the types of devices that tend to be available in modern school contexts.

In England, the integration of technology in schools began with the Education Reform Act (1988) that introduced the compulsory use of ICT in primary and secondary maintained schools. Despite the inconsistency in how technology was initially implemented, it gradually became a specialist subject in the school curriculum (Ofsted, 2011). More specifically, in the 1990s, due to the development of the World Wide Web and technological advancements, ICT became more recognised, and the government invested new hardware and software into schools (Brown, 2016). Later, in 2014, a new programme of study was introduced in the national curriculum entitled ‘Computing programmes of study’ (DfE, 2013b). This programme, which taught students the basic principles of computer science and programming, aimed to enhance schools' technology approaches and curriculum (NAACE, 2013).

In 2019, the Department for Education (DfE) highlighted the need for effective technology adoption in schools with the launch of the Educational Technology (EdTech) strategy (DfE, 2019c). EdTech was designed to help educators address the barriers to good use of technology, making references to practices that support access and inclusion. In line with the TEL concept, which had approached technology as an enabler of learning, the EdTech strategy emphasised the potential of integrating technology in education. Thus, it highlighted the beginning of a new era where technology was not perceived as a tool to develop specific skills but as an enhancer of learning.

With the potential of technology to support the needs of pupils with SEND, several provisions and regulations have been developed in the UK over the past decades. Under the Disability Discrimination Act (1995); and the Equality Act (2010), schools and authorities in the UK have been required to supply reasonable adjustments for students to reduce discrimination and challenges that hinder access to quality education. In 2014, the UK government published the SEND statutory guidance for individuals (0-25 years old), which involved information about SEND support in schools, including assistive technology (DfE/DoH 2015). In addition, the 'Performance P-Scale-attainment targets for pupils 5-16 years old with SEND' (DfE, 2017b) provided performance descriptors for subjects such as 'Computing' and 'Design and Technology'. Interestingly, the role of technology in SEND provision has been in the spotlight over the past years with the government's new SEND EdTech pilot initiative 2020-2021, which aimed to identify effective technologies used across schools to excel students' learning and performance (ITPro, 2020).

Research findings have shown a variety of technologies used in mainstream schools, including computers, laptops, digital projectors, interactive whiteboards, smartphones and tablets (Barna, 2020). Likewise, in SEND settings, there has been an increase in the type of hardware adopted to meet the individual needs of pupils and improve the quality of teaching (Wynne et al., 2016). For example, in a systematic literature review conducted by Olakanmi et al. (2020), the authors examined how technology was used internationally between 2014-2018 for learners with cognitive and developmental disabilities in special education contexts (such as medical centres, special education specific institutions, kindergartens/preschools/day-cares, pre-colleges, post-secondary and tertiary contexts).

The study, which involved 126 publications found through the ACM, IEEE, ScienceDirect, and SSCI databases, showed that technologies used for individuals with SEND were classified into two broad categories, namely those that supported a teaching method and those utilised as ongoing support tools. The findings revealed that among the most frequently mentioned technology types for teaching (90.9% of studies) were: games, multimedia support (e.g. virtual reality), mobile devices, wearable technologies (e.g. smartwatches) and robots. The remaining 9.1% of studies involved technologies used as ongoing assistance tools and were mobile devices or applications on a desktop or laptop computer. These results indicate the diversity in the types of technologies that have been used in school contexts across the years.

The literature has also shown variances in the way technology has been adopted by educators (Salavati, 2016). One of the distinguishing features of technology that has prompted teachers to integrate it into teaching has been its potential to increase collaborative learning practices (Raja and Nagasubramani, 2018). To date, several studies have investigated the role of technology in enhancing co-operative learning among students and students and practitioners (Donovan and Sullivan, 2012; Nemiro, 2020).

For example, a study conducted by Nemiro (2020) examined the role of a school robotics initiative on the collaboration skills of 194 elementary students in the USA. The findings showed that various collaborative behaviours emerged from the project, including peer assistance when help was required, knowledge sharing and potential solutions. Interestingly, the study revealed that collaboration between students and student-teachers was increased during this project compared to other classroom group activities. This investigation provided an example of how teachers adopted technology to enhance co-operation via the exchange of ideas and joint problem-solving.

Research also reveals that technology has been used as an extra communication channel between practitioners and parents (Oinas et al., 2017). During the last decades, technology has offered various methods to facilitate teacher-parent collaboration (ibid.). For example, emails, school webpages, online chats, and text messages have been among the most common communication methods between home and school (Thompson et al., 2015). According to the literature, feedback via technology can enable teachers to collaborate with parents regarding the progress of students and overcome difficulties of meeting in person (e.g. time restrictions or difficulty accessing schools) (ibid.).

A study conducted by Özdamlı and Yildiz (2014) examined the importance of mobile devices in school-family collaboration in elementary and primary schools in Nicosia, Cyprus. The study collected data via a survey and involved 790 parents who provided feedback about their experience of using mobile devices to co-operate with the school. The findings revealed that parents were positive about using technology to communicate with teachers and had high expectations about improving this experience.

Another way that educators have adopted technology relates to classroom assessment practices. Research findings have suggested that digital technologies can change assessment as they can easily capture various skills and use data analytics to inform teachers' practices (Oldfield et al., 2012). Considering that assessment requires effective feedback to enable students to improve, technology can enhance this process by producing several input methods (Deeley, 2018). For example, as Carruthers et al. (2015) stated, technology that uses audio-visuals can provide more detailed and personal feedback to pupils than traditional assessment methods.

The role of technology in assessment was explored in a study conducted by Danniels et al. (2020) in Ontario, Canada. Their study, which collected data through classroom observations, semi-structured and video-elicitation interviews from 20 kindergarten teachers, revealed that educators found incorporating technology-based assessment into their teaching beneficial. The findings showed that technology allowed teachers to capture the progress of pupils and collect information about the learning process and context. The points mentioned above shed light on the impact of various technologies in facilitating assessment and producing rich and quick feedback both for educators and students.

Technology can also improve a variety of students' abilities, such as academic, problem solving and research skills (Reinhold et al., 2020). The efforts of teachers to effectively integrate technology in the classroom have been based on research findings that support this view. For example, a study conducted by Lämsä et al. (2018) examined the potential of educational games in supporting the Maths and Literacy skills of pupils with learning disabilities. The review, which was based on 20 papers (657 participants, aged four-12 years old), showed that educational games for teaching specific skills supplemented teacher instruction and had the potential to positively impact the skills of students. Likewise, another study conducted by Aspiranti et al. (2020) on the academic effects of iPads/tablets on autistic students, suggested that these devices could have a positive and significant impact on learning outcomes. The findings, which were based on a meta-analysis of four papers and involved 37 autistic students (four-16 years old), highlighted that iPads increased the academic abilities and achievement of students.

Another way teachers have broadly adopted technology has been related to its potential to motivate students to stay engaged during the learning process (Shatri, 2020). This statement has been supported by the literature, which has shown that the positive attitudes of students towards technology can encourage performance results (Ankiewicz, 2016). Considering that teaching does not solely involve delivering material but requires the engagement of students, the use of technology as a motivator can enhance the learning process (Fatimah and Santiana, 2017).

For example, in a study conducted by Granito and Chernobilsky (2012), it was revealed that technology could be a powerful motivator for students who had an interest in it. The research, which was based on an experimental design and involved 102 seventh grade pupils (12-13 years old), showed that students who used an online digital storytelling tool were more interested in participating in a class activity than those using a paper-based storybook. In line with this, Raja and Nagasubramani (2018) stated that appealing visuals and enhanced teaching practices using technology can improve the interest levels of students. This is because different applications of technology can offer opportunities for innovative practices and new learning experiences that can bring excitement and motivation to learn (Shatri, 2020).

Moreover, the sharing of information and knowledge through technology can also have a significant impact on teaching and learning. According to UNESCO's regulation for free access to information (UNESCO, 2019), knowledge sharing via online platforms, online libraries and open resources has provided teachers with the opportunity to freely use learning materials, adapt and distribute them to students, producing high-quality teaching. Thus, the development of new technologies and the open knowledge movement has created the potential to make teaching more interesting by using various online resources.

Furthermore, in the context of teacher development, research has revealed that the use of technology can have multiple possibilities associated with enhancing the learning of educators (Arshavskaya, 2019). For example, in a study conducted by Killeavy and Molloney (2010), they found that blogging allowed 23 newly qualified language teachers in Ireland to share ideas and experiences through an interactive learning environment and improve teaching practices. These findings presented a different use of technology to facilitate teacher support networks and allow access to resources for the enhancement of the teaching practices.

Apart from applying technology as an enhancer of practitioners' teaching, another significant aspect of digital adoption relates to its use as an enabler of learning for students with SEND. For many years, schools have tried to create the required conditions to include pupils of different abilities in the learning process (Perna et al., 2020). Hence, a range of technologies have been adopted to support students, comprising, amongst others, devices with voice recognition or symbol-based applications (McKnight and Davies, 2013).

Speaking of the role of technology in inclusion, another term that has been used in the literature is 'E-inclusion'. According to Abbott (2007), this term describes "*the use of digital technologies to enable inclusive learning practices for people with learning difficulties"* (p.6). More specifically, 'E-inclusion' approaches technology as a transformer of the learning context that has the potential to facilitate, enhance and personalise the learning of pupils with SEND within and beyond the curriculum (ibid.). Technology is therefore considered under the headings of 'enablement, enrichment and extension' as it can give SEND students access to curriculum, improve quality of learning and enable personalised learning (Beltrán, Abbott and Jones, 2013).

Interestingly, Abbott (2007) also adopted a different perspective on the role of technology stating that the focus should not solely be on learning but also on the interaction between 'person-technology-environment'. However, the impact of context has often overlooked in studies, as attention has been mainly focused on the development of specific skills of pupils (Mølster and Nes, 2018). An example of this is presented in a study conducted by Abed (2018), which explored the viewpoints and experiences of 20 Saudi Arabia SEND teachers regarding technology adoption. The findings revealed that technology was recognised as a positive element for the social inclusion of the students and was accordingly adapted despite the limited ICT knowledge of the teachers. However, the practices that were implemented were related to one-to-one instruction, development of confidence and self-esteem and independence with no reference to the role of context.

Speaking of context, it should also be highlighted that technology and the Internet can also create opportunities for unlimited access to information at any time. As the world becomes more digitalised and learning is not limited to the school context, teachers have been prompted to create online resources that can be easily reachable by all pupils (Ally and Samaka, 2013). Diverse learning alternatives can allow individuals to take education anywhere and consequently incorporate in and out of school learning (Voogt et al., 2018). In the past decade, practitioners have begun to realise the potential of this process and have encouraged students to use mobile technologies to enable the continuity of learning in different environments (such as home and school) (Khaddage et al., 2016).

This has become more evident nowadays, where worldwide education systems have undergone extensive transformation due to the outbreak of COVID-19 pandemic. This is what Vial (2019) has described as 'digital transformation' and refers to *"a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies*" (p.118). Lockdown and remote teaching have expanded technology integration into teaching and learning with the adoption of a variety of applications such as Zoom, Microsoft Teams, Google Classroom and the extensive use of virtual classrooms, online libraries, TV broadcasts, video lectures, resources and online platforms (Basilaia and Kvavadze, 2020). In a few months, at least 96 countries moved from traditional to online education with teachers, school administrators, parents, children, and society making significant adjustments to provide the best education possible (ibid.).

Teachers' transformed adoption of technology since the pandemic outbreak has been depicted in a study conducted by Iivari et al. (2020). In their paper, they interviewed teachers from schools in Finland and special schools in India to showcase how they changed their practices depending on the context and culture of each country. Interestingly, in both countries, the educators showed remarkable resilience in adopting digital solutions to conduct the lesson (such as online platforms) and work together with parents (e.g. via WhatsApp). Despite the cultural differences and inequalities in each country, the findings revealed that educators identified digital practices that could be implemented in a variety of subjects.

These findings suggest that the twenty-first century has seen unique adoption of technology by educators. Consequently, this has led to an increase in investments from governments worldwide (Kearney et al., 2018). This has also been supported by legislative recommendations for successful technology integration into the curriculum. More broadly, the literature has shown a wide range of hardware and software that have been adopted over the past years in schools depending on the context, cultural background of each setting and social demands (Basilaia and Kvavadze, 2020). However, what has been common worldwide has been the shared value of technology adoption to improve the educational experiences of pupils.

In summary, this section identified that teachers around the world have mainly adopted technology to a) encourage collaborative learning, b) enhance communication with parents, c) assess pupils' progress, d) improve academic skills, e) motivate students, f) enhance learning resources g) achieve 'E-inclusion', h) connect formal and informal learning and i) implement distant schooling when required. The next sub-section moves on to discuss the barriers to educational technology integration.

2.3.2 Barriers to Educational Technology Integration

As stated above, the academic literature on educational technology has revealed a rise in technology use in teaching and learning processes (Berrett et al., 2012). However, despite the popularity, several authors have identified factors that influence the effective integration of technology in the classroom (Kaur, 2019; Voet and Wever, 2017). Drawing on the relevant literature, this section examines the barriers to integrating educational technology in the classroom by investigating what has been studied regarding the variety in technology adoption by teachers in mainstream and special needs settings. Although there has been no clear divide between educational technology enablers and barriers, this review identifies that some clear themes that relate to possible barriers are a) teachers' personal characteristics (such as confidence and beliefs towards technology) and b) external environmental factors.

The initial discussions and analyses of technology in learning started in the 1950s when computers were used to teach specific subjects (Aslan and Reigeluth, 2011). The first reports of technology in learning were mentioned in 1954, when Skinner started experimenting with teaching machines that used programmed learning and positive reinforcement for instructional purposes (Skinner, 1954; Skinner, 1958). To date, several studies have systematically explored how technology can be effectively embedded in learning (Anderson and Putman, 2020; Cheng and Xie, 2018; Clarke and Svanaes, 2014). Thus, educational technology has created expectations in educational settings and has become an essential component of the English national curriculum (DfE, 2013a; DfE, 2020a).

According to the literature, reviews have mainly explored specific types of technology, making the judgements often controversial due to the various aspects that might influence learning (Lai and Bower, 2019). Among the types of technologies that have been studied are mobile devices (e.g., Crompton, Burke and Gregory, 2017), computer-based (serious) games (e.g., Boyle et al., 2016), virtual environments / augmented reality (e.g., Bacca et al., 2014) and robots (Jung and Won, 2018). However, despite the diverse range of studies that have focused on specific technologies, or pupils' skills, the findings show that there have been different motivations for integrating technology into learning (Lai and Bower, 2019).

For example, the literature review revealed that many previous studies have focused on teachers' beliefs (Leem and Sung, 2019; Raja and Nagasubramani, 2018; Tondeur et al., 2017). Although there has been no consensus in the field about what teachers' beliefs entail, this study adopts the notion that they encompass teachers' psychological understandings or propositions that they feel to be true (Richardson, 2003). In a study conducted by Leem and Sung (2019), the relationship between teachers' pedagogical beliefs and technology acceptance of smart devices was explored. More specifically, 768 teachers from public primary and secondary schools in South Korea were asked to answer an online questionnaire to explore factors underlying their beliefs. The findings showed that teachers' negative beliefs of technology played a significant role in educational technology adoption and hindered the uptake of smart devices in the classroom.

Another recurrent theme on teachers' beliefs was presented in a study performed by Tondeur et al. (2016). The researchers conducted a systematic review of 14 papers between 2002-2012 and suggested a link between teachers' pedagogical beliefs and educational uses of technology. The authors stated that practitioners with more teacher-centred beliefs did not consider technology an essential component of their practice. On the contrary, educators who were more inclined to student-centred practices and constructivist beliefs approached it as a tool to support learning. This evidence was also confirmed by Ertmer et al. (2012), who identified in their review a strong link between technology use and the adoption of constructivist approaches by the practitioners. These findings revealed that the link between pedagogical beliefs and technology integration could be characterised as bi-directional (Tondeur et al., 2016) as technology-based learning experiences could encourage the use of pupil-centred approaches. Thus, teachers with student-centred beliefs had the potential to enhance the use of technology in the classroom.

Another personal characteristic that has been identified as a barrier to the way technology has been integrated into educational contexts is teachers' confidence. Kaur (2019) studied the perceptions, needs and attitudes of 125 prospective education students in India towards using technology in the classroom. The study conducted in the form of a survey (*n*=125) and focus groups (*n*=15) showed that the pre-service technology skills and the knowledgeability of teachers were important elements for integrating technology in teaching. Likewise, research findings from other studies conducted with mainstream education teachers indicated that the high or low confidence of users influenced the frequency that technology was used in the classroom (Cheng and Xieu, 2018; Saudelli and Ciampa, 2016). Hence, it can be stated that technology use in educational contexts has been related to teachers' confidence, knowledgeability and training (ICF, 2015).

Another reported theme as a possible barrier to educational technology has been the lack of adequate resources or equipment (Baturay et al., 2017). Although educational technology may include any device, resource or practice incorporated into teaching to achieve learning (Parkman et al., 2018), technical issues can also influence the process. According to the EdTech strategy (DfE, 2019c), addressing the barriers to good use of technology requires modern infrastructure in schools. For example, outdated devices, slow internet connection or poor internal school networking can hinder the effective integration of technology in the classroom. A study carried out by the European Commission (2019) on technology use in schools in 31 countries suggested a need for investments in educational infrastructure to modernise education and open up opportunities for effective technology integration. Hence, the findings confirmed that external environmental factors should also be considered when educational technology is discussed.

On a further note, the literature has drawn upon school support as another factor that can influence technology adoption. The DfE (2019c) underlines that school leadership can play a vital role in providing a supportive culture of technology-enhanced learning. Building a digital capability within a school context can enhance the confidence of the staff and, at the same time, achieve knowledge sharing and quality technology support. In a study conducted by Rabah (2015) on the benefits and challenges of integrating technology in Quebec English schools, the authors found that a lack of supportive school leadership had a negative effect on the successful integration of technology. Moreover, the findings from their focus groups with the 23 teachers and education consultants from seven different school boards indicated that teachers' isolated initiatives were not successful without the support of the school. The study showed that consistency in use, shared beliefs and values were closely intertwined and necessary for successfully integrating technology in the learning process. It also highlighted the need to study educational technology in line with the context, setting and environment of the school.

Other potential barriers to educational technology integration may refer to lack of time (Henriksen et al., 2016) and the rapid pace of new technological developments (Zhao, 2012). The research has stated that identifying the appropriate type of software/ hardware coupled with teachers' limited time to prepare the lesson have been other issues to consider. In an online study conducted by Yun-Jo and Reigeluth (2012), with 26 teachers from schools of different age levels in the United States of America (USA), it was reported that the restricted time of practitioners to prepare the technology-based activities before the lesson hindered the successful educational technology implementation. Similarly, in the special needs sector, the individual needs of children and the identification of appropriate software has been repeatedly reported as a common barrier to technology integration (Kennedy and Boyle, 2017). With many schools focusing on grades, standards and outcomes and the rapid development of technology-based software, technology development and use tend to advance research, leading educators to choose products without empirical evidence of their appropriateness (Kennedy, 2013).

Despite the diverse range of challenges that might have hindered the successful integration of technology in the classroom, the literature has shown that technology can enhance learning (Rabah, 2015). Thus, the following section explores research recommendations regarding strategies that could transform the barriers mentioned above to enablers of successful educational technology implementation.

2.3.3 Enablers to Educational Technology Integration

Over the past years, there has been an increasing interest in the factors that influence successful technology integration in teaching and learning. Although many studies have tried to explore the determinants of this dynamic process, it has been difficult to distinguish individual enablers and barriers as they are often interrelated (Al-Shboul, 2019; Kafyulilo, Fisser and Voogt, 2016). However, this section draws on relevant papers and discusses what studies have found to be the enablers of technology use, considering research that has taken place in different countries. Thus, the key themes that have been identified are the following: *a) Pre-service teacher education programmes, b) Continuous Professional Development (CPD) training/mentors, c) School environment/culture, d) Staff incentives, e) Interdisciplinary collaboration, f) Technological infrastructure/maintenance.* Although the results from these studies might have been contextually bound to the culture and practices in those countries, they have been relevant as they all have similar findings.

Several studies have investigated the readiness of educators to integrate technology in their lesson by looking at the influence of pre-service programmes on their practice (Ottenbreit-Leftwich et al., 2018; Admiraal et al., 2017; Tondeur et al., 2016). For example, Kafyulilo, Fisser and Voogt (2016) conducted a study to explore the impact of a professional development programme on technology use from pre- and in-service teachers in Tanzania. The professional development programme, which was implemented with 12 teachers, aimed to increase technology knowledge and integration skills of Maths and Science pre-service teachers after its completion. Although it was reported that there was a combination of determinants that influenced the process, the interviews revealed that the professional development training was an essential element for educators' continuous use of technology in teaching after the programme ended.

In line with this, Tondeur et al. (2017) identified that hands-on experience and technology-related internship programmes to pre-service teachers influenced their use of technology positively. In their longitudinal study which was conducted two years after 16 Belgian teachers completed their pre-service programme, it was reported that practitioners who had access to more technology-related learning opportunities felt more familiarised and prepared to integrate technology in teaching. This either involved practice during their internship in real classrooms with feedback from their mentors or exposure to educational possibilities of various types of technology from ICT experts. Based on these studies, the findings showed that appropriate preparation of teachers at pre-service teacher training programmes was an essential enabler for the effective integration of technology in the classroom.

Other authors have supported the view that there has been a discrepancy between what pre-service teachers are taught and how technology is integrated into the classroom (Admiraal et al., 2017; Ottenbreit-Leftwich et al., 2010), attributing this to a variety of factors such as environmental determinants, classroom management and technology challenges. In line with this, various studies have highlighted the role of training and mentors as possible enablers of successful educational technology integration (Baker et al., 2019; Admiraal et al., 2017; Cubukcuoglu, 2013).

For example, Baker et al. (2019) conducted a study that explored nine examples of good technology practice in classrooms of countries worldwide (e.g. Italy, Esthonia, Brazil). The aim was to provide recommendations for good use of technology in educational settings. The findings grounded in interviews and workshops with a wide range of stakeholders indicated that training was a crucial requirement for successful technology implementation. Although training around the globe varies, the authors stated that Continuous Professional Development (CPD) and investment in practitioners' capabilities were interwoven enablers. Thus, it was discovered that CPD technology-related programmes created the conditions to support teachers' effective use of technology, given the various contexts and their requirements.

This statement also accords with earlier observations, which have shown that adequate training on the use of technology should involve ICT skills and enhancement of pedagogical ways of using technology through practice and real-life examples (Cubukcuoglou, 2013). These views also relate to the role of mentors in supporting educators to implement technology effectively in lessons (Admiraal et al., 2017). For example, Dorner and Kumar (2016) conducted a study to investigate the role of an online collaborative mentoring model in integrating technology in the classroom. The participants who involved 116 Hungarian pre-service teachers revealed that the programme positively impacted the successful incorporation of technology in teaching. The participants stated that they had the opportunity to learn from the experiences of the mentors but also reflect on pedagogical and technological practices. This statement has also been supported by other studies which have showcased that face-to-face mentoring between pre-service teachers and mentors can positively influence the effective use of technology in educational contexts (Gökoğlu and Çakıroğlu, 2017).

However, given that technology integration is a multidimensional process, its successful implementation requires various factors to work in harmony. A growing body of literature has shifted the attention to school-level factors such as school culture and environment as promising enablers (Baker et al., 2019; Gürfidan and Koç, 2016; Ottenbreit-Leftwich et al., 2018). With the term ‘school culture’, this study refers to *“the belief and attitude influencing every aspect of how a school functions”* (Lewis et al., 2016, p.57). The impact of school culture on technology use was studied by Gürfidan and Koç (2016). To measure this relationship, the researchers distributed a questionnaire to 396 high school teachers in Southern Turkey. The aim was to test the multiple relationships between technology integration, support services, technology leadership and school culture. The findings showed that a positive school environment, culture and leadership resulted in good support services and enabled successful technology integration. Moreover, the study illustrated an indirect but strong correlation between school culture and technology integration.

Such a dynamic view of school culture and technology adoption has been necessary for creating different support mechanisms in school environments, such as staff incentives. In alignment with the literature, school culture can serve as a guide to shape technology integration and a mediator of practitioners' identity and technology competency (Yang and Chun, 2018). For instance, many researchers have focused on staff incentives as possible enablers of technology integration. In her paper, Cubukcuoglu (2013) stated that the encouragement of practitioners from the school leadership team and the existence of motivators/rewards positively influenced the effective integration of technology in the classroom. For example, one of the motivators that Fathi and Ebadi (2020) identified during their study with six Iranian pre-service English teachers was the social influence of their practice on their colleagues. The findings from the observations, semi-structured interviews and open-ended questionnaires showed that the approval and admiration of other teachers were motivating factors for practitioners to use technology effectively.

Similarly, incentives and motivators can come from external organisations such as partnerships or learning programmes designed to support educators using technology successfully in their practice. This enabler entitled in this study 'interdisciplinary collaboration' has been used as an umbrella term to capture research-practice partnerships, training programmes or governmental initiatives for technology integration. An example of this is the 'Realising the potential of technology in education: A strategy for education providers and the technology industry', produced by the Department for Education (DfE, 2019c) to help educators integrate technology in education and improve outcomes. Likewise, private companies such as Apple have provided incentives for practitioners (e.g. the 'Apple Distinguished Educators'-ADE programme) to use technology effectively and implement good practices (Apple, 2020). Moreover, Apple has encouraged the free dissemination of knowledge between educators with the design of free workshops at nominated Apple Regional Training Centres (ibid.).

Opportunities for teachers to be part of broader community technology networks of learning have also been provided through university research projects which have encouraged interdisciplinary collaboration between research and practice. An example of this is ECHOES, a three-year project which implemented participatory design to enable researchers to design together with 29 autistic children (five-seven years old) and practitioners a TEL environment to practice social interactions (Bernardini et al., 2014). Another project called 'SHAPE' explored together with practitioners from six special, specialist and mainstream schools the impact of four different technologies on children's SC skills (Parsons et al., 2015a). The findings of the two projects revealed that the collaboration between researchers and teachers created empowerment for knowledge sharing that influenced and informed all participants about effective ways of implementing technology in the classroom.

Similar conclusions were also produced in another project conducted by Mangafa (2017). In her study, the researcher involved educators, parents and technology experts to explore the use of iPads to encourage joint attention skills in autistic children. The findings provided insights about the use of tablets for this purpose, highlighting the role of interdisciplinary collaboration in the effective technology integration and knowledge co-creation between key stakeholders and the researcher. The studies mentioned above have affirmed that creating interdisciplinary partnerships in practice may work as enablers for supporting teachers' effective use of technology in learning. They have also highlighted the role of context in how technology is implemented in-situ (Guldberg et al., 2017).

Another identified enabler relates to technological infrastructure and maintenance of the equipment (Ouatiq et al., 2019; Light and Pierson, 2013). A study performed by Chaaban and Ellili-Cherif (2017) explored the effect of environmental factors on the technology integration in English as a Foreign Language (EFL) classes in Qatar. The study, which was conducted in the form of an online survey, took place in 67 independent schools and involved 263 teachers. The findings showed that contextual factors such as technological infrastructure and availability were among the core elements for successful educational technology integration. Moreover, reference was made to adequate technological equipment (e.g. laptops, computers, whiteboards), good Internet connection and technical support. In line with this, the need for accelerating connectivity has also been raised by the Office of Communications (Ofcom) (2018), which mentioned that up to 500 schools in England faced slow Internet connection challenges (1-2 Mbps), preventing practitioners from integrating technology in their lesson.

Ouatiq et al. (2019) have also stated that another factor to consider for successful technology implementation in educational contexts had been the need for adequate maintenance and renewal of the equipment. This has also been supported by a study conducted by Otieno et al. (2018), which evaluated the influence of the technology maintenance principals in secondary schools in Kenya. The findings revealed that according to the views of 804 respondents (principals, deputy principals and Heads of departments), the principals' maintenance of technology positively influenced the integration of technology into teaching.

Taken together, this section has painted a picture of the factors that should be taken into consideration when discussing effective technology integration in the classroom.

Although it could be argued that the enablers could be the reverse of the barriers which were explored in the previous section, they should not be considered as equal. This is because the enablers look deeper into the causes of the barriers and can provide recommendations for enhancing the recognised enablers. In other words, they aim to facilitate process evaluations to improve understanding of ways of integrating technology effectively in educational settings.

The following section moves on to discuss the use of technology in the field of autism.

2.4 Autism and Technology

2.4.1 A Brief Overview of Autism

Autism was initially described by Leo Kanner (1943) and Hans Asperger (1944) and was mentioned in papers that were part of the literature of child psychiatry (Frith, 1991). Despite early discussions on the relationship between autism and schizophrenia (Kanner, 1965), the concept has changed over the years. Specifically, in the 1980s, autism became known as a disorder of sociality, characterised by lack of responsiveness and challenges in language development and social interaction (Verhoeff, 2013). Although autism has been extensively researched since its discovery almost 80 years ago, no consensus has been in the literature on how it should be described. Hodges, Fealko and Soares (2020) state that 'Autism Spectrum Disorder' (ASD) has been widely used as an umbrella term to refer to a lifelong neurodevelopmental disorder that impacts the SC, behaviour and interests of individuals.

Over the past years, the terminology used to refer to individuals with a diagnosis has been subject to discussion (Vivanti, 2020), with many people questioning the term ‘disorder’. According to the National Autistic Society (NAS, 2020), the most frequently used terms to describe autism could be grouped into two broad categories: a) identity-first (e.g. ‘autistic person’), b) person-first (e.g. ‘person with autism’). Considering that people experience autism in different ways, Kenny et al. (2015) conducted an online survey to examine the terms used to conceptualise autism. The findings from their online survey, which involved 3.470 members of the autism community in the UK, revealed that adults with autism and their caregivers preferred identity-first terms to describe autism, while professionals and researchers mainly used person-first terms. Hence, this study has adopted both terms (‘people with autism’ and ‘autistic people’) to refer to individuals who have been diagnosed with autism.

Regarding the prevalence of autism, the World Health Organisation (WHO) has estimated that one in 160 children worldwide is on the spectrum (Elsabbagh et al., 2012). In line with this, it has been calculated that in the UK, approximately 1% of the population has autism (Laurie and Border, 2020). Autism is usually diagnosed before the age of three, is a lifelong condition, and the symptoms may not be fully expressed until later in life (APA, 2013). The challenges that accompany autism have been explained by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (APA, 2013) and the updated version of the International Classification of Diseases and Related Health Problems (ICD-11) (WHO, 2018). The two diagnostic manuals state that the main types of symptoms involve challenges in social communication, restrictive, repetitive activities/interests and sensory difficulties, while the previously separated areas of communication and social interaction have been merged (DSM-5; ICD-11).

Specifically, the American Psychiatric Association (APA, 2013) has mentioned that autism is characterised by *“persistent deficits in social communication and social interaction across multiple contexts, including deficits in social reciprocity, nonverbal communicative behaviors used for social interaction, and skills in developing, maintaining, and understanding relationships”* (p.31, see also DSM-5). In addition, among other challenges, autism might involve sensory-perpetual, intellectual, language and coordination difficulties (NICE, 2013) while it covers various ability levels (Kientz et al., 2020).

Given the heterogeneity of autism, the literature has shown that it has been difficult to provide a complete list of the common deficits in autism (Bellesi, 2016). However, some frequently reported difficulties also involve challenges in emotional regulation, emotional recognition and motivation (Sparapani et al., 2016). Finally, some non-social symptoms might entail obsessional interests, an excessive need for structure and order, and an insistence on sameness, repetitive behaviours and routines (Dodd, 2015). Having briefly presented the definition of autism, the diagnostic criteria and main challenges, the following sub-section discusses in more depth two of the difficulties that autistic individuals might experience. Hence, the attention is shifted to SC and ER, and to justifying why this study focuses on these skills.

2.4.2 Social Communication (SC) and Emotional Regulation (ER)

Difficulties in social and communication skills have been part of the earliest diagnostic definition of the spectrum as core features in autism (Watkins et al., 2017). After the DSM-5 (APA, 2013), social and communication impairments were combined into one category due to their strong link. Considering that there are substantial differences in how individuals communicate (Adamson et al., 2019), the complexity of the SC definition in autism has been captured repeatedly over the years. According to DSM-5 (APA, 2013), deficits in SC and social interactions across multiple contexts may involve challenges in a) social emotional reciprocity, b) nonverbal communicative behaviours, c) developing, maintaining, and understanding relationships.

Similarly, the NAS (2020) mentions that autistic people with SC challenges may a) experience difficulty with interpreting verbal/non-verbal language, b) be unable to speak or have limited speech, c) have very good language skills but struggle to understand sarcasm or tone of voice. In line with this, Prizant et al. (2007) used a broader definition for SC, explaining that it involves "*the development of spontaneous, initiated, functional communication, the development of secure and trusting relationships with children and adults, and an understanding of the conventions of different social situations*" (p.1).

Despite the difficulties in SC that encompass several skills that influence different aspects of life, research findings have shown that there is also a strong relationship between SC and joint attention (JA) (Adamson et al., 2019; Mundy, 2016). JA is a pre-communication skill that includes the ability of sharing, sustaining and shifting attention between social partners and an object and can take place through physical actions (such as pointing) or object-directed gazes between the object and the individuals (Patten and Watson 2011; Kasari et al., 2010). In other words, JA refers to *“the prelinguistic gestures children use to communicate before they learn to speak, such as pointing to something of interest”* (Shih et al., 2021, p.1). Considering that the literature has shown that the concept of JA has been central to studies exploring the processes involved in language and communication development (Bottema-Beutel, 2016) it could not have been omitted from this discussion.

In a study conducted in Atlanta, Adamson et al. (2019) explored JA and its relation to expressive language development. The participants included 144 toddlers (40 typically developing, 58 autistic and 46 with delay) observed between January 2007-October 2012, and their skills were measured using standardised assessments. The findings revealed that JA and language development mutually reinforced one another and verified previous studies that supported that JA deficits negatively impact social interactions necessary for language development (Mundy, 2016). Thus, considering the fundamental role of JA in the development of SC, this study acknowledges that they are both viewed as skills that grow through human engagement and are influenced by context.

The literature on SC and JA has also highlighted several studies that focus on joint engagement (JE). Jahromi, Bryce and Swanson (2013) state that another related challenge to JA is JE which refers to the period of time when two social partners actively focus on a shared object or event. Their study examined the differences in self-regulation, emotional and behavioural school engagement and prosocial peer engagement of 40 pupils (20 with high functioning autism and 20 neurotypical) aged 4.5 years old. The findings elicited based on parents’ reports and observations of the pupils revealed that children with autism had difficulties modulating affective or behavioural responses, which influenced their school and peer engagement. Considering that school engagement refers to children's ability to behaviourally, cognitively and emotionally interact and attend to social and non-social aspects of the school environment, it has been connected in research to academic and social functioning (Fredricks et al., 2005). Therefore, in this study JE is perceived as an element of SC developmental area and will be explored under this category.

Regarding emotional regulation (ER), research findings have shown that individuals with autism may experience challenges regulating their emotions and behaviour (Sparapani et al., 2016). Prizant et al. (2007) describes ER as "*the development of the ability to maintain a well-regulated emotional state to cope with everyday stress, and to be most available for learning and interacting"* (p.1). Although there has been little research on ER and behaviour problems in young individuals with autism (Berkovits, Eisenhower and Blacher, 2017), ER has been considered a critical skill as it underlines multiple key areas of children's development.

For example, in a study conducted by Samson et al. (2014) with 56 autistic and 38 typically developing individuals (aged six-16 years old), researchers identified that autistic people experienced higher levels of emotional dysregulation, which affected their social communication and increased repetitive behaviours. Likewise, Sharmin et al. (2018) state that the difficulty of autistic people to regulate and express their emotions has been associated with difficulties in understanding social boundaries and social interactions. Thus, children who can control their emotions may exhibit positive behaviours and facilitate positive social interactions.

Although ER difficulties are a serious concern for autistic individuals, the literature stresses that emotional recognition has been another skill that could be included in this category (Richard, More and Joy, 2015). In line with this, Mazefsky and White (2014) have stated that emotional recognition is one aspect of the broader construct of ER although it differs from the experience of emotion itself, in that ER is the process that is used to modify the intensity and features of emotion. However, according to DSM-5 (APA, 2013), the ability to identify facial emotional cues has been a necessary nonverbal skill and could also be considered as an early social skill.

Notwithstanding the numerous studies on emotional recognition in children with autism, the findings have been inconsistent (Brooks, 2020). Several researchers have suggested that autistic individuals have difficulties recognising emotions (Loth et al., 2018), while others have highlighted no significant differences between typically developing and autistic pupils (Lacroix et al., 2009). However, despite the contradictory findings, emotional recognition in autism has been of fundamental importance as it can influence both ER and SC skills. Specifically, in this study, emotional recognition has been grouped under the ER developmental area, as it is acknowledged that recognising and understanding emotions is necessary for successful ER (Ciarrochi, Heaven and Supavadeeprasit, 2008). Likewise, Mazefsky et al. (2014) stated that labelling one's emotion is a critical aspect of ER, as it is also the ability to communicate it to others or understand other people's emotional state.

The points mentioned above highlight that SC and ER are two developmental areas that are interconnected. Difficulties in SC can create emotional challenges, such as anxiety or stress and similarly, deficits in ER can have a negative effect on the SC of autistic people (Gotham, Brunwasser and Lord, 2015). Besides, as mentioned in DSM-5 (APA, 2013), autism might involve social-emotional reciprocity challenges, showing the influence of these two skills on each other. In addition, the literature underlines that SC has attracted the attention of many studies as it concerns a variety of different skills and often results in challenging social relationships (Baron-Cohen and Wheelwright, 2003). Contrary to that, there is limited research on ER and emotional recognition, although they influence a range of autism outcomes (Cai et al., 2018).

Considering all these points and given the importance of these areas of development to the everyday functioning of autistic individuals, this study has concentrated on SC and ER. It has also included aspects of their broader construct (such as joint attention, joint engagement, and emotional recognition). Thus, although JA, JE and emotional recognition have not been the main focal point of this research, they have been acknowledged as parts of SC and ER to get a well-rounded view of these developmental areas. A visual representation of the core skills and the categorisation of their associated challenges is presented in Figure 2.1 (below).

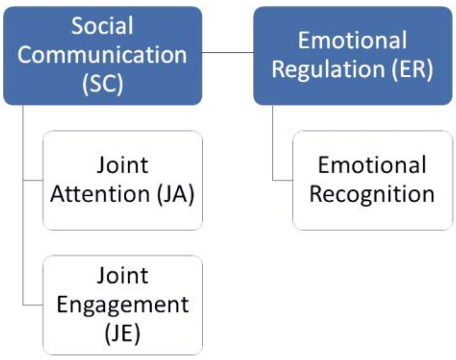

Figure 2.1: Autism core skills and their associated challenges

Taken together, this sub-section has discussed two of the core challenges of autism and has justified the reasons why this study has focused on SC and ER. Considering that several studies show that using technological tools can be very helpful in scaffolding these areas and have provided promising results, the following sub-section moves on to analyse the types of technologies that have been implemented for these skills over the past years.

2.4.3 Technologies for SC and ER

Despite the unprecise rate of autism, the rise in the measured approximate prevalence over the years has led to an increase in autism international research (Pellicano, Dinsmore and Charman, 2014). Since the 1980s, a new research field has emerged that focused on technology use for and by autistic individuals. In the 1990s-2000s, an increase in relevant publications (Ploog et al., 2013) was encouraged by research claims which supported that autistic individuals show an affinity for technology (Fletcher- Watson, 2014; Durkin, 2010) and that technology can offer a predictable and simplified environment to autistic individuals (Bölte et al., 2010; Battocchi et al., 2008; Bosseler and Massaro, 2003). Moreover, reviews have indicated that technology could help teach several topics (Grynszpan et al., 2014; Kagohora et al., 2013), such as social skills (Ramdoss et al., 2012) and in managing repetitive and challenging behaviours (Alhalabi, Carryl and Pavlovic, 2014).

Based on the statements mentioned above, various technology-based interventions have been proposed and explored over time with attention to overcoming the challenges of autism (Kientz et al., 2020). In line with this, this sub-section presents a summary of the different types of technologies that have been applied over the years for the development of SC and ER of autistic individuals. More specifically, the broad categories that have been identified are as follows a) Desktop computers/Laptops/Web-based interventions, b) Tablets/iPads, c) Smart objects, d) Robot technology, e) Virtual Environments and Augmented Reality, f) Serious games and Tangible interfaces, g) Wearable technology/Smartphones.

a) *Desktop computers/Laptops/Web-based interventions*

With the different types of technologies and the rapid growth rate in this field, a wide variety of hardware and software has been researched over the years from multiple disciplines. The first personal desktop computers were introduced to the general public in the 1970s and were later evolved to laptops which in combination with the world wide web, led to web-based interventions (Kientz et al., 2020). Over the years several scholars have studied the use of these types of technologies for the development of specific skills of autistic individuals (e.g. communication, emotional, daily life or academic skills) (Abdo and Osman, 2019; Ramdoss et al., 2012). In a systematic review conducted by Ramdoss et al. (2012), researchers analysed the use of computer-based interventions to improve the social and emotional skills of autistic individuals. The studies (11 in total), which involved, among others, desktop and laptop computers, showed that technology had a positive impact on the social skills of the individuals and mixed results on facial expression and emotion recognition skills.

Likewise, web-based software has also been designed for autistic people or their caregivers and refers to training or interactive activities/interventions that can be accessed online. For example, in an experimental pilot study conducted by Ibañez et al. (2018), the impact of a web-based tutorial on the participation of autistic children in daily routines at home was investigated. The study, which involved 104 parents of autistic pupils aged 18-60 months, was conducted using a Randomised Control Trial (RCT) design and a survey. The findings showed that the web-based tutorial positively affected eliminating parental stress and enhancing children's engagement and positive behaviours. According to the literature, other web-based software might also involve programmes that allow participants to conduct courses/activities in their natural context, offering cost-effective 24-hour, individual learning (Ballew et al., 2013).

Interestingly despite the broad use of computer-based interventions for the improvement of emotional (Wainer and Ingersoll, 2011), language and social skills (Grynszpan et al., 2014), research findings reveal that there has been limited evidence on their generalisation in real-world contexts (Whyte, Smyth and Scherf, 2014). This has been related to the limitations of studies, which have included small sample sizes and lack methodologically rigorous designs and appropriate tasks to measure the generalisation of behaviours (ibid.).

b) Tablets/iPads

The field of autism and technology has also focused extensively on mobile devices such as tablets and iPads. Mobile devices that shape our everyday lives have become very popular in the field of education due to their variety of content, flexibility, portability and affordability (Stockall and Dennis, 2014; Yee, 2012). According to King, Brady and Voreis (2017) the use of tablets could broadly be categorised within the following functions a) as tools to deliver instructional video (video-modelling), b) as speech-generating augmentative and alternative communication (AAC) devices, or c) as means to facilitate learning in combination with other methods.

Several studies conducted since 2010 have explored the use of tablets for the development of specific skills, including, among others communication and academic skills (Taylor and Urquhart, 2018; Fage, 2016; Lorah et al., 2014). For example, video modelling techniques have been implemented in tablets to teach social (Marcus, 2014) or Maths problem-solving skills (Burton, Anderson, Prater and Dyches, 2013) to individuals with autism. Additionally, promising results have also been observed in the use of tablets as tools to improve SC (Alzrayer, Banda and Koul, 2017; Muharib et al., 2018), literacy (Price, 2011) or engagement skills of pupils (Ok and Kim, 2017).

However, despite the widespread use of these devices from autistic individuals, most of the empirical evidence of their effectiveness has been generated from individual cases (Sansosti et al. 2015; Hourcade et al., 2013) that lack repeated evidence to determine the findings (Knight, McKissick, and Saunders, 2013). Furthermore, most studies on tablets/iPads have focused on specific skills and applications (Alhajeri, Anderson and Alant, 2017), and have not involved the views of education professionals (King, Brady and Voreis, 2017). For example, in a study conducted in the USA by King et al. (2017), researchers explored the experiences of special education professionals on the use of tablets with autistic pupils. The findings, which were elicited from focus groups with 17 professionals, showed a gap between the research base and how tablets were used in practice. Moreover, it was highlighted that no empirically validated method was available to help professionals select apps or show them how to use tablets.

Overall, the studies suggest that although tablets have been used for various educational purposes, there have been many challenges associated with their use, such as lack of quality control of applications and limited evaluation by evidence-based studies (Parsons et al., 2020; Fletcher-Watson, 2015). Moreover, although tablets have been the most popular reported devices in classrooms, they have been predominantly used to support learning, engagement, and communication (Laurie, Manches and Fletcher Watson, 2018). Hence associated core areas such as ER or emotional recognition have often been omitted (Berkovits, Eisenhower and Blacher, 2017).

c) Smart objects

Other innovative technology projects that have been carried out in autism and technology refer to smart objects. Smart objects can involve small figures, toys, custom-made objects or building blocks that can be touched or manipulated to interact with a system of a virtual environment (Kientz et al., 2020). Research in smart objects has explored their use in several contexts (e.g. museums), emphasising skills such as ER, social interaction and engagement (Price, Jewitt and Brown, 2013).

A review conducted by Grimaldi, Palatuci and Medaglia (2016) identified that smart objects could be classified into three broad categories: a) enablers of social interaction, b) enablers of communication and c) behaviour inhibitors. The authors highlighted that using smart objects as enablers of social interaction was related to developments in social and emotional skills due to the devices' ability to engage children's attention through a multimodal interaction. Moreover, they identified that the smart objects that targeted communication development involved apps that provided training opportunities to the users. Finally, smart objects, which were classified as behaviour inhibitors, were characterised by their ability to engage, calm and relax children and reduce repetitive behaviours.

An example of the effectiveness of a smart object as a behaviour inhibitor has been presented in a study conducted by Sperati et al. (2020). The authors explored the impact of '+me' experimental interactive smart soft toy on imitating the behaviours of autistic children and stimulating engagement. The participants involved two groups of children aged 30-48 months (*n*=14), with the first group being diagnosed with autism and the second with communication disorders. The smart object emitted coloured lights and sounds (outputs) every time it was touched by the children (inputs), while the outputs could be modified via a control tablet by the caregiver. The findings showed that all children responded positively to the smart object showing higher levels of attention and engagement when they used it. Moreover, the device increased the social responses of the participants, such as imitative behaviours and joint attention.

Given the information mentioned above and the versatility in technical features of smart objects, they have been among the most promising innovations for people with autism and special needs. However, the literature highlights that the development of smart objects has been still in its infancy (Sperati et al., 2020). Thus, further studies are required to involve the opinions of end-users and their caregivers and explore interdisciplinary perspectives on how to develop flexible and adaptable devices (Grimaldi, Palatucci and Medaglia, 2016).

d) Robot technology

A considerable amount of literature has been published on the use of robots as support tools for developing specific skills of pupils with autism (Sartorato, Przybylowski and Sarko, 2017; Pennisi et al., 2015; Miskam et al., 2014). This is because previous studies have revealed that autistic individuals show a great interest in robots and can more easily connect with them than with humans (Begum, Serna and Yanco, 2016; Diehl et al., 2014b). Robots appear to be more effective than computer-based practices due to their flexibility for interactive play, multisensory features, 3-dimensional body movements and simpler and predictable stimuli (Cabibihan et al., 2013; Kim et al., 2013). Thus, much of the literature has been concerned with using robots to develop SC and interaction skills of autistic pupils (Sartorato, Przybylowski and Sarko, 2017).

An example of this has been presented in a study conducted by Zorcec, Robins and Dautenhahn (2018), which explored the impact of a humanoid robot named ‘Kaspar’ on two young autistic children (26 and 24 months old). The study, conducted at the University Children’s Hospital-Skopje, Macedonia, was based on video-recorded observations and lasted one year. The frequency of the sessions was 2/week and involved familiarisation with the robot and imitation games. The findings revealed that after ten sessions, the pupils learned basic SC skills (such as greetings) and emotions. At the same time, they were happier and calmer during the interventions with the robot. Likewise, another robot that has attracted the attention of studies with autistic children is ‘Nao’. In a pilot study conducted by Bekele et al. (2013), it was observed that six autistic students spent more time and facilitated more JA behaviours with ‘Nao’ than the control group, which consisted of six typically developing children.

Robot-based interventions have also been used for the enhancement of the emotional skills of autistic individuals. A review conducted by Mazon, Sauzeon and Charles (2018) revealed that from the selected 31 studies between 2000-2016, 11 focused on robots and involved robot-mediated training. The researchers explored the impact of robots on developing the emotional skills of the participants, including emotional recognition (Salvador, Silver and Mahoor, 2015) and emotional vocabulary (Jeong et al., 2015). Interestingly, despite the interest of autistic people in robots and the provided research evidence which ranged from promising to effective, the quality of the studies was disputable due to the lack of methodologically rigorous designs.

e) Virtual Environments (VR) and Augmented Reality (AR)

Over the past 30 years, researchers have also focused on virtual and augmented realities and their use by autistic individuals (Strickland et al., 1996). Although both VR and AR can enable individuals to interact with the medium in a three-dimensional space using head motion and hands gesture, they are distinct (Newbutt and Donegan, 2010). VR usually includes headsets, sensors and input devices to create simulated environments where the users are represented by avatars or digital characters (Kientz et al., 2020). On the contrary, AR refers to *“a virtual interface, in 2D or 3D, that enhances (or augments) what we see by overlaying additional information (digital content) onto the real world. Immersion in the virtual world is not total, because we can always see the real world around us”* (Elmqaddem, 2019, p.237).

Research on VR and autism has shown that the use of this technology has been particularly beneficial for autistic individuals as they experience high levels of immersion when they use these environments (Wallace et al., 2010). Given the attention on the development of social and emotional skills, many VR studies have focused on these areas (Bekele et al., 2016), including, among others conversation (Politis et al., 2019), social understanding skills (Cheng et al., 2015) and recognition of facial expressions (Mower et al., 2011). For example, in a study conducted by Politis et al. (2019), the impact of VR on the conversation skills of three autistic participants on the mid/moderate end of the spectrum was examined. The study, which used a participatory design approach and involved autistic people in every stage of the process, revealed that the VR intervention had positive results on the conversation skills of the participants.

Parsons (2015b) also produced a paper to illustrate the results of a preliminary observational study that involved a collaborative virtual environment (CVE) called 'Block Challenge CVE'. The software, which was one of the prototypes produced in another project called 'COSPATIAL', was a two-player CVE game in which children in pairs (typically developing-TD and ASD pairs) had to verbally communicate to resolve a problem. Overall, 14 children and five facilitators (two teachers and three researchers) were involved in the study, with six children being autistic (aged 10-13 years) and eight being TD (aged seven-nine years). The findings revealed that the software encouraged SC, perspective-taking and reciprocity between autistic pupils when teachers provided the necessary support. It also suggested that CVE can be motivating for increasing the collaboration and mutual communication of children.

Just as VR, AR applications have focused on SC, emotional skills and physical engagement (Kientz et al., 2020). AR has been used in educational settings to support learning and encourage students to practice skills in some cases via connection to external devices such as Microsoft Kinect (Ringland et al., 2019). For example, Lee (2020) designed a study and used Kinect combined with AR to play and manipulate 3-dimensional virtual characters to teach autistic pupils social greetings and body gestures. The participants were three autistic children between the ages of seven and nine years old, and the data were collected through interviews with their parents and therapists. Moreover, a multiple baseline experiment was implemented when Kinect was used as a roleplay tool from trainers and autistic pupils. Overall, the findings showed that the combination of AR and Kinect developed children's understanding of social skills and achieved good development and use of body gestures even after the end of the intervention.

While the research focused on VR and AR seems to be promising, more methodologically rigorous studies are needed to produce convincing results (Kientz et al., 2020). As detailed in several reviews (Rajendran, 2013; Wang and Reid, 2011), most research has involved case studies, a small group of participants and has not focused on the preferences of autistic individuals. Hence, the attention should be shifted to interdisciplinary collaborations that will involve a larger number of autistic participants, implement affordable technologies, and be conducted in natural contexts (Kientz et al., 2020).

f) Serious Games and Tangible Interfaces

The idea of serious games and game-based learning in education has been present for many years (De Freitas, 2006). Serious games have been used as tools to give individuals a different way of developing or learning new skills through digital games (Ma, Oliveira and Hauge, 2014). The literature on autism has highlighted many studies that use game-based interventions to teach autistic pupils social, emotional, or awareness skills (Hulusic and Pistoljevic, 2016; Grynszpan et al., 2014).

Several lines of evidence have suggested that serious games attract the attention of researchers as they can support training on different skills and in diverse contexts, encouraging interactions that resemble everyday life (Grossard et al., 2017). A variety of serious games were presented in a review conducted by Grossard et al. (2017) in which they explored the impact of serious games on the development of social and emotional skills of autistic individuals, focusing on the principles of theories that underline the games. The findings were based on 40 papers between 2001-2014 and revealed 31 different serious games, 16 of which targeted emotion recognition and 15 social skills. However, despite the promising results of the interventions, limitations were identified in the clinical validation and generalisation of the findings.

Regarding the implementation of serious games, various technologies have been used for this purpose, including desktop computers, laptops, large screens, smartphones or even tablets (Ma, Oliveira and Hauge, 2014). To date, several studies have focused on the combination of serious games and tangible interfaces for the development of social skills for autistic individuals (Barajas, Osman and Shirmohammadi, 2017; Bernardini, Porayska-Pomsta and Smith, 2014). According to Price, Jewitt and Brown (2013), tangibles can be defined as *"interfaces where computational power is embedded in everyday artefacts or customised objects which* *can be wirelessly networked or linked to various forms of digital representation"* (p.307).

An example of the use of serious games and tangible interfaces was presented in a paper where a serious game called 'ECHOES' was built to help autistic children develop their SC skills (Bernardini, Porayska-Pomsta and Smith, 2014; Guldberg et al., 2010). ECHOES used a tangible interface with 25 children of average age eight years and five months who interacted with an intelligent virtual agent and objects to complete learning activities. The experimental study, which also used a participatory approach, was conducted in a natural context and showed that the programme had a positive influence on the children's social skills such as turn-taking, sharing attention with others, and initiating and responding to bids for interaction.

Although serious games and tangible interfaces have become more commonplace and have offered perspectives for developing specific skills, the literature highlights several limitations in terms of the evidence, methodology and the generalisability of the findings (Grossard et al., 2017). Thus, there is a need for clearer guidelines on their design (Hulusic and Pistoljevic, 2016) and testing of their effectiveness in real-world contexts including the views of the associated stakeholders and users (Bernardini, Porayska-Pomsta and Smith, 2014).

g) Wearable technology/Smartphones

Another emerging field in autism is wearable technology (Scholz, 2015) which involves devices that are usually worn by individuals and are connected over a wide area of networks (Kirkham and Greenhalgh, 2015). Wearable assistive technologies might include cameras, smart glasses, smartphones and sense wear clothing or wristband devices (Koo et al., 2018). Studies with such devices have been mainly used to monitor emotional states of autistic individuals and self-regulation via specific behavioural techniques (Taj-Eldin et al., 2018).

For example, in a study conducted by Finn et al. (2015), a smartwatch called ‘Watchminder’ was used to increase the on-task behaviour of autistic elementary students. Four students in South Florida between the ages of eight and nine years old were provided with ‘Watchminder’, which vibrated and displayed the message *“pay attention”* every five minutes. The study used an experimental design and showed that the smartwatch was a useful prompting device for increasing the on-task behaviour of students.

Similarly, studies have also been conducted on smartphones and emotion-aware apps, showing that they could help autistic people avoid experiencing negative emotions and understand others better (Papoutsi, Drigas, and Skianis, 2018; Gay, and Leijdekkers, 2014). Another example of a wearable emotional self-regulation device was presented by Torrado, Gomez and Montoro (2017). Their study investigated the influence of a smartwatch system on the implementation of self-regulatory strategies by two autistic individuals (ten years old) who experienced anxiety, tantrums, and challenging behaviours. The study that followed an experimental design was conducted in a natural context and measured the heart rate of the participants. When the heart rate of pupils reached a specific maximum peak, the connected smartphone created corresponding self-regulation strategies that appeared on the smartwatches of the pupils. The findings illustrated that the system enabled students to control most of their anxiety episodes quickly while they were not stigmatised as their devices were not visible to their peers.

Overall, the findings that have emerged from studies on wearable technology and smartwatches have highlighted that there has been a strong interest in the use of these devices for the improvement of the emotional intelligence of autistic individuals (Papoutsi, Drigas and Skianis, 2018). However, although these technologies can provide innovative instructional content due to their real-time feedback and motives, attention should be paid to the generalisability of the findings and the impact of the caregivers and context on their successful implementation (Torrado, Gomez and Montoro, 2017).

2.4.4 Where the Focus Tends to Be

The above sections have highlighted the different types of technologies that have been studied in the field of autism to develop SC and ER. Interestingly, the findings reveal that attention has been mainly placed on developing the SC of autistic individuals, while ER has been primarily explored by studies that involve wearable technologies/smartphones, serious games and tangible interfaces. Despite the variety of technological advancements that have provided the conditions for constant learning (Valencia et al. 2019), several research limitations have accompanied their validity. Thus, this sub-section critically summarises where the focus tends to be in autism research and technology. It focuses on the main methodologies that have been implemented until now, the characteristics/role of the participants, and the contexts that the studies have taken place.

One of the central themes that has emerged in the literature relates to the repeated claims that research has been usually performed excluding the voices and experiences of autistic individuals (Spiel et al., 2019). The findings have shown that although previous studies may have involved autistic individuals, their engagement in research has not been ‘real’ or ‘sustained’ (Greenwood and Abbott, 2001), as their experiences and perspectives have often been omitted or silenced. Hence, autistic individuals can become sceptical of researchers, leading to a breakdown of their relationship (Milton, Mills and Pellicano, 2012; Milton, 2014). In other cases, the literature reveals that scholars have avoided gathering data from autistic individuals due to the traditional knowledge transfer model of research, which positioned the researcher as the ‘expert’, the teacher as the ‘deliverer’, and the child as the ‘receiver’ of learning (Guldberg, 2017).

For example, in a review (*n*=185 papers) conducted by Spiel et al. (2019) on the agency of autistic pupils in technology research, it was identified that autistic children were repeatedly excluded from the definition of the studies’ purposes. Moreover, the design of the technologies was not geared towards the desires/needs of end-users but conceptualised children as the participants that needed to be *“observed, analysed and corrected”* (p.21). Thus, the experiences of the autistic children were omitted as were also their perspectives in the evaluation of these technologies. In line with this, Parsons et al. (2020) stated that the experiences, engagement and participation of key stakeholders (autistic people, educators, parents) should be valued and respected in the field of autism and technology. Similarly, Fletcher-Watson et al. (2019a) highlighted that parents/practitioners should not be excluded from the research process as they also interact with the technologies and advocate for their children.

Moreover, another point that emerged from the literature relates to the involvement of autistic individuals of younger ages in research. In a review conducted by Mazon, Fage and Sauzeon (2018), it was stated that the age range of previous technology-based papers mainly targeted young children. The paper, which included 31 studies, identified that 21 of them focused on school-aged children, five involved adolescents and five preschool children. Likewise, another review on innovative technology-based interventions for autism, based on 22 articles found that the average of the mean age of participants across the technology-based studies was 12.68 years (Grynszpan et al., 2014). These findings suggest that autistic adults have been underrepresented in the field as educational technology research in autism fails to reflect diversity.

With respect to the target skills, several studies have focused on specific technologies and their effectiveness to target particular areas of difficulty (Valencia et al., 2019; Den Brok and Sterkenburg 2015). As presented earlier, a growing number of researchers have investigated technology as a support tool to teach pupils behaviour or skills that they find challenging (Kaur and Pany, 2016; Singhal and Garg, 2019; Grynszpan et al., 2014). For example, Laurie, Manches and Fletcher-Watson (2018) created a brief report on the use of educational technology with autistic children and presented that technology was mainly used to support learning, engagement and communication. The findings, which were based on 136 responses, were conducted via an online survey and involved various occupations and settings (both mainstream and special needs). Interestingly, the researchers highlighted that the participants did not refer to social interaction skills or technology use to scaffold teaching.

These data suggested that there has been a particular emphasis in research on the use of technology to develop the communication, academic and social imitation skills of autistic individuals. However, very few studies have focused on ER, or emotional recognition (Cai et al., 2018). Furthermore, most studies have tended to separately investigate technology and its impact on the target skills without closely exploring the relationship between these two elements (Parsons et al., 2020).

Regarding research methodologies, the literature has shown that most studies in the field of autism and technology lack methodological rigour (Mazon, Fauge and Sauzeon, 2018). For example, in a review conducted by Begum, Serna and Yanco (2016), which involved 22 articles that were published between 1990 and 2014, it was stated that most studies used experimental designs or case studies and did not meet the required research standards. Some of the limitations of previous studies related to their small sample size, the controlled environment that they have been conducted and the lack of longitudinal evaluation (Fletcher, 2013; Mazon, Fauge and Sauzeon, 2018). As Guldberg et al. (2017) highlighted, although experimental research designs can explore fundamental questions, their approach has been usually narrow due to their lack of flexibility to capture the complex interactions of learning and teaching. This has also been enhanced by the quick pace of technological evolution and the aim of researchers to meet the individual needs of as many autistic people as possible.

Interestingly, a closer look at the bibliography indicates that over the past years, there has been a strong shift in the field towards the use of participatory designs which aim to bring together researchers and communities to meet shared targets (Fletcher et al., 2019b). According to Long et al. (2017), participatory research (PR) draws on the meaningful input of associated stakeholders to bridge the gap between research findings and relevant, meaningful, practical recommendations. An example of participatory research in the field of autism and technology is the ESRC-funded 'SHAPE' project (Parsons et al., 2015a). The project that involved practitioners as co-constructors of knowledge explored ways in which various technologies could be embedded in existing classroom practices. To achieve this, digital stories were used where practitioners narrated their own experiences of embedding emerging TEL tools in the classroom. Twenty-nine digital stories were created across six schools, while the attention was focused on enabling practitioners to gather and create evidence by themselves.

The 'SHAPE' project depicted how PR can involve participants as active agents in studies, enabling the creation of new and meaningful knowledge. The findings revealed that the focus of autism and technology research should gear towards collaborative engagement between researchers, autistic individuals and their social context (such as parents, carers, practitioners) and be implemented in real-world environments to produce realistic recommendations. In line with this, Spiel et al. (2019) moved a step further and justified that although PR might seem to be the most straightforward design to achieve this, researchers should consider a more general stance that can be implemented with any methodology. More specifically, they highlighted the need to include autistic participants and stakeholders at an earlier stage of research to capture their needs and desires of what technology should capture (ibid.).

Overall, the findings have suggested that there is a need to implement more participatory approaches in the research of autism and technology, where the voices of all associated stakeholders and autistic individuals should be valued. Hence, researchers and communities should be involved in research as equal partners, while the studies should capture the needs and desires of the participants. As Fletcher-Watson et al. (2019b) mention, research findings should align with the views of autistic people, their families, and practitioners considering structural and cultural issues (Raymaker and Nicolaidis, 2013). This means that technology should not be studied in isolation of the context but in conjunction with the environment and the person (Ifinedo and Kankaanranta, 2021; Brosnan et al., 2017; Abbott, 2007).

The next section discusses what the literature tells us specifically about the practices relating to using iPads for SC and ER in the classroom, as this is the focal point of this study.

2.5 Autism, iPads and the Classroom

2.5.1 iPad Focus

Over the past decade, researchers have focused their attention on emerging technologies to transform the learning of children by enhancing motivation and engagement in rich, authentic experiences (Geer et al., 2017). Since the emergence of iPads in 2010, they have become one of the most widely used technologies in schools across the UK (Aspiranti, Larwin and Schade, 2020), while their implementation has also flourished in special needs settings.

As previously mentioned, with the outbreak of COVID-19, the UK government provided children of all ages and settings with handheld devices to access remote education (GOV.UK, n.d.-a). In the same vein, during the academic year 2020-2021, a UK school network called 'Oasis Community Learning' introduced a new scheme that delivered over 30.000 iPads to primary, secondary, sixth form staff and pupils to give them access to online learning (MacDailyNews, 2020). Thus, the increased popularity of tablets has led to their uptake in education, emphasising access and learning outcomes (Haßler, Major and Hennessy, 2016).

Specifically, in the field of autism, several studies have investigated the use of iPads as educational tools (Aspiranti, Larwin and Schade, 2020; Petrov et al., 2017). The increased interest in the potential of iPads for autistic people has been based on the recognition that such users show affinity with computers (Ploog et al., 2013). Moreover, the characteristics of tablets such as functionality, flexibility, mobility and the growing trend towards personalised learning (Stockall and Dennis, 2014) has led to an interest in educational applications. Attempts at providing evidence for improving outcomes for students with autism using touch-screen devices have included academic, behavioural and social communication skills (Larwin and Aspiranti, 2019). However, despite the focus of researchers on iPads and autism and the examination of possible advantages associated with their use, the literature has highlighted the existence of limitations that influence the findings of studies.

Yavich and Davidovich (2019) have stated that previous research has been mainly based on experiments with small groups of autistic participants. The same view has also been supported by Grynszpan et al. (2014), who identified in their meta-analysis on innovative technology-based interventions for autism that most studies included small sample sizes. Although controlled experimental approaches have been important to provide recommendations about the effectiveness of tablets on the development of specific skills, they have often not examined technology thoroughly and have involved poor quality designs (Knight, McKissick and Saunders, 2013). Thus, the findings cannot be generalised, and in many cases, studies have not been evidence-based as they provide limited information about the methodology implemented or the characteristics of the participants (King, Brady and Voreis, 2017).

In the same vein, Fletcher-Watson (2014), supported that many technology-focused experimental studies have mainly captured outcomes related to learning and have omitted areas such as participants' behaviour, wellbeing or context. In line with the aforementioned points, the literature has highlighted that there is a need for future research to implement diverse forms of data collection (Guldberg et al., 2017) and capture the perspectives, experiences and interpretations of autistic individuals and key stakeholders (King, Brady and Voreis, 2017). Given the points mentioned above, this study focuses specifically on iPads for the following reasons:

a) iPads are widely used in UK educational settings.
b) There is increased interest in the potential of iPads for autistic people.
c) The results that previous studies have provided are not conclusive.
d) There are many limitations associated with research designs on iPads and autism.

Having justified why this study focuses on iPads, the next section analyses the relevant literature that has been conducted on iPads' use in the classroom to develop SC and ER skills of autistic individuals.

2.5.2 iPad Use in the Classroom for SC

A growing and large body of literature has investigated the use of iPads for the development of social and communication skills of autistic individuals (Yavich and Davidovich, 2019; Fletcher-Watson et al., 2015; Xin and Leonard, 2014). Research has suggested that mobile devices have the potential to provide positive results for autistic pupils as Augmentative and Alternative Communication devices (AAC) (Lorah et al., 2015) or means to facilitate learning (Chen, 2013). For example, the focus of previous studies can be depicted in a review conducted by Ebert (2018), which explored iPad and mobile-based interventions for language development in autistic children. The findings, which were based on 28 studies, revealed that all papers targeted language and communication domains, with the vast majority (n=17) investigating iPads as intervention tools.

To date, many studies have explored the use of iPads as speech generating devices, aiming to provide recommendations about their use as viable communication devices (Alhajeri, Anderson and Alant, 2017; Xin and Leonard, 2014). For example, Waddington et al. (2014) studied the 'Proloquo2Go' app to increase the requests of three autistic pupils aged seven to nine years old. The findings revealed that the participants improved their general and specific requests for access to toys and maintained their SC skills using sequences. Likewise, another study examined the use of iPads for assisting autistic students in learning communication skills (Xin and Leonard, 2014). The participants involved three individuals (ten years old) who were given access to an iPad speech-generating app called 'SonoFlex'. The study showed that iPads served as technological aids and increased pupils' requests and skills that were also generalised in other settings. Together, these points indicate that most studies that have used iPads as speech generating devices have found that mobile devices attract the attention of autistic individuals and can positively influence their communication skills.

Much of the previous research on tablet-based strategies for SC skills has also been studied in conjunction with engagement (Hourcade et al., 2012) or joint attention (Mangafa, 2017; Kaale et al., 2012). A systematic review conducted by Alhajeri, Anderson and Alant (2017) investigated the use of iPads in the classroom to enhance the communication and learning of autistic students. The review, which included 14 studies published between 2011-2015, explored the domains of communication and academic engagement. The results showed that iPads were supportive communication and educational tools and enhanced the academic engagement of people aged three to 17 years old. In the same vein, Mangafa (2017) studied the use of tablets to encourage the development of JA and SC of autistic children. Her study highlighted that iPads contributed to the development of autistic pupils' JA skills. At the same time, they were also used for a variety of other purposes such as engagement or collaborative activities.

Tablets have also been used to promote the social skills of autistic individuals (Smith and Santori, 2015). According to Redman, Jakab and Carlin (2014), iPads can contribute to the development of social interaction, independence, and SC skills when used one-to-one. Their study, which was conducted via questionnaires, interviews, surveys with key stakeholders, and data analysis of a special school report in Australia, showed that iPads were powerful tools to facilitate SC interactions. Likewise, in another study in two mainstream schools in the USA, Smith and Santori (2015) conducted observations (*n*=13) with six teachers and interviews with 19 middle school students to gather information on their perspectives of learning using iPads. The findings showed that iPads provided opportunities for collaboration and enhanced the learning process. Although these studies have shown that iPads can improve social skills and collaboration, the research findings in this field have not always been unanimous. For example, a study conducted by Fletcher-Watson et al. (2015) explored the impact of the 'FindMe' therapeutic app on the SC skills of 54 autistic pre-school children. The findings from the randomised controlled trial revealed that the app did not have any significant impact on the SC skills of children but increased their engagement.

The studies mentioned above reveal that although mobile devices may engage autistic children in meaningful interactions, there has been no empirical evidence of their effectiveness beyond the results generated from experimental studies or individual cases (Hourcade et al., 2012). In addition, the balance of evidence in SC skills suggests that iPad-based practices can promote certain target skills such as instrumental requests but not others, such as spontaneous SC (Allen, Hartley and Cain, 2015). Moreover, with researchers focusing on specific applications for SC and the fast pace of technological advancements, the danger of providing outdated recommendations has been evident. In line with this, Kim (2017) stated that there has been a lack of standardisation in the literature of which apps could be used for educational purposes, with most of the new software lacking an evidence base.

Therefore, the research suggests that future studies should follow a different approach that will include the perspectives of key stakeholders in research and allow them to evaluate the effectiveness of iPads in improving the communication skills of children (Boyd et al., 2015). In line with this, King, Brady and Voreis (2017) have argued that researchers need to expand their focus and collect information regarding educators' perspectives on tablet use in the classroom. Therefore, it is recommended that the attention should be shifted from the use of iPads as intervention tools (Hourcade et al., 2013) to the practices implemented by professionals in real contexts and the identification of relevant challenges and enablers for the generation of meaningful findings (ibid.).

The next section moves on to discuss the studies that have been conducted in-situ regarding the use of the iPads for the development of the ER of autistic individuals.

2.5.3 iPad Use in the Classroom for ER

Autism has often characterised by difficulties in emotion processing which might involve the use or understanding of multiple nonverbal behaviours such as facial expressions, eye contact, body posture and gestures (Mantziou, Vrellis and Mikropoulos, 2015). The deficits in social-emotional reciprocity (e.g. the reduced sharing of emotions) (APA, 2013), have placed the identification of emotional cues in the centre of researchers' interests when studying behaviours in autism. The literature reveals that emotional deficits can influence the quality of life of autistic individuals leading to social isolation, health problems, poor academic performance or emotional outbursts (Ramdoss et a., 2012). In line with this, the rates of anxiety are much higher in the autistic population, also affecting their families and the professionals who work with them (James Lind Alliance, 2020). Thus, various different technologies have been implemented over the years to help autistic people with emotional challenges (such as robots or smartwatches) (Mazon, Sauzeon and Charles, 2018; Papoutsi, Drigas and Skianis, 2018).

Interestingly, most studies have focused on emotion and face recognition skills (Bakola, Rizos and Drigas, 2019), and only a few have targeted ER (Torrado, Gomez and Montoro, 2017). In line with this, Mazefsky and White (2014) stated that although emotional recognition and understanding have been important elements and the first step to successful ER, the research on ER in autism has been in its infancy. In a review conducted by Papoutsi, Drigas and Skianis (2018) on mobile applications designed to enhance emotional intelligence to autistic children and adolescents, several iPad apps were identified. For example, a study conducted by Alves et al. (2013) measured the impact of the 'LifeisGAME' serious game on eleven autistic individuals (five to 15 years old). The participants were asked to play the 'LIFEisGAME' prototype for 15 minutes and the data collection involved video-recorded observations of participants' game usability, a questionnaire filled by their parents and an unstructured interview with therapists. The findings showed that the app promoted the emotional understanding of participants and improved their quality of life.

'Can you CopyMe' has been another tablet-based app that has targeted emotional recognition, expression and understanding. The software involves mimicking facial expressions from photographs and allows the recording of the users' gameplay. In a pilot study conducted at a childcare centre in Sydney with six children, two of whom had autism (aged eight to10 years old), it was found out that the app showed promising results in developing children's emotional skills (Harrold et al., 2014).

Regarding research connecting ER to behaviour problems in young autistic individuals, the literature shows that this field has been under-explored (Berkovits, Eisenhower and Blacher, 2017). In contrast, most technology interventions to date have focused their attention on ‘fixing’ challenging behaviours and teaching social skills through repetition or modelling (Burton, Anderson, Prater, et al., 2013). The literature findings also reveal that in the field of autism and technology, ER usually occurs in studies as a cascade of other researched target skills such as engagement or social performance.

For example, a pilot study conducted by Fage et al. (2018) tested a package of mobile applications on the socio-adaptive behaviours of 50 participants (30 autistic children and 20 with intellectual disabilities). The experimental intervention was implemented for three months and involved apps that targeted, among others, emotion regulation and emotion recognition skills. The findings showed that autistic children improved their initial target skill at the end of the intervention, which was socio-cognitive performance. At the same time, there was an increase in facial emotion identification and awareness.

The literature has also highlighted studies that examine the devices’ impact as calming and transitional tools for autistic individuals. In a study conducted by Lee and McCord (2012), the researchers used the iPad together with the class teacher as part of a music lesson. Two eight-year-old autistic children with communication difficulties and sound sensitivity were involved in the study. Specific music apps were used as part of the lesson while the researchers videotaped the children. The findings, which also involved an interview with one of the parents and the class teacher, illustrated that iPads engaged children in the lesson while they also helped them calm when they had tantrums.

The use of mobile applications for mindfulness has been another emerging field associated with emotional regulation as it targets the reduction of stress, anxiety, and/or challenging behaviours (Nunes, Castro and Limpo, 2020). Mindfulness has been defined by Kabat-Zinn (2003) as "*the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment"* (p. 145). However, despite research findings stating the advantages of mindfulness on well-being (Flett et al., 2019), little attention has been paid to the impact that it might have on individuals with autism. Therefore, it remains unclear which practices are beneficial for improving ER abilities in young autistic people (Granville, 2020).

One smartphone app designed to provide personalised support and reduce anxiety is 'Brain in Hand' (BiH). BiH, originally created for individuals with autism, allows users to create structured diaries with proposed solutions to challenges, reminders and task completion records (Kettlewell et al., 2018). Thus, when individuals feel overwhelmed, the app provides users with access to possible solutions and keeps them on track. A pilot trial conducted by the National Autistic Society (NAS, 2015) explored the impact of the BiH app on NAS's mentoring service for 24 Higher Education autistic students aged from 20 to 34. The findings revealed that 53% of the students rated the app positively or significantly positively, while there was a 30% reduction in their stress levels after the trial. Despite the small study and lack of a control group, it was stated that the BiH app was good for controlling participants' anxiety and improving their confidence and course engagement. This study confirms that apps have the potential to improve the wellbeing and reduce the distress of autistic individuals. However, the literature review reveals there is a lack of robust evaluation on coaching interventions and their impact on ER skills.

Overall, the findings in this field show that despite the potential of applications in developing autistic pupils' ER, the research base has been limited. This is because studies have mainly focused on emotional recognition or the delivery of treatments for specific skills such as anxiety (Firth et al., 2017b; Torrado, Gomez and Montoro, 2017). Similarly, the potential impact of ER on social functioning has received little attention, despite the findings that argue that it is an essential element for social and behavioural functioning (Berkovits, Eisenhower and Blacher, 2017).

It should also be highlighted that few studies have provided practical examples of the use of technology as a reward (Constantine et al., 2017) or a calming strategy (Lee and McCord, 2012), with research on technology use to deliver behaviour change for autistic children remaining scarce. Grynszpan et al. (2014) have stated that a small number of studies have focused on the behaviours that are usually rewarded by practitioners or the practices' generalisation to real-world situations. Last but not least, previous studies on mobile learning applications and ER have omitted environmental elements such as cultural background and context and their impact on the development of socio-emotional skills of autistic children (Ahmad and Shahid, 2015).

The following sub-section investigates the impact of context and key stakeholders (such as teachers/parents) on iPad use in the classroom for autistic pupils.

2.5.4 The Impact of Educators, Parents and Context on the iPad Use

With the increased interest in handheld devices and the studies' promising findings on their effectiveness for developing specific skills, both educators and families have turned to their use to support autistic children's needs (Dixon et al., 2015). With most prior studies having explored the functionality of the iPad as a tool, there is a need to look at several other issues associated with its use (NAACE, 2014). This involves pedagogical/school practices, management issues and technical aspects, which have often been omitted from studies.

Considering that technology affects not only the autistic individuals who use it but also their parents, teachers, support workers, and friends (Chandler, 2016) iPad studies should also include input from key stakeholders (Fletcher-Watson et al., 2016). In line with this, it could be argued that studies on tablets and autism should explore the role of context (Tondeur al., 2017) and readiness of educators/parents to use touchscreen devices (Christensen and Knezek, 2017), as technology opens opportunities for interactions and learning both inside and outside educational settings (Stathopoulou et al., 2019). Considering these points, this sub-section discusses the impact of key stakeholders and context on iPad use for autistic individuals.

The literature states that it is necessary to explore the behaviours and attitudes of key stakeholders towards iPads to assess the potential influence of devices on autistic children's progress (Clark et al., 2015). While previous studies have investigated the impact of technology on special needs settings, little has been done to explore the perspectives and perceptions of teachers regarding the use of iPads with autistic individuals (Sulaimani, 2017). Considering that the way teachers implement and integrate these technologies in teaching can influence their impact on learning (Livingstone, 2012), the research highlights that it is necessary to examine this field in-depth.

In line with this, Clark et al. (2015) conducted a study to investigate professional and parental attitudes towards iPad use for autistic individuals. Their survey involved 90 parents and 31 professionals and investigated their anxiety attitudes towards technology and the frequency-duration of tablet use. The findings revealed that both professionals and parents were positive towards iPads, while parents observed high uptake of the devices. The study also showed that technology-related anxiety was present in the answers of both parents and professionals. Interestingly, their findings which contrasted with previous studies illustrated no observed association between the anxiety of participants with technology and their attitudes towards iPads.

Another area that needs the attention of researchers is the involvement of families in the development and implementation of practices for autistic pupils (O'Reilly and Wicks, 2013). Mintz et al. (2012) highlighted that when technology implementation at home and school is based on collaborative strategies, it can ensure access to appropriate support at any time. However, although previous research has emphasised the importance of educators-parents partnership for autistic individuals' progress (O'Reilly and Wicks, 2013), few studies have explored the use of tablets at home (Neikrug and Roth, 2015; Dixon et al., 2015).

For example, Dixon et al. (2015) conducted a study to identify how iPads were used at home for autistic students. The researchers employed a qualitative methodology involving semi-structured interviews with four families. They also analysed parents' diaries and collected video shots of children using the devices. The findings showed that all families used iPads daily with their children, while their positive attitudes towards the devices influenced the learning and engagement of pupils. It was also revealed that iPads were mainly used by parents as calming tools, behaviour supports and communication devices. Interestingly, home-school collaboration was one-sided, with teachers sharing information with parents about the iPad use at school. The findings highlighted the need for greater two-way collaboration between educators and parents with a focus on the training needs of families.

Considering the different way iPads are implemented in different contexts and the various skill levels of teachers, the literature recommends that future studies encompass the role of systemic support (Chambers et al., 2018). In this study, systemic support has been used to refer to the role of training, funding, technical/administrative support and pedagogical approach that might influence the way iPads are integrated into learning environments. Geer et al. (2017) state that the implementation conditions may not always the same in schools as some settings may provide training and technological support, while others may prefer to allow practitioners to explore iPads independently. The lack of guidance and research on how teachers should use tablets in the classroom (Mangafa, 2019) shows that future research should determine how teachers are being prepared to use iPads. Moreover, there is a need to explore how the devices are being utilised in real-world learning contexts.

Chambers et al. (2018) conducted a study that examined the perspectives of teachers regarding the use of iPads with students with learning supports needs. The study collected data from Australia, the United States and the UK via an online survey and involved 393 practitioners. The findings revealed differences in the way iPads were integrated into classrooms depending on the school support. Moreover, it was pointed out that professional development and technical support were necessary components for the successful use of iPads as learning tools.

Another essential element that should be considered in the implementation of iPads in the classroom for individuals with autism is the role of pedagogy. Livingstone (2012) has mentioned that technology on its own cannot improve student achievement but relates to the way educators implement and integrate it into learning. Geer et al. (2017) have supported this view further by stating that researchers need to consider that technology was not initially designed as an education tool. Thus, studies should focus on how teachers use it as a potentially transformative tool. However, despite the quick adoption of iPads in schools, little research has focused on whether practitioners' pedagogy changes after integrating iPads in learning (Diemer, Fernandez and Streepey, 2013).

A study conducted by Beauchamp, Burden and Abbinett (2015) investigated how primary school teachers from Scotland and Wales learnt to use and embed iPads into their practice. The study used an online survey distributed to parents and teachers in both countries and involved interviews with pupils (n=184) and teachers (n=34). The findings showed that with the integration of iPads in teaching, practitioners co-constructed their understanding and learning together with pupils leaving behind the linear traditional power relationships. Thus, they adopted a collaborative model of teaching where students were co-constructors of knowledge. Interestingly, the evidence suggested that educators and students contributed equally to the learning process, changing how they saw themselves and pedagogy. The points mentioned above illustrate that using new technologies with student-centred pedagogies can provide opportunities for authentic learning (Shuler, Levine and Ree, 2012).

Another component that is often omitted from technology research is context (Kelly, 2010). In this study, context refers to the elements *“woven together with the object of study and are unable to be separated from it”* (Rosenberg and Koehler, 2015, p. 440). According to the literature, the role of context in educational technology research has been left out (Kelly, 2010) despite its essential nature in studying and understanding teachers and their practice with technology (Rosenberg and Koehler, 2015). Considering that teachers and children develop their knowledge in context, it is a necessary part of the complex domain of education (ibid.).

Overall, the findings in the field of iPads and autism have revealed that there is a need to shift the attention from the use of technology as an assistive tool (Bakola et al., 2019) to a shared understanding of the affordances and reservations attached to the implementation of iPads in context (such as training, resources, pedagogy). Moreover, researchers need to consider the challenges/enablers associated with the use of iPads in practice from the perspective of key stakeholders (King, Brady and Voreis, 2017). Thus, in this study iPads have been approached as enablers of learning, and the attention is on the interaction between the person, technology and the environment. The aim has been to collect the views of key stakeholders about practices relating to using iPads in-situ for autistic pupils’ SC and ER and better understand how aspects of context support or undermine teaching with iPads.

2.6 Conclusion

This chapter discussed issues that emerged from the literature regarding how autism and technology are situated in context. It provided an overview of the educational technology field, narrowing down the focus to iPads and autism. Below are summarised the key issues that were identified:

- Various studies have investigated the use of 'technology' in education, adopting different terms depending on its functions. This study considers the broader dimensions of technology, focusing specifically on the interaction between context, technology and the user.
- Teachers around the world have adopted technology to a) encourage collaborative learning, b) enhance communication with parents, c) assess pupils' progress, d) improve academic skills, e) motivate students, f) enhance learning resources, g) achieve 'E-inclusion', h) connect formal and informal learning and i) implement distant schooling.
- The identified barriers to educational technology adoption have been related to a) teachers' characteristics and b) external environmental factors. The identified enablers have been related to a) Pre-service teacher education programmes, b) CPD training/mentors, c) School environment/culture, d) Staff incentives, e) Interdisciplinary collaboration, f) Technological infrastructure/maintenance.
- The broad categories of technology-based interventions in the field of autism have been a) Desktop computers/Laptops/Web-based interventions, b) Tablets/iPads, c) Smart objects, d) Robot technology, e) Virtual Environments and Augmented Reality, f) Serious games and Tangible interfaces, g) Wearable technology/Smartphones.

- Research in autism and technology has been mainly focused on the development of the SC, with ER being explored by studies that involve wearable technologies/smartphones, serious games and tangible interfaces. Research has tended to exclude the voices and experiences of autistic individuals, targeting specific skills and technologies' effectiveness to develop areas of difficulty.

Research in iPads and Autism:

- Lacks methodological rigour with most studies using small sample sizes in controlled environments, exploring technology in isolation of the context, participants' behaviour and wellbeing.
- Has focused on specific applications for SC evaluating the use of iPads as intervention tools. The use of iPads for ER has been under-explored and usually occurs in studies as a cascade of other researched developmental areas such as emotion recognition.
- Should involve input from key stakeholders, focusing also on educators-parents partnership and tablet use at home.
- Needs to encompass the role of systemic support considering the different way iPads are implemented in different contexts and the various skill levels of teachers. The attention should be shifted to the affordances and reservations attached to iPads' implementation in context.

Having discussed the key issues elicited from the literature review, the next chapter moves on to provide a snapshot of iPad practices used in-situ for autistic pupils' SC and ER. The data are collected via an online survey and, together with the literature review findings (mentioned above), shape the main study of the thesis (case study).

Chapter 3: ONLINE SURVEY- A SNAPSHOT OF AUTISM AND IPAD USE IN PRACTICE

3.1 Introduction

The literature review suggested a need for research on in-situ iPad practices that will involve the perspectives of key stakeholders on how tablets are used with autistic pupils (King, Brady and Voreis, 2017; Boyd et al., 2015). In other words, it has recommended that research shifts the focus from the exploration of the effectiveness of specific technological tools (Hourcade et al., 2013) to the identification of practices and contextual elements that might influence the iPad use in the classroom (Tondeur al., 2017; Fletcher-Watson, 2014; NAACE, 2014). In line with this, Christensen and Knezek (2017) have highlighted the need for studies to also investigate the readiness of educators to use touchscreen devices, as little has been done to explore this matter.

Based on these points, this chapter reports on the results of an online survey to educators in Special and Mainstream (Autism Resource Base) schools. This survey explores the practices of 55 educators, focusing on how they used iPads to support the SC and ER of autistic pupils. Furthermore, it provides a snapshot of the purposes for using such devices in learning in different educational settings and the perspectives of educators about the iPad use for SC and ER. The findings provide a context for a later in-depth investigation of iPad practices implemented in two schools, as they collect a synthesis of key messages elicited from practice that will be used to inform the main study of this thesis (chapter 4-case study).

In particular, this chapter reports on the data collected from educators with experience in using iPads and teaching pupils with autism. The chapter describes the main aim of the online survey, the methodology followed for the questionnaire design, and the procedures undertaken to identify the sample and distribute the survey. The results highlight the purposes and practices of the respondents in using iPads with autistic pupils, elements that influenced this process and the potential impact of each context on the implemented practices. The chapter also considers the level of teacher support provided in Special and Mainstream (Autism Resource Base) settings regarding the use of iPads in learning. It also draws out the perspectives of educators on the impact of iPad use on the SC and ER of autistic students.

3.2 Research Aims, Questions and Online Survey Design

3.2.1 Research Aims and Questions

The main aims of designing the online survey have been to a) contribute to the literature base on iPad practices implemented in schools for autistic individuals' SC and ER and b) inform the main study of this thesis about elements that need further exploration regarding iPads' use in context. The survey has been motivated by the literature review and recommendations from previous studies on technology, highlighting the need for inclusion of stakeholders' viewpoints in research (Boyd et al., 2015). Particularly, this study has shifted the attention from the use of iPads as assistive tools (Bakola et al., 2019) to a consideration of the elements that might influence the implementation of the devices in context. Thus, the current analysis and results have aimed to provide a snapshot of practices and support provided in different school settings and a presentation of educators' perspectives on iPads role for SC and ER.

In line with the aforementioned points, the study aimed to:

a) Provide an overview of how iPads might be used in practice for the SC and ER of autistic pupils.
b) Explore whether the context impacts on the iPad use and practices implemented in the classroom.
c) Collate professionals' perspectives related to iPad use for SC and ER.

These broad aims align with the following research questions:

1. What is the purpose of using iPads from the perspectives of teachers and what are the practices implemented in educational contexts for the SC and ER of autistic pupils?
2. What is the support provided for the use of iPads in the classroom?
3. What are the professionals' perspectives on iPad use for SC and ER?

The intention was to contextualise technology and collect information about educators and their practice with electronic devices (Rosenberg and Koehler, 2015). Considering the insufficient information in the literature about the use of iPads in real-world classrooms for SC and ER of autistic children, the current research has not intended to explore other technologies or areas of development. It has been specifically interested in describing teachers' practices and understanding the contextual elements that might influence their use. Finally, the aim has been to inform the under-explored area of iPad use in-situ for SC and ER, collect a synthesis of key messages from practice to inform the main study and not provide generalisations of the researched phenomenon.

3.2.2 Online Survey Design

Online surveys require attention to the clarity of content and structure to elicit information that can meet the objectives of studies (Graber et al., 2011). This survey (Appendix 3) has comprised 29 questions constructed with an eye toward the gaps identified during the review of the relevant literature in chapter 2 and the aims of the study mentioned in the previous section. The initial three questions focused on consent for participation and inclusion criteria, the next ten on demographic information, and the remaining questions addressed the following topics:

a) iPad use in the classroom for SC and ER
b) Apps' selection criteria
c) Prioritisation of target skills with iPad
d) iPad embedding into the curriculum and practices implemented
e) Measurement of students' performance during iPad use
f) Frequency and duration of iPad use
g) Training provided for iPad use
h) Practitioners' perspectives on iPads for SC and ER
i) Educators' recommendations of apps for SC and ER
j) Educators' intention for further training

More specifically, the first six topics (a, b, c, d, e, f, g) aimed to elicit information about the iPad use in context and the purposes of implementing iPads for the SC and

ER of autistic pupils. This set of questions was informed by a report from NAACE on ‘The iPad as a Tool for Education’ (2014) which had explored several issues associated with technology use in context such as the nature of iPad use in the classroom, its incorporation into the curriculum, the selection criteria of apps and its impact on student performance. Following the statement of Chambers et al. (2018) about the variety of ways that tablets can be implemented in different contexts, the first six topics of the survey aimed to provide information about the role of context and systemic support on the use of iPads in the classroom. Besides, considering Mangafa’s view (2019) on the lack of guidance on how teachers use iPads in the classroom, the questions focused on collecting data about the readiness of educators to implement tablets with autistic pupils.

The last three topics (h, i, j) were associated with recommendations from the literature about including input from stakeholders in research (Sulaimani, 2017; Fletcher-Watson et al., 2016) and collecting meaningful information regarding the enablers and challenges of iPad use in context. In addition, the questions aimed to collect input to inform the literature base regarding future issues for consideration in the field of iPads and autism. Overall, the design of the questions for the online survey was informed by Abbott’s statement (2007) which emphasised the need to explore the interaction between technology, context, and individuals to shed light on ways of transforming learning.

To capture all the points mentioned above, the online survey was divided into two sections which contained various primary questions to collect rich and informative data. More specifically, the study included: nine categorical, two multiple-choice, three Likert Scale and two open-ended questions, while eight of the primary questions provided the option to the participants to elaborate on their answers. The questions related to demographic information were asked as closed type questions as they included ‘factual knowledge’ of respondents (Newby, 2010) such as age group, professional role and gender (Qs.3-12). The remaining categorical questions (Qs.13,14,20,21,23,24,26,27,28) asked participants to choose a particular category in which they belonged or express their agreement/disagreement to a given statement. These types of questions collected data about using iPads in different contexts, the practices implemented, practitioners’ perspectives and training needs. More specifically, the questions that showed the impact of context on iPad use were related to a) educators’ in-situ use of iPads for autistic pupils’ SC and ER (Qs.13,14), b) the incorporation of iPad applications in the school’s curriculum (Q.20), c) the measurement of autistic pupils’ performance while using the iPads (Q.21) and d) the training that educators received to use the iPads (Q.27).

Two main open-ended questions (Qs.19,20) asked educators’ views about specific apps used in the classroom for SC and ER, while Likert scale questions (Qs.15,16,17) collected opinions on the selection process of the apps and specific target skills. More specifically, questions 15,16,17 asked educators to rate these topics using a four-point scale that ranged from least to most effect or importance. Hence, they provided information about the influence of the two different school contexts (Special school and Mainstream Autism Resource Base) on iPad use in the classroom. Finally, questions 22 and 25 were multiple-choice and asked participants to select the best possible response from several options, referring to the frequency and duration of iPad use in each context.

The scope of the study which was to collect information from key stakeholders about the way iPads are used in real-world contexts, informed the decision about the content and balance between the open- and close-ended questions of the online survey. This was also supported by the literature review, which identified that no relevant studies have been conducted in this field, specifically focusing on autistic pupils and the use of iPads for SC and ER. Thus, the selection of different types of questions provided opportunities for comparing the different practices and perspectives depending on the school context. The inclusion of follow-up open-ended questions to the principal questions intended to avoid a common weakness of questionnaires which relate to the exclusion of additional comments that the respondents might have wished to provide (Cohen, Manion and Morrison, 2007).

For the online survey design, Bristol Online Survey (BOS) tool was used, and attention was paid to the employment of concepts that participants across different settings (e.g. special, mainstream schools) would relate. To check the coherence of the study, an informal check was implemented in the construction of the questions with useful existing contacts. More specifically, before the official launch of the research, advice was gathered from six educators (ex-colleagues of the researcher) about the format, length of the survey and wording of the questions.

3.3 Methodology

3.3.1 Ethics

According to the literature, research that is based on interpersonal interactions should consider the moral codes and principles of those involved (Cohen, Manion and Morrison 2011, Mauthner et al. 2002, Robson 2011). Moreover, all research participants have the right to have the information they provide kept confidential while it is mandatory that the research causes no harm to them.

For this study, full ethical approval was received by the Ethics Committee of the University of Birmingham (Reference: ERN_16-0551, Appendix 1), and confidentiality was maintained through the process. More specifically, privacy issues were prevented by keeping participants' anonymity during the collection and analysis process. At the same time, all respondents were assured that their personal data would not relate to identifiable persons. To achieve this, the survey was anonymous, and code names were allocated to participants during the data analysis process or report of the findings (e.g. R1, R2). Moreover, the questionnaire was distributed to several schools across England, thus meeting the aims of the study and minimising the possibility of workplace identification.

The ethical procedures involved a digital version of a participant information sheet, and consent form (Appendix 2a, 2b) added to the first page of the online survey. Similarly, brief information on the study was also provided in the recruitment email sent to the participants. Although *"the boundaries between ethical and unethical practices are not clear-cut"* (Bryman, 2016, p.145), the key ethical concern of this study was to treat participants with *"as much care and respect as possible"* from the early stages to the end (Oliver, 2010, p.173).

3.3.2 Sample Selection and Distribution

The online survey involved data from 55 participants, all working or having worked as educators in Special or Mainstream (Autism Resource Base) settings. The respondents were selected using a convenience sampling strategy as the target population should meet specific inclusion criteria (Etikan, 2016). More specifically, educators needed to have previous experience working with autistic pupils and iPads in English educational settings. Despite the limitations of convenience/nonprobability sampling in research, which denotes the absence of representative units of the population (Wolf et al., 2016), the participants were selected based on the needs of the study at the given time for the data collection.

The study aimed to identify characteristics of the sample that would contribute to a better understanding of the iPad practices used in schools for SC and ER of autistic pupils. In other words, the intention was not to produce findings that would be generalised to the broader population but inform the relevant literature and this research by collecting a snapshot of iPad practices implemented in school contexts through educators' perspectives. In line with this, Mesibov and Shea (2011) have stated that generalisations have not been particularly useful in the field of autism given the heterogeneity of the population.

Several exhaustive and systematic procedures were implemented to distribute the online survey to a wide range of educators and school contexts. Following the official ethical permissions, the data collection process started in September 2016 and was completed in April 2017. It involved identifying primary Special and Mainstream (Autism Resource Base) schools across England that used iPads in their practice. After a thorough search on the EduBase Public Portal database of educational establishments across England and Wales (DfE, 2014) and on schools' websites, 40 settings were selected to be contacted: 20 Special and 20 Mainstream (Autism Resource Base). All schools included a computing policy on their websites and were located in different parts of England to achieve better representation.

To facilitate electronic surveying, all the relevant information about the survey, its inclusion criteria and completion process was provided to the headteachers of the schools via email (Appendix 2). After confirming that their setting used iPads and taught students with autism, they were asked to forward the survey link to the related staff. From the 40 schools that were contacted, a total of 15 replied positively to the invitation, while five emails were returned as undeliverable. Finally, over-sampling was attempted via distributing flyers to conferences to ensure an adequate number of responses and inclusion of participants from various educational contexts.

3.3.3 Data Analysis

The data were descriptively analysed using Microsoft Office Excel program. The main descriptive statistics techniques used for the analysis involved frequency tables and central tendency measures (means). In particular, the steps followed for the data analysis was carried out in four stages, as presented in Table 3-1.

Table 3-1: Steps for the data analysis of the online survey

Analysis' Steps	Explanation of Process
1) *Data Preparation and Tidying*	• Data export from BOS to MS Excel • Set up structure of data • Screen data for errors • Identification of variables
2) *Exploration and Analysis of Data*	• Analysis of data based on school context: a) Special School b) Mainstream (Autism Resource Base) • Encapsulation of data through descriptive statistics • Exploration of relationship between variables within each educational context • Frequency table analysis of open-ended questions
3) *Data Set Report and Interpretation*	• Findings' conclusions, report, and discussion

- ***Step 1: Data preparation and tidying***

Data preparation constitutes a fundamental stage of data analysis (Zhang, Zhang and Yang, 2003). The online survey data were transferred from BOS and prepared in Excel software by checking for possible missing/incorrect values or poor-quality answers. In line with the statement of De Vaus (2002), who has highlighted that to avoid errors it is better to "*code for more rather than less detail"* (p.8), the variables of the whole dataset were identified, grouped and prepared for analysis. Hence, items were combined according to the educational context: a) Special school and b) Mainstream (Autism Resource Base) setting, specifying the coding schemes used for the analysis. To reduce potential errors, the researcher worked together with the primary supervisor of the research throughout the coding process.

- ***Step 2: Exploration and analysis of data***

The analysis involved looking at the data considering the focus of the questions and the aims of the study. The datasets that targeted the different contexts of the schools were analysed separately for: a) Special and b) Mainstream (Autism Resource Base) schools, resulting in a descriptive overview of the iPad uses and practices, the support provided in these settings as well as the respondents' perspectives on iPads' use for SC and ER. The main descriptive statistical techniques used for analysing the data were frequency tables and measures of central tendency (means). To further explore the relationship between variables, the analysis focused on identifying the central position of variables within the two different educational contexts. Thus, centralised tendency techniques were implemented to determine the most representative values in the given datasets (Akbayrak, 2019). Regarding the follow-up open-ended survey questions, they were analysed and presented after developing categories based on content analysis. Finally questions 18 and 19 were reported based on the number of times that each answer was mentioned, as educators were asked to refer to iPad applications that they considered useful for developing the SC and ER of autistic pupils.

- ***Step 3: Dataset Report and interpretation***

After the analysis of the datasets, patterns of interest were identified and categorised into three broad themes:

1. Demographic Information of Respondents
2. iPad Use, Practices and Support According to School Type
3. Educators' Perspectives on iPad Use for SC and ER

The findings were reported accordingly to provide insights about iPad implementation and educators' perspectives on iPad use for SC and ER of autistic pupils in different school settings. Finally, the findings were discussed and interpreted, including a synthesis of key messages from the literature.

3.4 Results of Online Survey Data

3.4.1 Demographic Information of Respondents

The information that participants provided about themselves, their professional context, and education level is summarised in Table 3-2. Frequency counts of the responses and the corresponding percentages for the whole sample of 55 participants are reported to show their professional roles, work experience, and the number and age of their students. From the 55 educators who took part in the online survey, five were males and 50 females while most of them (*n*=36) were under 35 years old. All respondents were education professionals, with the majority (*n*=41) being SEND educators (teachers or teaching assistants). The remaining sample (*n*=14) involved other educators with SEND experience or qualifications. The category ‘Other Educators (SEND experience/qualifications)’ comprised of autism specialists/consultants/advisors (*n*=7), general educators (teachers or teaching assistants) with autism experience (*n*=3), an autism researcher, an autism resource base deputy manager, a technology specialist and a Special Educational Needs Coordinator (SENCO).

Thirty-two of the participants worked in Special schools and 23 in Mainstream (Autism Resource Base) settings. All participants who completed the online survey supported students with autism following the relevant SEND Code of Practice (2015) and computing policy of their school. The respondents represented a group of both newly qualified (*n*=29) and experienced practitioners (*n*=26), while more than half of the whole sample (*n*=35) had up to five years of autism-related experience.

Most of the participants held a Postgraduate Degree (*n*=28: Masters or Doctorate), 20 were Bachelor's graduates, while only two of the respondents had a Teaching Diploma Certificate. Thirty-six stated that their students were primary-age level, 16 mentioned that they worked at a secondary or older level, and three at a pre-school level. Finally, most respondents (*n*=35) supported up to six autistic pupils in their educational setting.

Table 3-2: Demographic information of online survey respondents

Participant Demographic Information		**N**	**[%]**
Total		55	100%
Gender			
	Male	5	9%
	Female	50	91%
Age Groups			
	Under 35	36	65%
	Over 35	19	35%
Professional Groups/Role			
	Other Educators (SEND Experience/Qualifications)	14	25%
	SEND Educators	41	75%
Work Setting			
	Mainstream (Autism Resource Base)	23	42%
	Special School	32	58%
Professional Experience			
	Up to 5 years	29	53%
	6+ years	26	47%
Autism-Related Experience			
	Up to 5 years	35	64%
	6+ years	20	36%
Education			
	Diploma/Certificate	7	13%
	Bachelor's Degree	20	36%
	Master's Degree	26	47%
	Doctorate Degree	2	4%
Students' Age Groups			
	Under 5 years old	3	5%
	5-11 years old	36	65%
	11+ years old	16	29%
Number of students supported			
	Up to 6	35	64%
	6+	20	36%

3.4.2 iPad Use, Practices and Support According to School Type

This section addresses the questions that collected information on how iPads were used in a) Special and b) Mainstream (Autism Resource Base) settings, the implemented practices and the support provided to educators. The data were analysed according to the two types of educational contexts and refer to the following areas:

- iPad use to support SC and ER
- Apps' selection criteria for SC and ER
- Prioritisation of areas of reported iPad use
- Level of iPad incorporation into the curriculum
- Measurement of student's performance during iPad use
- Frequency and duration of iPad use
- Training provided in iPad use

Firstly, the respondents were asked to report whether their schools used iPads to support the SC and ER of autistic pupils (Qs 14&15). As seen in Table 3-3, over half of the participants from each educational setting mentioned that their schools used iPads to support autistic students' SC skills. More specifically, 19 educators from the sample of 32 people who responded from Special schools stated that they used the devices for this purpose. Interestingly, an even higher response rate was observed regarding the iPad use for SC in Mainstream (Autism Resource Base) settings, with (*n*=14) from the sample of 23 participants mentioning it. The data showed that educators in both settings indicated that the use of iPads to support the ER of autistic pupils was not the main area of application. As summarised in Table 3-3, less than half of the respondents (*n*=14) from Special schools reported that they used tablets for this reason and similarly, only eight out of the 23 respondents from Mainstream (Autism Resource Base) schools.

Table 3-3: iPad use to support SC and ER according to school type

iPad use to support SC and ER	Special School (N = 32)				Mainstream (Autism Resource Base) (N = 23)				Total (N = 55)			
	Yes		No		Yes		No		Yes		No	
	n	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*
Do you currently use iPads to support the ***SC*** *of students with autism?*	19	59%	13	41%	14	61%	9	39%	33	60%	22	40%
Do you currently use iPads to support the ***ER*** *of students with autism?*	14	44%	18	56%	8	35%	15	65%	22	40%	33	60%

Some of the respondents from both settings who stated that they did not use iPads to support the SC and ER of autistic pupils provided extra information about other purposes of using iPads referring among others to the following: a) motivation for task engagement, b) academic purposes, c) entertainment and d) task reward.

The findings in response to the question about the effect of specific criteria on the selection process of SC apps have been summarised in Table 3-4. More specifically, the results, which are reported in mean values (as also in Tables 3-5 and 3-6), show the central tendency ($\bar{x}$) of responses within each educational context a) Special school and b) Mainstream (Autism Resource Base) setting. Thus, where $\bar{x}>2$ out of 4**,** it is considered that the given criterion had a *moderate-to-strong effect* on the selection process. In responses where $\bar{x}<2$ out of 4**,** it is considered that the given criterion had a *minimal-to-no effect* on the selection process.

According to the participants, the effect of the child's individual needs for selecting apps for SC was the strongest, with $\bar{x}=3.78$ in both school settings. It is also evident that the school's policy within Special schools had a more substantial effect **(**$\bar{x}=3.03$)

than the national curriculum (x̄=2.56). On the contrary, it appeared that within the Mainstream (Autism Resource Base) settings, it was the national curriculum (x̄=2.83) that had a more significant impact on the selection process than the school's policy (x̄=2.57). Moreover, educators in both settings mentioned that the collaboration with parents had a greater influence on the selection of apps for SC than the co-operation with the associated stakeholders. Finally, in both educational contexts, the impact of other criteria (such as effectiveness, ease of use, adaptability of the app) appeared to have a minimal-to-no effect on the selection process of apps for SC.

Table 3-4: Effect of specific criteria for the selection of apps for SC according to school type

How do you choose which iPad apps to use in the classroom to support the SC of students with autism?	***Rating Scale (N = 55)***								***Mean (x̄)***		
	1		**2**		**3**		**4**		**Special School**	**Mainstream (Autism Resource Base)**	**Total**
	No effect		**Minimal effect**		**Moderate effect**		**Strong effect**		**(N = 32)**	**(N = 23)**	**(N = 55)**
	n	***[%]***	***n***	***[%]***	***n***	***[%]***	***n***	***[%]***	***out of 4***	***out of 4***	***out of 4***
Apps that fit with the National Curriculum	8	15%	12	22%	25	45%	10	18%	2.56	2.83	2.67
Child's Individual Needs	1	2%	2	4%	5	9%	47	85%	3.78	3.78	3.78
Parent-Teacher collaboration	6	11%	13	24%	26	47%	10	18%	2.66	2.83	2.73
Collaboration with Associated Stakeholders	25	45%	20	36%	10	18%	0	0%	1.78	1.65	1.73
School's Policy	8	15%	8	15%	24	44%	15	27%	3.03	2.57	2.84
Other	9	16%	0	0%	3	5%	6	11%	0.78	0.74	0.76

Following this question, the participants were also asked to rate the effect of a similar set of criteria for selecting apps for ER (Table 3-5). The results indicated that the child's individual needs had the most dominant effect in both educational contexts**,** with x̄=3.66 in Special schools and x̄=3.70 in Mainstream (Autism Resource Base) settings. Moreover, the school's policy within Special schools had a stronger effect (x̄=2.72) than the national curriculum (x̄=2.44). The same pattern was also observed within Mainstream (Autism Resource Base) settings for ER, in contrast with what was observed for SC, with the school's policy (x̄=2.52) having a more significant influence than the national curriculum (x̄=2.39). Regarding the impact of collaborations, participants from both educational contexts stated that co-operation with the parents for selecting apps for ER had a greater effect than the collaboration with Associated Stakeholders. Finally, the impact of other criteria such as accessibility and effectiveness appeared to have minimal-to-no effect in both Special (x̄=0.69) and Mainstream (Autism Resource Base) settings (x̄=0.57).

Table 3-5: Effect of specific criteria for the selection of apps for ER according to school type

How do you choose which iPad apps to use in the classroom to support the ER of students with autism?	***Rating Scale (N = 55)***								***Mean (x̄)***		
	1		**2**		**3**		**4**		**Special School**	**Mainstream (Autism Resource Base)**	**Total**
	No effect		**Minimal effect**		**Moderate effect**		**Strong effect**		**(N = 32)**	**(N = 23)**	**(N = 55)**
	n	***[%]***	***n***	***[%]***	***n***	***[%]***	***n***	***[%]***	***out of 4***	***out of 4***	***out of 4***
Apps that fit with the National Curriculum	11	20%	17	31%	20	36%	7	13%	2.44	2.39	2.42
Child's Individual Needs	1	2%	4	7%	7	13%	43	78%	3.66	3.70	3.67
Parent-Teacher Collaboration	9	16%	9	16%	22	40%	15	27%	2.72	2.87	2.78
Collaboration with Associated Stakeholders	24	44%	19	35%	11	20%	1	2%	1.94	1.61	1.80
School's Policy	11	20%	9	16%	24	44%	11	20%	2.72	2.52	2.64
Other	11	20%	1	2%	2	4%	4	7%	0.69	0.57	0.64

Participants also reported on the skills of autistic pupils that they prioritise to develop when using iPads in the classroom. According to the findings summarised in Table 3-6, it seems that both in Special and Mainstream (Autism Resource Base) settings, respondents focused on all three given skills (communication, social and emotional). In particular, the results indicated that educators within Special schools rated as their highest priority the development of communication skills (x̄=3.53), followed by social (x̄=3.19) and emotional (x̄=3.09) skills. On the contrary, it appeared that in Mainstream (Autism Resource Base) settings, participants prioritised slightly more social (x̄=3.65) and emotional (x̄=3.57) skills than communication (x̄=3.39). Finally, in both educational contexts, educators rated other skills such as independence, attention, academic and fine motor skills as low-to-no priorities.

Table 3-6: Prioritisation of autistic pupils' skills that educators aim to develop with iPads according to school type

Which skills do you aim to develop while using the iPads in the classroom with students with autism?	***Rating Scale (N = 55)***								***Mean (x̄)***		
	1		**2**		**3**		**4**		**Special School**	**Mainstream (Autism Resource Base)**	**Total**
	Not a priority		**Low priority**		**Medium priority**		**High priority**		**(N = 32)**	**(N = 23)**	**(N = 55)**
	n	***[%]***	***n***	***[%]***	***n***	***[%]***	***n***	***[%]***	***out of 4***	***out of 4***	***out of 4***
Communication skills	2	4%	7	13%	9	16%	37	67%	3.53	3.39	3.47
Social skills	2	4%	4	7%	20	36%	29	53%	3.19	3.65	3.38
Emotional skills	3	5%	4	7%	22	40%	26	47%	3.09	3.57	3.29
Other	5	9%	0	0%	2	4%	9	16%	0.91	0.78	0.85

Regarding the incorporation of iPads into the school curriculum, Table 3-7 shows that more than half of the participants from Special schools (*n*=21 out of 32) responded favourably to this process. Interestingly, the findings revealed that this was not the main priority of the educators within the Mainstream (Autism Resource Base) settings, as only 11 out of the 23 educators mentioned that they embedded tablets into the curriculum. However, most participants from both educational contexts who responded positively to this question justified that they mainly used iPads to increase engagement and individualised learning across different learning areas. For example:

R2: *"The integration of new technologies in the national curriculum and the need of incorporation of activities with the use of the iPad is vital […] I use them in a range of different ways: To introduce new topics (use of videos, images in parallel with oral communication),* ***as a reward after the completion of a learning task,*** *as an option during the free choosing time,* ***to design learning activities by myself according to my goals****"* (Mainstream-Autism Resource Base school).

Table 3-7: iPad incorporation into the curriculum according to school type

iPad Incorporation into the Curriculum	***Special School (N = 32)***				***Mainstream (Autism Resource Base) (N = 23)***				***Total (N = 55)***			
	Yes *n*	*[%]*	**No** *n*	*[%]*	**Yes** *n*	*[%]*	**No** *n*	*[%]*	**Yes** *n*	*[%]*	**No** *n*	*[%]*
Do you embed the use of iPad apps in the school's curriculum?	21	66%	11	34%	11	48%	12	52%	32	58%	23	42%

In relation to whether educators measured students' performance while using the iPads, the findings revealed that over half of the participants from both educational contexts followed this practice. Table 3-8 shows that 20 out of 32 people from Special schools recorded students' performance when using the iPads and 12 out of 23 from Mainstream (Autism Resource Base) settings. Several respondents (*n*=10) from both school contexts also justified how they measured pupil's performance, explaining that they either observed or took photos to evaluate whether students met pre-set outcomes. Some educators (*n*=6) mentioned that they preferred to use apps that involved progress tracking. Others (*n*=5) justified that they used online software such as 'Seesaw', online learning journals or web-based assessment tools to track and save students' progress. Below are some examples of participants' responses:

R16*: "****I observe if and how the applications help them better understand the topics in subjects*** *such as mathematics, language, etc. I have seen positive results in those areas"* (Mainstream-Autism Resource Base school).

R8: *"****Many apps have tracking inside such as 'Colourful Semantics'.*** *Otherwise we* ***take photographs*** *and* ***take notes"*** (Mainstream-Autism Resource Base school).

R40: *"We **monitor the students work** and **record their ideas** using **online learning journals"*** (Special school).

Table 3-8: Measurement of students' performance during iPad use according to school type

Student Performance and iPads	*Special School (N = 32)*				*Mainstream (Autism Resource Base) (N = 23)*				*Total (N = 55)*			
	Yes		No		Yes		No		Yes		No	
	n	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*
Do you measure students' performance while using iPads?	20	63%	12	38%	12	52%	11	48%	32	58%	23	42%

Participants were also asked to report on the frequency and duration of iPad use with their autistic pupils. Table 3-9 shows that most of the respondents in Special schools used tablets on a daily basis (*n*=22 out of 32). In Mainstream (Autism Resource Base) settings, the daily and weekly use of iPads was highlighted by an equal number of respondents (*n*=11 out of 23).

Table 3-9: Frequency of iPad use according to school type

Frequency of iPad use	*Special School (N = 32)*						*Mainstream (Autism Resource Base) (N = 23)*						*Total (N = 55)*					
	Rarely		Weekly		Daily		Rarely		Weekly		Daily		Rarely		Weekly		Daily	
	n	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*
How often do you use iPads with students with autism?	2	6%	8	25%	22	69%	1	4%	11	48%	11	48%	3	5%	19	35%	33	60%

Regarding the daily duration of iPad use in the classroom (Table 3-10), it was revealed that most educators from both educational contexts allowed pupils to access tablets for up to 30 minutes. According to Special schools' findings, only a minority of participants (*n*=11 out of 32) referred to 30-60 minutes of daily use. Likewise, in Mainstream (Autism Resource Base), seven people out of the whole sample of 23 referred to maximum daily use of 30-60 minutes.

Table 3-10: Daily duration of iPad use according to school type

Daily duration of iPad use	*Special School (N = 32)*								*Mainstream (Autism Resource Base) (N = 23)*								*Total (N = 55)*							
	more than 120'		61-120 minutes		31-60 minutes		0-30 minutes		more than 120'		61-120 minutes		31-60 minutes		0-30 minutes		more than 120'		61-120 minutes		31-60 minutes		0-30 minutes	
	n	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*
On a daily basis, how much time do students with autism spend with the iPads?	2	6%	2	6%	11	34%	17	53%	0	0%	0	0%	7	30%	16	70%	2	4%	2	4%	18	33%	33	60%

Finally, participants were asked to indicate if their setting had provided training to them on how to use iPads with autistic students. Interestingly, the findings revealed that most educators from both educational contexts had not received training. More specifically, as Table 3-11 illustrates, only eight of 32 educators from Special schools and three out of 23 participants from Mainstream (Autism Resource Base) settings were trained. However, almost all educators from both Special (*n*=30) and Mainstream (Autism Resource Base) (*n*=23) settings expressed their interest in receiving training.

Table 3-11: Training and iPads according to school type

Training and iPads	*Special School (N = 32)*				*Mainstream (Autism Resource Base) (N = 23)*				*Total (N = 55)*			
	Yes		No		Yes		No		Yes		No	
	n	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*	*n*	*[%]*
Have you received training for using the iPads in the classroom for students with autism?	8	25%	24	75%	3	13%	20	87%	11	20%	44	80%
Would you be interested in receiving training for learning how to use iPads in the classroom for students with autism?	30	94%	2	6%	23	100%	0	0%	53	96%	2	4%

A few respondents also provided further information about the type of training they had received, stating that it was delivered either by their local authority autism team or the school's ICT person. For example:

R35: *"**Local authority CAT team delivers training and monitors progress/sets targets** on these devices for the autistic children"* (Special school).

R51: *"Training on certain applications and general use **were completed by the Apple Teacher of the school"*** (Special school).

3.4.3 Educators' Perspectives on iPad Use for SC and ER

This sub-section addressed the questions that collected information about educators' perspectives of iPad use in the classroom for SC and ER of autistic pupils. Moreover, the section reports on the applications that participants considered appropriate for the development of these skills. This set of questions were analysed based on the educational context where the respondents worked a) Special and b) Mainstream (Autism Resource Base) settings.

Beginning with the participants' opinion about the impact of iPads on autistic students' SC and ER, the findings in Table 3-12 show that educators from both Special and Mainstream (Autism Resource Base) schools valued that the way they used the devices as tools positively influenced these skills. More specifically, respondents in Special schools seemed to be slightly more in favour of iPads' impact on SC (*n*=27 out of 32) than ER (*n*=22 out of 32). The same pattern was observed in Mainstream (Autism Resource Base) settings were 20 respondents out of the total sample of 23 referred to tablets' impact on SC and 16 out of 23 on ER. Regarding the educators from both educational contexts who were unsure about iPads' positive impact on these skills, they seemed to be more in doubt about tablets' usefulness on ER than SC.

Table 3-12: Educators' perspectives of iPad impact on SC and ER

Educators' Perspectives of iPad impact on SC and ER	***Special School (N = 32)***						***Mainstream (Autism Resource Base) (N = 23)***						***Total (N = 55)***					
	Yes		**No**		**Not sure**		**Yes**		**No**		**Not sure**		**Yes**		**No**		**Not sure**	
	n	***[%]***	***n***	***[%]***	***n***	***[%]***	***n***	***[%]***	***n***	***[%]***	***n***	***[%]***	***n***	***[%]***	***n***	***[%]***	***n***	***[%]***
Do you feel that iPad applications can have a positive impact on the SC of children with autism?	27	84%	0	0%	5	16%	20	87%	0	0%	3	13%	47	85%	0	0%	8	15%
Do you feel that iPad applications can have a positive impact on the ER of children with autism?	22	69%	1	3%	9	28%	16	70%	0	0%	7	30%	38	69%	1	2%	16	29%

The respondents were also asked to elaborate on iPad applications that they considered useful for developing the SC and ER of autistic pupils. As this question was open-ended, educators had the opportunity to mention more than one application used in their practice. Table 3-13 presents a snapshot of the apps reported, focusing on the reported answers more than once. It should be noted here that the extensive list of suggested apps for SC and ER can be found in Appendix 5.

As it can be seen from Table 3-13, under the list of apps for SC, ‘PECS’ (*n*=3), ‘Proloquo2Go’ (*n*=3) and ‘Widgit Go’ (*n*=2) seemed to be the most popular software, with all of them targeting Augmentative and Alternative Communication. Regarding the apps suggested for ER development, the findings showed that music apps such as ‘iTunes’ (*n*=3) were most frequently mentioned as a means to calm students down. Reference was also made to ‘Breath, Think, Do’ (*n*=2) app, which is described as software that targets pupil’s problem-solving, self-control and task persistence skills. Moreover, a few other educators mentioned ‘Choiceworks’ (*n*=2), ‘LightBox’ (*n*=2) and ‘5-Point Scale’ (*n*=2) apps for the development of students’ understanding and control of their feelings.

Table 3-13: Educators’ suggested applications for SC and ER

Suggested Apps from Educators	*Which iPad application do you think is the best for the development of the SC of students with autism?*		*Which iPad application do you think is the best for the development of the ER of students with autism?*	
	Social Communication	Times Mentioned	**Emotional Regulation**	Times Mentioned
	PECS	3	iTunes	3
			Breathe, Think, Do	2
	Proloquo2Go	3	Choiceworks	2
			Sensory Light box	2
	Widgit Go	2	5-Point Scale	2

3.5 Discussion

This section discusses issues in relation to iPad practices used in schools for autistic pupils' SC and ER that emerged from online survey analysis.

- ***iPad use for SC and ER of autistic pupils***

Participants from both Special and Mainstream (Autism Resource Base) contexts reported using iPads to support autistic pupils' SC, confirming previous research on the use of mobile-based interventions for language purposes (Ebert, 2018). The analysis also highlighted that using tablets to support pupils' ER skills was not the schools' highest priority. While ER is an important topic in schools' curriculum that considers the emotional needs of autistic individuals (Mantziou, Vrellis and Mikropoulos, 2015), less than half of the respondents from both educational contexts reported using iPads for this purpose.

This could be attributed to teachers' confusion of what the term entails combined with the limited research on ER and technology (Torrado, Gomez and Montoro, 2017; Mazefsky and White, 2014). For example, educators referred to using iPads to calm students down without acknowledging calmness as a critical element of ER (Lee and McCord, 2012). Therefore, it is possible that respondents incorporated ER into other areas of development offered to pupils with tablets. From the above and by considering the participants' limited guidance on how to use iPads, it could be suggested that future training should also focus on areas that may have not been broadly associated with tablet use, such as ER.

With respect to the selection criteria of the apps, the findings supported the current research base, highlighting the need to choose hardware and software that meet the individual needs of students (Wynne et al., 2016; DfE, 2019c). In line with this, respondents from both educational settings focused on pupils' needs to select apps for SC and ER. This finding affirms previous research on the value of focusing on the interrelationships between technology, context and the individual (Abbott, 2007). Other potential influences included the collaboration of educators with the parents and the associated stakeholders and the policy and national curriculum of the school.

Parent-teacher collaboration appeared to have a medium-to-strong effect on the process. Consistent with the literature, this finding confirms Coleman's statement (2011) about the important role of collaboration with parents when discussing the use of assistive technology. Working with parents can ensure that the use of the device meets the needs of both students and families, enhances understanding of the tablet's use and enables sharing of vital information and guidance (Wong and Cohen, 2011). Though, due to the limited number of studies that have documented the parent-teacher relationship (Neikrug and Roth, 2015; Dixon et al., 2015), this finding implies that future research should further investigate this area.

The effect of collaboration with the associated stakeholders on apps selection for SC and ER was valued less by educators from both contexts. Although previous studies have identified the positive impact of co-operation between different professions in technology implementation and knowledge-sharing (Parsons et al., 2015a; Bernardini, Porayska-Pomsta and Smith, 2014), this survey revealed that it was not the highest priority of these educators. This might be due to the lack of systemic support provided in schools and their insufficient preparation for the operational and instructional implementation of technology (Messinger-Willma and Marino, 2010). Overall, it could be inferred that the value of forming technology-related collaborative partnerships needs to be further encouraged and appropriately communicated to the educators.

The school's policy and the national curriculum were also reported as elements that influenced the selection of apps for SC and ER. The results indicated that the school's policy had a stronger effect within Special schools than the national curriculum. Contrary to that, it was revealed that the national curriculum had a greater impact within Mainstream (Autism Resource Base) settings than the school's policy. The variance in the strength of the influence between the school settings could be closely related to the impact of context and type of support provided in different environments (Chambers et al., 2018). Moreover, it could be attributed to the different needs of children and the specialisation of each setting. For example, in Special schools, the national curriculum is adapted and adjusted as necessary to meet their students' needs and the schools' objectives (DfE, 2015). Therefore, their specific school policies could have a stronger effect than the national curriculum on forming targeted plans for technology integration.

Regarding the areas of reported iPad use in the classroom, respondents from both educational contexts mentioned using iPads as multi-modal learning tools for communication, social and emotional purposes. More specifically, participants rated the aforementioned three given areas of development almost equally, affirming research on the value of iPads as tools to support various skills in learning (Kucirkova, Messer, Critten et al., 2014). This claim was also supported by practitioners' reflection on other areas of reported use, including independence, attention, and academic skills.

The data also revealed a disparity in practices relating to how iPads were implemented in the two educational contexts. For example, educators in Special schools were more in favour of the potential incorporation of iPads into the curriculum compared to Mainstream (Autism Resource Base) teachers. Likewise, the frequency and daily duration of tablet use also varied. This could be associated with differences in the systemic support provided in each setting. For example, Chambers et al. (2018) explored how iPads were used in various K-12 schools to support students with a range of learning support needs. The findings elicited information from teachers in different countries and identified a link between the support provided in each context and the level of technology integration in the classroom. However, other probable factors contributing to these variances between the different settings are also related to the different needs of students and the limited number of trained educators.

- ***A snapshot of educators' perspectives***

The perspectives of educators regarding the impact of iPads on autistic pupils' SC and ER were overall positive in both educational contexts, with a large percentage reporting using the device to positively influence SC. The fact that training was provided to a small number of educators in both settings did not seem to have prevented most of them from acknowledging the potential benefits of iPad use in practice. Thus, from this research, it seems that educators' opinion regarding the advantages that could stem from such devices in the classroom is not necessarily affected by training, although training can impact the implementation of iPads in the classroom (Chambers et al., 2018). Of course, other factors might contribute to the educators' positive opinions, such as familiarisation with the device via personal use.

Given that little has been done to explore the perspectives and perceptions of teachers regarding iPad use with autistic individuals (Sulaimani, 2017), it is recommended that future studies involve the opinions of end-users to inform research findings.

In addition, significant variations were noticed in the number and type of apps that educators recommended for the development of SC and ER of autistic pupils. More than 20 applications were reported for SC and more than 15 for ER, with most of them targeting multiple skills. This finding supports Mangafa's work (2018), who investigated the need for teachers to receive training and guidance on how to select appropriate iPad apps for autistic pupils. Moreover, it confirms the existence of variation in the way iPads are implemented in different school contexts (Chambers et al., 2018) and informs research about practitioners' preference to select applications that can be applied across the curriculum for various skills. It also highlights that the lack of collaboration between teachers and associated stakeholders might influence the selection of apps.

The data showed that almost all participants expressed interest in receiving training on the use of iPads regardless of their professional role, years of working experience and school setting. This finding may have potential implications for schools that intend to include iPads in lessons, as the implementation process should focus on the training of teachers. Hence, the need for adequate training is revealed, which is usually one of the biggest challenges in schools, and may involve information about technological advancements, associated pedagogies and practices (DfE, 2019c). Overall, greater systemic support and training from schools could ensure better use of tablets in education.

3.6 Conclusion

This chapter presented and analysed the data collected from an online survey that involved 55 educators with experience in teaching autistic pupils and using iPads. The aims of the survey were to a) provide an overview of the iPad practices used in Special and Mainstream (Autism Resource Base) settings in England for the SC and ER, and b) collect a synthesis of key messages that will be used later in the thesis (chapters 5,6,7) for the in-depth investigation of iPad practices implemented in two schools. The study also considered the level of teacher support offered in each setting and educators' perspectives about the impact of tablets on SC and ER. The chapter reported on the methodology followed for the design of the questionnaire, the procedures implemented for the ethics approval, identification of the sample and distribution of the survey. Finally, the findings were analysed and then discussed pulling out key points from the relevant literature. The main points that emerged from the analysis and will be explored further in the following chapters could be summarised as follows:

- Similarities and variations in the way iPads are implemented in Special and Mainstream (Autism Resource Base) schools for SC and ER are noted and analysed, based on:
    - The effect of specific criteria for the selection of apps
    - The prioritisation of autistic pupils' skills that educators aim to develop
    - The measurement of students' performance during iPad use
    - The frequency and daily duration of iPad implementation in practice
    - The iPad training provided to educators

- iPads are applied as multi-modal learning tools in educational contexts, prioritising pupils' individual needs.
- Contextual factors (such as systemic support and training) appear to influence how iPads are implemented in different settings.
- Participants' perspectives about iPad use in the classroom for SC and ER of autistic pupils seem to be positive and not dependent on training.

The online survey findings highlight elements that may create variation in the way iPads are implemented in different school contexts and confirm Abbott's statement (2007) about the need to shift the attention to understanding the interrelationships between participants, technology and context. Further, this study also contributes to research as it informs the literature by providing a snapshot about iPad practices used in educational contexts for the SC and ER of autistic pupils. Moreover, it highlights contextual issues, such as school support, that might enhance or hinder the use of iPads as additional learning tools in the classroom and offers educators' perspectives about the use of tablets for SC and ER.

Having provided an overview of how iPads and autism are contextualised in theory (chapter 2) and practice (chapter 3), the next chapter will take a closer look at practice in-situ. Following the statement of Mesibov and Shea (2011) about the important role of qualitative research in autism research for *"studying the real-life experiences and outcomes"* (p.122), two case studies will be implemented to conduct an in-depth exploration of key stakeholders' perspectives about the practices relating to using iPads for the SC and ER of autistic pupils in two school contexts.

Chapter 4: CASE STUDY METHODOLOGY

4.1 Introduction

Chapter 3 provided a snapshot of iPad practices implemented in-situ from educators for the SC and ER of autistic pupils. The findings revealed differences and similarities in the way tablets were used in Special and Mainstream (Autism Resource Base) settings. Moreover, contextual elements such as systemic support and training were identified to influence educators' variability of iPad practices. Similarly, the literature review (chapter 2) showed a need to situate iPads and autism in context and include the views of key stakeholders in research. Hence, this chapter discusses the methodology followed in researching two schools to explore the perspectives of educators, parents and autistic pupils about practices relating to using iPads for SC and ER.

The chapter first explains how the research questions have been conceptualised following the literature review and online survey findings and focusing on the rationale behind the study. It then justifies the philosophical underpinnings and the theoretical conceptualisations based on the research questions of the study, presenting a reflective commentary to discuss the validity and reliability of the findings. Next, the chapter discusses the research design, which included two case studies conducted in a Special and Mainstream with Autism Resource Base setting.

It then outlines the data collection methods, which involved interviews with key stakeholders and document analysis of the schools' computing and E-safety policies. Before analysing the data collection procedures, the chapter also describes the steps followed for ethical approval, referring to specific issues and dilemmas. It also presents the data collection method implemented in each school, providing information about their context and the participants. To conclude, it discusses the data analysis for the qualitative data, which adopted the thematic analysis approach.

4.2 Conceptualising the Research Questions

A fundamental step in all studies is the development of research questions (Alvesson and Sandberg, 2013). Maxwell (1996) highlights their influential role in creating the research design and production of innovative research. Research questions are core elements for knowledge creation; therefore, they should be clear and connected with *"established theory and research"* (Bryman, 2016, p.83). In line with these points, the formulation of the research questions for this study was based on key messages that emerged from the literature review-theory (chapter 2), the online survey findings-practice (chapter 3), and the theoretical-philosophical perspectives described in this chapter.

The three broad key themes that were identified in the literature are the following:

a) Technology has been mainly used as a tool to develop specific skills of autistic students, with very few studies focusing on iPads and ER.
b) The autistic voice and key stakeholders' perspectives about technology are usually omitted from studies.
c) There is a need for future studies to contextualise technology and explore how it is implemented for autistic pupils in real-world contexts.

Moreover, the three broad themes that were identified in the online survey are the following:

a) Similarities and variations in the way iPads are implemented in Special and Mainstream (Autism Resource Base) schools for SC and ER.
b) iPads are applied as multi-modal learning tools in educational contexts, prioritising pupils' individual needs.
c) Contextual factors (such as systemic support and training) appear to influence the way iPads are implemented in different settings.
d) Participants' perspectives about iPad use in the classroom for SC and ER of autistic pupils seems to be positive and not dependent on training.

Following these points, the main research questions of the study have been reformulated and conceptualised in relation to the interaction between a) iPads, b) key stakeholders (educators-parents-autistic pupils), and c) educational contexts.

More specifically, the first question focuses on technology and aims to explore how iPads are used in practice:

1) What are the iPad practices that educators and parents implement for the SC and ER of autistic pupils?
    a) What are the similarities and differences in the way iPads are being used in the classroom for SC and ER of different educational contexts?

Also, question 2 below was developed to capture participants' perspectives about the practices relating to using iPads for SC and ER:

2) What are educators' and parents' perspectives on iPad use for SC and ER?

a) How do the different educational contexts influence key stakeholders' confidence and perspectives regarding iPad use?

Finally, the role of context was captured by exploring how iPads are implemented in two school settings, as follows:

3) What are the reported contextual influences (enablers and barriers) to iPad adoption at home and school for SC and ER?
    a) What does the interaction of digital technology, context and individuals look like in relation to autism and iPads in the classroom?
    b) What are the different levels at which iPads, individuals and context interact?

Overall, these questions intend to shed light on how iPads are used in practice for SC and ER, collecting the views of practitioners, parents and autistic children. To explore the various levels at which participants, iPads and context interact, and their impact on the practices adopted in each setting, the main concepts of Ecological Systems Theory (Bronfenbrenner, 1979) and Abbott's 'E-inclusion' (2007) have been applied as conceptual frameworks.

The next section presents the underlying philosophical and theoretical concepts of the study which have been based on the research questions mentioned above.

4.3 Underlying Philosophical and Theoretical Assumptions

4.3.1 Philosophical Approach

An essential element in every research study is establishing and adopting a philosophical view and situating the research within a paradigm. Neuman (2006) mentions that paradigm is a “*general organising framework for theory and research that includes basic assumptions, key issues, models of quality research, and methods for seeking answers*” (p.81). In line with this, this section clarifies the philosophical approach adopted for this study and analyses the conceptual lenses through which the researcher examines the topic.

This study has taken an interpretive approach to the researched phenomenon and methodologies. The interpretivist paradigm is based on the viewpoint that realities are multiple and socially constructed, and the world should be explored through the perceptions and experiences of individuals (Al riyami, 2015). Cao Thanh and Thi Le Thanh (2015) highlight that interpretivist scholars should accommodate several viewpoints to seek answers, as external reality is variable (Thomas, 2017). The interpretive paradigm also values context for understanding a situation and considers it a critical element to the analysis of the data (Willis, 2007). Therefore, interpretivists prefer to adopt holistic research approaches and study phenomena in their unique environment (Creswell, 2007).

Along the lines of these perspectives, this study has aimed to accommodate the viewpoints of individuals to understand the researched phenomenon and its complexity. As previously mentioned in the introduction, the study explores key stakeholders' perspectives about the practices relating to using iPads for SC and ER of autistic pupils. Hence, the goal has been to understand how iPads are used in the classroom and at home, considering the impact of environmental influences. This approach has been informed by the findings from the literature review (chapter 2), which highlighted that there is little relevant in-situ research (Avramides et al., 2012), that incorporates the views of practitioners, parents and autistic pupils (Sulaimani, 2017). Thus, an interpretive approach and qualitative methods have been implemented to "*understand in depth the relationship of human beings to their environment and the part those people play in creating the social fabric of which they are a part*" (McQueen, 2002, p.17).

Although the interpretive paradigm can provide valuable information about a researched phenomenon, it has some limitations. For example, Orne and Bell (2015) state that findings can be subjectively analysed and, as a result, should not be generalised. However, it could be argued that validity and reliability are not supposed to be to the fore in this approach since it is the interpretation and the analysis of the evidence that is significant. In other words, in qualitative research, the intention is not to explore the world through observable and measurable facts but to get insight into a phenomenon through deep understanding. Speaking of objectivity, Al riyami (2015) mentions that any study is challenging to be objective-free, considering that researchers need to decide about their actions. However, in this thesis, specific steps have been taken to eliminate bias. More specifically, attention has been paid to the construction and conduct of the research and the production of findings as they emerged from the analysis. Also, the study has adopted a theoretical framework to conceptualise the research questions and inform the data collection and analysis.

4.3.2 Reflective Commentary on the Validity of The Analysis

Positivists often criticise the trustworthiness of qualitative research because of the difficulty of addressing concepts such as validity or reliability (Shenton, 2004). According to the literature, validity is described as *"the degree to which a method, a test or a research tool actually measures what it is supposed to measure"*

(Wellington, 2015, p.41). Reliability refers to replicating the findings with different participants accurately and precisely (Cohen, Manion and Morrison, 2011). Thomas (2016) states that the issues addressed in pursuit of trustworthiness and validity of studies take on different meanings in qualitative research. Hence, when qualitative researchers discuss validity, the focus is on credibility, authenticity, richness, and depth of the data (Winter, 2000).

Maxwell (1996) argues that one of the ways of establishing validity relates to the objective interpretation of data. This means that researchers should avoid imposing their meaning on data but capture the viewpoints of participants. In the current research, this issue was overcome by testing the reliability of the analysis process with the researcher's supervisors. Several parts of the stages of the analysis were checked by the supervisors, who verified data interpretation.

Another form of validity involved the use of a wide range of informants in the study. Shenton (2014) highlights that verifying individuals' viewpoints against others can increase the trustworthiness of studies. This is because the experiences captured are corroborated by a range of people. For this study, information was collected by various informants from different contexts. For instance, perspectives of iPad practices were collected from practitioners of different professional backgrounds who taught in different classrooms of each school and were verified against others. In addition, the researcher drew information from professionals, users and parents to involve a diversity of informants and examine the quality of findings.

A growing body of research refers to the potential of multiple perspectives interviews (MPI) collected separately from members of the same social unit to triangulate data (Vogl, Schmidt and Zartler, 2019). Kendall et al. (2009) states that MPIs are powerful ways to understand the dynamics and relationship of members who are connected to each other but have different social roles and perspectives of the same topic. Considering that relationships and interactions between educators, parents and pupils are essential for educational practice (Santoro, 2014), this study corroborated the findings by collecting different data sources. Hence, validity was ensured by *comparing* "*sources of different types to reduce the chances of reaching false conclusions*" (Hammersley, 2008, pp. 22–23). This approach also provided greater insights into the relationships and interactions between participants, incorporating the role of context.

Further the validity of the analysis involved collecting data from different schools to enhance the contextual data relating to the fieldwork. To deal with the wider context in which each school operated information was also elicited by the computing and E-safety policies of the two settings. Lincoln and Guba (1985) argue that rigour in qualitative research can be achieved using multiple data collection methods. In the current research, both interviews and documents were employed as sources of materials to get a more stable view of the schools' realities and practices. Moreover, the online survey results verified the case study findings, as similar concluding points were detected.

Finally, concerning the interpretation process, the study used Bronfenbrenner's (1979) and Abbott's (2007) conceptual frameworks to minimise validity threats. The theories provided a conceptual framework to analyse, merge, interpret and consistently present data. Finally, to avoid interpretation bias, the personal experiences and interests of the researcher were acknowledged and reported at the beginning of this study (chapter 1).

Overall, several procedures were implemented to secure the validity of the analysis. However, although the data were triangulated with the methods mentioned above, generalisation was not the purpose of this study. As Thomas (2016) states, *“concerns about how far we can generalise from a case study are neutralised when we realise how tentative any generalisation might be in social research”* (p.69). Thus, this study aimed to collect valid and trustworthy evidence from various sources and draw from the experiences of key stakeholders to inform literature and practice.

4.3.3 Theoretical Framework of the Study

The findings that emerged from the literature review and online survey highlighted the need to contextualise autism and technology to understand how iPads are implemented in practice. To achieve this, the study has adopted Abbott’s (2007) concept of ‘E-inclusion’ and Bronfenbrenner’s Ecological System’s theory (1979) as the conceptual lenses to approach and investigate the researched phenomenon. The frameworks have been analysed in the sections below, where it is also discussed how they complement each other.

4.3.3.1 Abbott’s conceptual framework of ‘E-inclusion’

The first framework used in this study is Abbott’s concept of ‘E-inclusion’ (2007). In his writing, Abbott makes a clear distinction between the terms ‘inclusion’ and ‘E-inclusion’, outlining the links between the two and shedding light on inclusive learning practices with the use of technology.

Abbott (2001) highlights that although inclusion has been a high priority in educational settings, it has often been viewed as a statement of a policy that can be challenging to achieve. The author states that inclusion was initially linked to ways of meeting the needs of individuals with physical disabilities (Abbott, 2007). However, it gradually became a fundamental concept in education, encompassing a broader sense of social inclusion by which the needs of users with learning difficulties were considered and met by implementing relevant learning practices (ibid.). Hence, according to this view, inclusion focuses on context and differentiation of practices, using a range of support to meet the needs of all students in a classroom (Abbott, 2007a).

Abbott (2007) also uses the term ‘E-inclusion’ to describe the application of digital technologies to remove or minimise learning difficulties in educational contexts. Adopting the social model of inclusion, Abbott states that learning challenges are created by the learning environments and not from the characteristics of the individuals (ibid). Based on this concept, Abbott creates a taxonomy of technology use for ‘E-inclusion’, providing three broad categories: Technology a) to train or practice, b) to assist learning or c) to enable learning.

Within this classification, technology use to train describes the implementation of special software to students with learning difficulties for practising specific skills (such as writing, reading), showcasing how digital devices were mainly utilised in the 1980s-1990s (Wright et al., 2011). The second category presents technology as an additional learning tool, highlighting its supportive role for students with learning or communication difficulties. This process involves additional features in the software of technologies found in mainstream and special schools. It also focuses on *“the role* *of technology in assisting students with learning difficulties as they are increasingly included in mainstream education"* (Abbott, 2007, p.18).

Interestingly, the third category presents a different perspective of technology as an enabler of learning, highlighting the active role of digital devices in facilitating learning (Abbott, 2007). One primary driver of this concept is how technology is viewed in relation to 'E-inclusion'. Contrary to the previous two categories, technology is not prioritised over learning but situated in context and studied in relation to the individual and the environment where it is applied (ibid.). Thus, this concept focuses on the interaction between context, individuals and digital technologies and considers this interplay an important element when discussing effective e-inclusive practices.

These perspectives provide interesting insights about the links of inclusion and 'E-inclusion' and the role of technology in supporting e-inclusive practices. According to the points mentioned earlier, both terms of inclusion reflect ways of minimising learning difficulties, with 'E-inclusion' referring to the use of digital devices as enablers of learning. Interestingly, 'E-inclusion' focuses not only on the pedagogical approach or technological devices but also on the context and conditions where learning occurs, highlighting the role of technology to facilitate inclusion more collaboratively and holistically. In line with this, Abbott (2007) refers to e-inclusive practices that take place in rich social contexts and offer opportunities for collaboration, independence, engagement, interaction, knowledge building and recreational learning.

Taking everything into consideration, this study has adopted the concept of 'E-inclusion' as a basis for the exploration of the researched phenomenon. More specifically, based on the literature review findings (chapter 2), which identified that research in iPads and autism needs to explore the context where the practices are implemented, the study has adapted Abbott's concept to illustrate how the interaction between iPads, key stakeholders and contexts looks in practice. In other words, this thesis used this concept to explore the interplay between these three elements in relation to autism and iPads in the classroom. Thus, the concept of 'E-inclusion' has been adapted for the needs of this study in the following ways:

- 'Context' has been used to refer to the two educational settings and pupils' home environments.
- 'Individuals' has been used to describe educators, parents and autistic pupils.
- 'Technology' has been used to refer to iPads.

In line with the points mentioned above, the study views the perspectives of key stakeholders as 'evidential artefacts' to provide insights into the contexts and the practices of iPad use for SC and ER. Hence, Abbot's concept (2007) has been used to generate authentic evidence about iPad use in-situ and technology's role in facilitating inclusion by reflecting on the role of local contexts, educators, parents and autistic pupils.

4.3.3.2 Bronfenbrenner's Ecological Systems Theory

The lines of enquiry of this study and the interpretation of data have been based on the Ecological Systems Theory of Urie Bronfenbrenner (1979). The theory offers a model towards human development focusing on various determinants that might influence the learning of the active person (Darling, 2007). Bronfenbrenner's theory stresses the interrelation between person and context (Tudge et al., 2009), describing the environment as a *"nested arrangement of structures, each contained within the next"* (Bronfenbrenner, 1977, p.514). The theory is depicted as a diagram of concentric circles that place the active person in the centre of the system. Around the central point where the person stands, other circles represent the Microsystem, Mesosystem, Exosystem, Macrosystem and Chronosystem as shown in Figure 4.1.

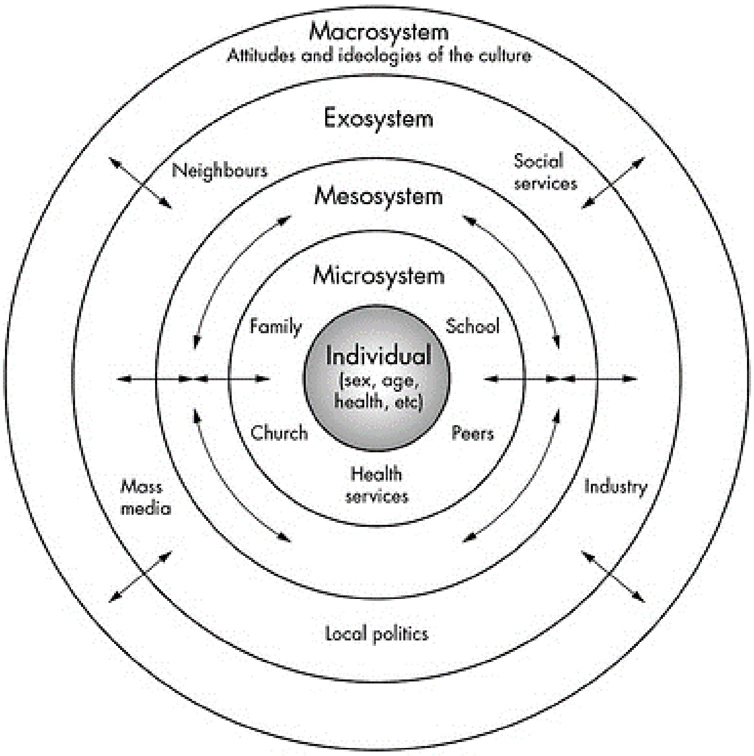

Figure 4.1: Visual Representation of Ecological Systems Theory (Bronfenbrenner, 1979)[1]

The system that is directly around the person (autistic child in this case) is the Microsystem, which contains all the elements that are present within the various environments in which the person interacts (Anderson et al., 2014). In this study, this system involves the school and home environments, which are comprised of school professionals and parents/carers. The Microsystem captures the perspectives of

[1] Development Standards accessed 11 February 2021, https://intascprinciple2.weebly.com/bronfenbrennerrsquos-ecological-systems-model.html

educators-parents towards iPads and the practices that they implement for the development of pupils' SC and ER.

The Mesosystem represents the dynamic relationships and influences between the developing person and the immediate environment. This system is characterised by complexity as it occurs because of various connections between Microsystems (Herselman et al., 2018). For example, it may depict the interrelations among two or more settings in which the child actively participates, such as home and school (Bronfenbrenner, 1979, p.25). According to Bronfenbrenner (1979), there are four types of interconnections that can occur in Mesosystem (pp.209-210):

- 'Multi-setting participation' where the individual participates in more than one setting and/or other persons participate in the same settings.
- 'Indirect linkage' where a third party is the intermediate link between persons in the two settings.
- 'Inter-setting communications' where messages are transferred from one setting to the other.
- 'Inter-setting knowledge' where information that exists in one setting about the other setting is obtained through external sources.

In this study, the Mesosystem captures the collaboration between a) practitioners, b) practitioners and parents, c) the Educational Technology Coordinator/Lead ICT and educators, d) educators and pupils, e) pupils and their peers. Moreover, 'multi-setting participation' refers to the child's participation at home and school and the influences that he/she receives from these settings.

Whereas the developing person might have direct contact with Micro- and Mesosystem, this is not the case with the rest of the layers (Arriaga, 2017). The Exosystem involves elements that acknowledge other social structures that might indirectly impact the individual. For example, in this study, the use of technology at home may influence the child's performance in using iPads at school. Likewise, the values or policies of the school might affect the iPad practices implemented in educational settings. Hence, Exosystem encompasses the school's structure (such as computing policies, E-safety committee), the technological infrastructure, the school's culture towards technology and the leadership structure (such as the roles of educators-headteachers).

Next, in the Macrosystem, there are elements that are outside of the school's environment but indirectly influence the individual. This layer may involve the social background of the student, the education system, the agenda of the school, or even the national curriculum. Arriaga (2017) defines this system as *"a cultural layer, being made up of people who have shared identity, values, and access to resources"* (p.424). Likewise, Bronfenbrenner (1979) describes Macrosystem as a set of cultural prototypes that define the activities and structure of societies. In this study, Macrosystem refers to elements such as the national curriculum, the national educational values/system and the SEND legislation that can indirectly influence the learning of autistic pupils with iPads.

Finally, in the last tier of the diagram stands the Chronosystem, which depicts the impact of time on the development of the individual. Time and life experiences can influence how the person interacts with the other systems and consequently alter its existing relationship with the environment (Akbayrak, 2019). Considering that this study is not longitudinal, this system has not been the main focus of this thesis.

Based on the points mentioned above, Figure 4.2 illustrates the author's adapted visual representation of Bronfenbrenner's Ecological Systems Theory according to the scope of this study.

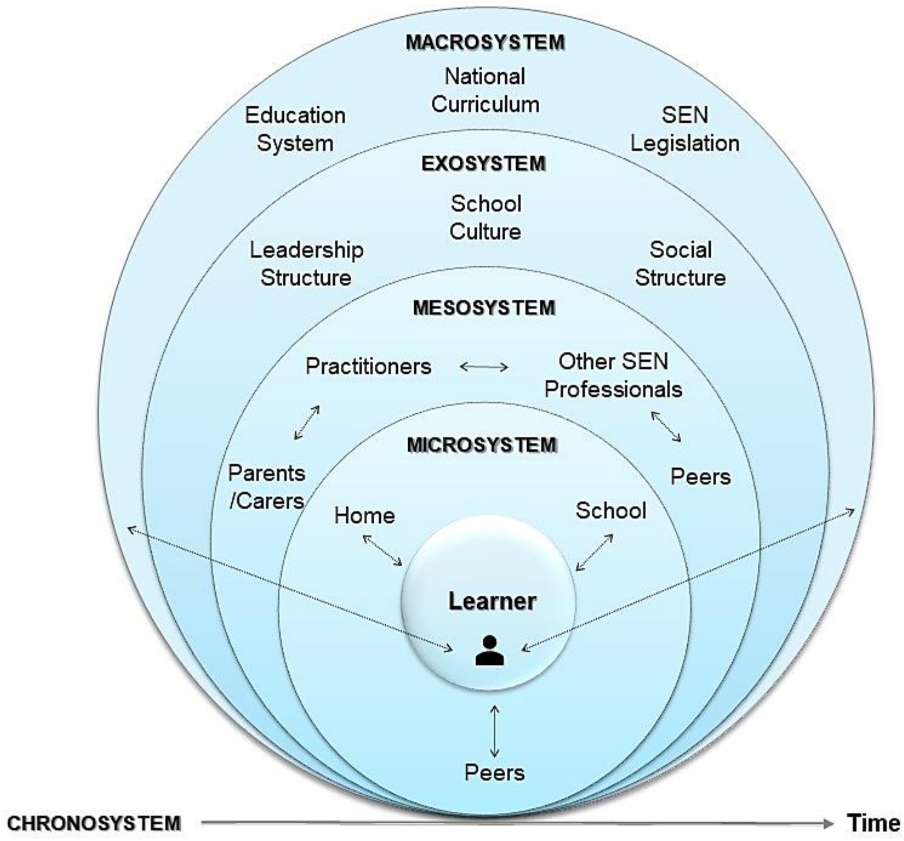

Figure 4.2: Adapted Visual Representation of Ecological Systems Theory (Bronfenbrenner, 1979)

As indicated by the literature, variations and aspects of this theory have been applied in many fields of education (e.g. vision impairment and intellectual disability studies) to examine support strategies and teaching interventions targeting access to curriculum and inclusion (Hewett, Douglas and McLinden, 2021; McLinden et al. 2020; Panopoulos and Drossinou-Korea, 2020; Gladstone et al., 2017; Hewett et al., 2017). For example, McLinden et al. (2020), used the bioecological systems theory to contextualise a dual model of 'access' *(*access to learning and learning to access*)* and examine how early intervention strategies can promote equitable curriculum access for children with vision impairments in different contexts. The researchers adopted Bronfenbrenner's theory to investigate the proximal and distal influences on facilitating access to the curriculum within educational contexts, focusing on the dimension of time and the changing nature of the learner and the environment over time.

Similarly, in another study, McLinden et al. (2016) implemented Ecological Systems theory to conceptualise and examine the challenges that specialist teachers faced in providing appropriate curriculum balance and support to young people with visual impairments. The study, which demonstrated examples from practice, used Bronfenbrenner's theoretical framework as a lens to holistically investigate the distinctive role of the specialist teacher across settings, acknowledging the complexity and multi-dimensional nature of the influences of the child's development and its environment.

This theory has also been applied by researchers in the field of intellectual and developmental disabilities. For example, Panopoulos and Drossinou-Korea (2020) conducted a study to investigate and evaluate the impact of a special teaching methodology on the language skills of a 16-year-old student with an intellectual disability. The authors used Bronfenbrenner's theoretical framework to explore elements in the micro-, meso-, exo-, macro- and chrono-systems of the student and their impact on the pedagogical tool applied to enhance the specific skills. The study provided insights about the effectiveness of the given teaching methodology and informed research about factors of the student's educational ecological system that can directly or indirectly affect the development of learners with intellectual disabilities.

Bronfenbrenner's earlier and more recent conceptualisations of child development have also guided researchers in the field of autism. For example, studies have used this theory to evaluate the quality of educational programmes (Odom, 2018) or study brain development and eye gaze patterns as early predictors for autism (Odom, 2019). However, although there are research investigations that have analysed their findings through Bronfenbrenner's Ecological Systems theory, the researcher has not identified any related work to apply this theory explicitly for iPad use for autistic pupils' SC and ER. Moreover, as indicated in the literature review (chapter 2), very few studies have explored the role of context (Tondeur, 2017) or socio-ecological elements and their influence on autistic individuals' learning with technology. Hence, considering the need to situate iPads and autism in context, this study uses Ecological Systems theory (1979) to provide a deep exploration of the broader environmental elements and their impact on the individual's learning with tablets.

4.3.3.3 How the two conceptual frameworks complement each other

As previously mentioned, this study has embraced Bronfenbrenner's (1979) and Abbott's (2007) concepts to contextualise iPad use in the classroom for the development of the SC and ER of autistic pupils. More specifically, Abbott's concept of 'E-inclusion' (2007) has been used to explore what the interaction between digital technologies, contexts and individuals looks like in relation to iPads and autism in the classroom. It has also provided insights into the role of iPads in the 'E-inclusion' of pupils with autism. On the contrary, Bronfenbrenner's theory (1979) has been used to illuminate the different levels at which iPads, key stakeholders and contexts interact, providing an overview of the hierarchy of the interplay between these three elements. These two theories, which both focus on context, complement each other and provide a framework for an in-depth exploration of the researched phenomenon. Finally, their implementation has encouraged consistent language and structure to analyse the data collected from the two schools.

4.4 Research Design

4.4.1 Two Cases Studies

The research design involves elements that structure research and connect aims, questions, and data collection methods (Thomas, 2017). Maxwell (2013) argues that qualitative research designs should promote efficient and successful research operations, be flexible and adapt to any stage of the process. Moreover, they should be informed by previous literature and the purposes of the study to provide a frame for conducting the research (Heck, 2006). In line with these points, the literature review (chapter 2) - online survey findings (chapter 3) and the aims of the study, the case study design was selected as the most appropriate for this project.

Simons (2009) justifies case study as *"an in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, programme or system in a 'real-life' context"* (p.21). Case studies allow the investigation of a topic from different angles without intending to generalise findings

(Thomas, 2016). This type of research design can be beneficial when the boundaries between context and case are unclear, and different viewpoints are required to get a rich picture of a topic (Yin, 2014). Starman (2013) argues that case studies provide a detailed examination of contextual factors focusing on complex phenomena and their variables which are challenging to explore with other types of research. This process can offer valuable findings of complicated causal relationships by implementing an analytical frame to investigate the interaction of many factors (Thomas, 2011a).

Based on this, a case study design frame was implemented to illuminate how technology, key stakeholders and context interacted in two schools (a Special school and a Mainstream with Autism Resource Base) and how this relationship shaped iPads practices for SC and ER. The aim was to study the 'real life' experiences of participants and practices by shifting the attention from 'what works' to 'what happens in practice'. Mesibov and Shea (2011) highlight that evidence-based clinical evaluations promoted by autism research may be challenging considering the heterogeneity of autistic individuals. Thus, this study uses case studies to drill down into detail, focusing on concepts that emerged in context.

While larger-scale, more controlled studies can provide valuable, formative findings, there is currently limited information about the iPad approaches and implementation practices used in schools. Moreover, technology is intended for use in the world. Thus, although case studies are often criticised for their credibility and validity as they are context-dependent and cannot be generalised, concrete case knowledge is often perceived as more valuable in social sciences than large-scale quantitative outcomes (Flyvbjerg 2006). In line with this, Mesibov and Shea (2011) argue that the focus should be on applied work rather than on trials that evaluate the efficacy of interventions in controlled settings. Considering these points, the work reported in this thesis might be smaller in scale but acknowledges the heterogeneity of participants and contexts. Therefore, instead of involving a larger sample to provide generalisable findings, it seeks to generate rich and in-depth information from fewer participants to inform research and produce findings that can supplement other methods (Flyvbjerg 2011).

Another criticism that case studies often receive relates to their verification and the researchers' bias in interpreting the data (Starman, 2013). Case studies are usually more prone to be judged than quantitative research due to their difficulty to be repeated under the same circumstances (Idowu, 2016). However, the verification process in a case study can be strengthened by describing the entire research and analysis process in detail (Sturman, 1997). This may involve acknowledging any bias, defining how the concepts were shaped, determining how the data were collected and interpreted (ibid.). This study covers these points in this chapter, providing a detailed analysis of the case study methodology and data analysis process.

Thomas (2016) states that the steps to conduct a case study involve, among others defining the a) subject, b) object and c) kind of case study to be implemented. The author highlights that the 'subject' can be a phenomenon of interest to the researcher and does not necessarily represent the wider population. Moreover, the 'object' of a case study refers to the theoretical and analytical side of research, while the 'kind of case study' is usually determined by the purpose of the study (Thomas, 2011a). According to the literature, the distinction between subject and object is necessary in case studies (Starman, 2013). Hence, it needs to be clearly explained to define the borders of research and provide a comprehensive analysis and interpretation of the phenomenon (ibid.).

In this study, the subject comprised a Special school with expertise in using iPads with autistic pupils and a Mainstream (Autism Resource Base) setting with little experience in embedding technology in the classroom. The selection of the cases was informed by the findings from chapters 2 and 3, which identified that context might have a central role in how technology is used in practice. Therefore, the two different educational settings were defined as the two cases of the study to explore contextual elements pertinent to iPad practices.

Regarding the 'object' of a case study, Heck (2006) highlights that case studies may adopt various conceptual lenses depending on their purpose. As previously mentioned, two concepts were implemented for this study to provide an in-depth exploration of the topic. Bronfenbrenner's Ecological Systems theory (1979) and Abbott's concept of 'E-inclusion' (2007) were used to form a structured approach to situate technology in-situ, capture the perspectives of key stakeholders about iPads for SC and ER and investigate the relationship between individuals, iPads and context.

The two case studies conducted for this study, could be characterised as 'nested or embedded' due to the attention given to the subunits of each school (Yin, 2014). Starman (2013) states that in nested studies the analysis is within the main unit of study and "*it gains its integrity – its wholeness – from the wider case*" (p.33). Similarly, Thomas (2011b), emphasises that nested elements play an important role on the *"the holism of the wider context by forging the components within a subject"* (p.517). Thus, nested studies are different from multiple case studies as although comparison may occur within one case, these comparisons form an essential part of a bigger picture. In line with this, each case study in Schools A and B was treated as a distinct single case. However, to gain a holistic understanding of each context, the sub-units of the schools were also investigated in detail (nested case studies). Inevitably the study involved some comparative components between the two schools, although this was not the focus of the thesis. In other words, the intention was not to identify the differences between the two settings but shape the variances of iPad practices and relationships formed in each context to provide a broader picture of the researched phenomenon.

Specifically, the Special school selection could be characterised as a 'key or exemplary' case due to its particularity in providing examples of good iPad practices for SC and ER in-situ. Morgan (2019) states that exemplary cases can lead to knowledge accumulation as they illustrate valuable examples. In this study, the Special school was an iPad training centre for educators and comprised experienced staff who were confident about using the devices. Therefore, it was decided to be selected to shed light on successful technology-related social relations and school processes to inform research.

Overall, that two case studies were conducted in two schools, with one of the settings (Special school) being a key/exemplary case of iPad use. The process involved in-depth exploration of the overall picture of the two schools by focusing on specific sub-units (individuals-iPads-context) and their interaction. This involved the investigation of key stakeholders' perspectives of iPads, relationships and social processes that existed within the landscape of each setting. Based on the theoretical framework of the study, the analysis was conducted in more than one level and involved using a qualitative research design (interviews and document analysis) to establish a complete account of the elements that influenced the iPad practices in each school.

The following section moves on to discuss the data-gathering methods that were implemented in the two settings.

4.4.2 Research Methods

As previously mentioned, this study implemented qualitative data collection methods to gain a deep understanding of the researched phenomenon. An interview research method was selected to explore how iPads were used in practice and investigate participants' perceptions and purposes of using the devices. Moreover, the E-safety and computing policies of the Special and Mainstream Autism Resource Base settings were analysed to enable a deeper understanding of the relevant contextual elements.

Below is presented a detailed analysis of the tools used for the two case studies, including information about how they were designed and their relevance to the literature and theoretical framework.

- **Interviews**

Interviews were prepared and conducted with a) practitioners, b) parents, and c) autistic pupils to explore their views of iPad use for SC and ER and capture how the devices were implemented. They also provided information about how the interaction between technology, context and participants looked like in the two schools. Two semi-structured interview schedules were designed for practitioners (Appendix 3) and parents (Appendix 3) based on the characteristic and experiences of the two populations. Moreover, a structured interview schedule was created for the autistic pupils (Appendix 3), including adapted questions and visual aids to ensure a clear capture and understanding of their responses (Bedoin and Scelles, 2015). All interview schedules were informed by the theoretical framework of the study and were designed in relation to the participants' roles within and between the different layers of the ecological system of the learner. An informal check with useful existing contacts was also applied in the construction of all questions to identify elements that needed further clarification.

The interview questions of the practitioners were constructed to conceptualise the role of educators a) with the learner within the immediate setting (e.g. school), and b) around the learner within other people from distal settings (e.g. with parents or other professionals). In line with the key points that emerged from the literature (chapter 2) about the need to include the perspectives of key stakeholders in research, the semi-structured interview schedule was designed consisting of the following five topics 1) Introduction, 2) iPad use in practice for SC and ER - purposes, 3) Practitioners' perceptions of iPads, 4) Interdisciplinary collaboration and 5) Closure. Table 4-1 presents the semi-structured interview schedule of the practitioners, including the content of questions related to each topic.

Table 4-1: Design of practitioners' semi-structured interview schedule

Practitioners' Interview Topics	Questions' Content
1) Introduction	***Background Information (Microsystem)*** o Previous experience o Professional role o Number of students that supports daily
2) iPad use for SC and ER-Purposes	***Educators' interraction with the learner (Microsystem)*** o iPad use for SC and ER o Factors that influence the selection of apps o Students' target skills o Examples of iPad applications o Examples of embedding iPads into the curriculum o Frequency of iPad use
3) Practitioners' perceptions of iPads	***Personal views (Microsystem)*** o Recommendations for iPad use for SC and ER o Teachers' confidence o Children's development of SC and ER o Students' attention
4) Interdisciplinary collaboration	***Collaboration with other professionals & parents (Mesosystem)*** o Role of collaboration on iPad use in practice o Impact of collaboration on educational success
5) Closure	***Additional Comments and Recommendations***

A similar semi-structured interview schedule was prepared to gather the views of parents regarding the purposes and uses of iPads at home for children's SC and ER. The schedule followed a similar structure to the one used for the practitioners to collect information about the interaction between parents, children and iPads at home. It also provided a view of the researched phenomenon from a different angle, considering other elements from the child's immediate environment that might impact the iPad practices used at school. The topics that were covered with the interviews related to 1) Introduction, 2) iPad use and purposes, 3) Parents' perceptions of iPads, 4) Parent-teacher collaboration and 5) Closure. Table 4-2 summarises the design of the semi-structured interview schedule for the parents.

Table 4-2: Design of parents' semi-structured interview schedule

Prarents' Interview Topics	Questions' Content
1) Introduction	***Background Information (Microsystem)***
	º Family Background
	º Occupation
	º Child-Children (Age-Diagnosis)
2) iPad use-Purposes	***Parents' interraction with the learner-child (Microsystem)***
	º Experience in using iPads with the child
	º Factors that influence the selection of apps
	º Child's target skills
	º Examples of iPad applications used for SC and ER
	º Frequency of iPad use
3) Parents' perceptions of iPads	***Personal views (Microsystem)***
	º Recommendations for iPad use for SC and ER
	º Children's development of SC and ER
4) Parent-Teacher collaboration	***Collaboration with school (Mesosystem)***
	º Role of collaboration on iPad use and impact on educational success
5) Closure	***Additional Comments and Recommendations***

Following the literature which addresses the need to include the autistic voice in technology-related research (Spiel et al., 2019), the final set of interviews targeted the viewpoints of autistic pupils. The aim was to obtain information about how children used iPads at home and school and their preferences and emotions when using the devices. Carrington and Graham (2001) argue that qualitative research should be conducted with autistic people to discover their lived experiences and perspectives. In line with this, interviews were implemented to investigate the meaning that students ascribed to their experiences in using iPads. Moreover, consistent with the theoretical framework of the study, the opinions of children were collected to illustrate how learners interacted in different contexts (home and school), focusing on elements of the direct and distal systems that impacted iPad use.

Abbott's concept (2007) was also used to inform the design of the interviews and showcase the dynamics of practitioners, parents, and iPads in each system of the learner's ecology. The design of the interview schedule is presented in Table 4-3 below.

Table 4-3: Design of children's structured interview schedule and examples of questions

Childrens' Interview Topics	Questions' Content-Examples
1) Introduction	***Background Information (Microsystem)*** ◦ Name, age, school, siblings
2) iPad school use-Feelings	***(Microsystem)*** ◦ **School use** *"Do you like using iPads?Why?"* *"What is your favourite application on the iPad?"* ◦ **Preferences** *"Do you prefer using the iPad or the Computer? Why?"* *"What do you like most playing with friends or playing on the iPad?"* ◦ **Feelings** *"How do you feel when you use the iPad (at school)?*
3) iPad home use	***(Microsystem)*** ◦ **Home use** *"Do you ask your parents before you take the iPad?"* *"How do you know it is time to shut down the iPad?"* ◦ **Preferences** *"Which applications do you use at home?"* ◦ **Feelings** *"You go on the iPad when you are…* *a) Happy, b) Sad, c) Neutral d) Anxious, e) Confused?"* *"How do you feel when you use the iPad at home?* ◦ **Parents' familiarisation with iPads** *"Do you parents know how to use the iPad?"*
4) Closure	**Additional Comments and Recommendations**

According to the literature, conducting interviews with children with autism and communication difficulties may involve several methodological challenges (Bedoin and Scelles, 2015). Considering the heterogeneity of autism and the variety of developmental needs, attention needs to be placed on the characteristics of the interviewees. For this study, the interview schedule design involved getting to know the pupils before the interview. Considering that two out of four children had communication difficulties, the interviews included structured questions and explicit vocabulary (Breslin and Liu, 2015) adapted based on their needs. Follow-up questions were used to explore the contextual meaning and help participants elaborate on their answers when they were not clear. Moreover, images with multiple answers were provided to enable participants recall situations and capture their responses (Barnes and Mercer, 2010).

Overall, despite the structured form of interviews, a certain amount of flexibility was required due to the heterogeneity of children's needs. This means that the process included variation in the questions and language used, depending on the needs of every child. For example, using pictures with pupils with communication difficulties was important, as was also the presence of a teacher to ascribe meaning to gestures or unclear words. In all cases, fundamental methodological guidelines were followed, including a) the fostering of a climate of confidence, b) creating a mutual understanding of the interview content and c) be attentive to the language used and questions posed (Bedoin and Scelles, 2015).

The next section presents the second method implemented to collect data in the two schools, which involved document analysis of their computing and E-safety policies.

- **Document analysis**

Another method of collecting data for the case studies involved the document analysis of the two schools' computing and E-safety policies. According to Bryman (2016), the analysis of documents can enable researchers to understand aspects of a setting and how it is organised. Besides, the author argues that if documents are combined with other data sources, they can reveal necessary information about the environments where they are developed. Traditionally, research focuses on the evaluation or effects of proposed policies (Yanow, 2000). However, the literature highlights that an interpretive policy analysis that combines field and document research can also provide interesting findings of beliefs and feelings (Weimer and Vining, 2005).

In line with the theoretical framework of the study about the indirect impact of elements from the exo- and macrosystem on the learning of pupils, a decision was made to analyse the relevant policies to collect more information about the structure of the two settings, their technology culture and related regulatory norms. Moreover, following the literature review (chapter 2), this process provided a deeper understanding of the two schools' contexts and their impact on iPad practices. The purpose was to find common features of technology practices in the two schools and identify similarities or differences in how they supported technology use in learning.

The documents were collected via the websites of the schools and were systematically analysed using thematic analysis. The focus was on identifying the values and philosophy of the settings relating to teaching and learning with iPads. Moreover, the analysis explored the framework of each school within which practitioners operated. Considering that school policies connect school leadership, practitioners, parents and education standards, the data provided insights into how iPads, key stakeholders and contextual elements interacted in each setting.

The next section discusses the methodology that was used in the two case studies, providing information about the ethics, data collection and analysis processes.

4.5 Methodology

4.5.1 Ethics

This study received full ethical approval from the Ethics Committee of the University of Birmingham for the interviews of the practitioners, parents (ERN_16-0551A), and autistic pupils (ERN_16-0551B). Permission for the case studies was also granted from the two target schools after discussing with the headteachers confidentiality issues and participation time and tasks. All the information about the interviews of the practitioners, parents and autistic pupils and the relevant consent/assent forms are provided in Appendix 2.

The project advocated an approach to consent that included equal opportunities of choice for all participants. Specifically, children were offered the option to consent for their participation. According to Article 12 of the Unites Nations Convention (UN, 2009), every child has the right *"to freely express her or his views, in all matters affecting her or him, and the subsequent right for those views to be given due weight, according to the child's age and maturity"* (p.5). Following this statement, autistic children were asked to assent their participation through verbal conversation (and paper forms). The process involved a 'consent discussion' with the pupils about their roles, rights and the study's key ideas (Hughes and Helling, 1991). Besides, parents were also asked to provide written consent about their children due to the concern that young pupils (especially autistic) may not always be able to make fully informed choices.

Regarding the participation of practitioners and parents, they were initially informed about the aims of the study, confidentiality/anonymity issues and possible implications through the information sheet. They were also verbally reminded about the interview process on the data collection day. Both practitioners and parents provided written consent to be involved in the study acknowledging their right to withdraw at any time of the data collection.

4.5.2 Data Collection: School A

4.5.2.1 General Information for School A

School A was a primary state Special school for cognition and learning located in the West Midlands. In the data collection year, the school had achieved an ‘Outstanding’ rating from the Office for Standards in Education (OFSTED) and implemented a curriculum that supported TEL. The school provided iPad training to children and other professionals, as it specialised in technology use in-situ and was also actively involved in technology-related research projects.

The determinants for selecting School A were related to the online survey findings, which identified similarities and variations in the way iPads are implemented in different educational contexts. Having previously collected a snapshot of practices used in Special schools (chapter 3: Online survey), this case study intended to provide an in-depth exploration of the researched phenomenon. Following the aims and theoretical framework of the study, selecting a technology-oriented school would also provide insights into how iPads, individuals and context interacted in this type of setting. Therefore, School A was purposively included in the study as it provided an exemplary case of a school that specialised in embedding iPads in learning.

Access to the field was negotiated with the Educational Technology Coordinator (ETC) of the school, who became both the gatekeeper and key informant for the study duration. The following section presents a full report on the selection process of the participants from School A.

4.5.2.2 Participants

- **Practitioners**

The selection process for the participants was purposive and followed a non-probability strategy (Robson, 2011). The intention was to attract a divergent sample that would meet the following characteristics a) have teaching experience with autistic pupils, b) embed iPads in learning and c) be experienced in using technology. Considering the literature review (chapter 2) that there is little research on iPad practices in-situ, the purposive sample aimed to identify practitioners from different backgrounds and classes who would share good examples of iPad use for SC and ER. Based on the theoretical framework of the study, the intention was to identify different elements within and around the learner's environment that may influence iPad implementation.

Thus, practitioners with different professional backgrounds (teachers, assistant SENCO, speech and language therapist, ETC, quality standards and performance officer etc.), working with different age groups of learners were selected. The aim was to offer multiple viewpoints, enrich the perspective of the study, and provide a well-rounded view of the specific context with practical examples. Table 4-4 presents the ten educators who were purposively selected after discussion with the ETC of the school. The interviews were conducted in the school setting and lasted on average, 30-35 minutes.

Table 4-4: Demographic Characteristics of Practitioners in School A

Practitioners' Demographic Characteristics: School A		
Pseudonym	**Role**	**Age Group of Students**
TA1	Teacher	Years 5 and 6
TA2	Teacher	Reception and Year 1
TA3	Teacher	Years 5 and 6
TA4	Teacher	Year 5
TA5	Newly Qualified Teacher	Year 1 and Year 2
TA6	Teacher & Assistant SENCO	Year 2
TA7	Teacher & Quality Standards and Performance Officer	Year 5
TA8	Teacher & Educational Technology Coordinator	Year 5
TA9	Teaching Assistant	Year 1
TA10	Speech and Language Therapist	Years 1-6

- **Parents**

According to the literature, parents should not be excluded from research as they also interact with technology (Fletcher-Watson et al., 2019a). However, their representation in studies is limited (Athbah, 2015), although they are part of the learner's direct environments (micro- and mesosystem) and can influence learning (Bronfenbrenner, 1979). Based on these points, it was decided that the viewpoints and experiences of parents with iPads should also be included in this research.

Thus, a letter with an invitation and information about the study was sent to 10 parents of autistic pupils from School A (Appendix 2f). After two weeks, another reminder was emailed to them, returning three positive responses. Considering the time constraints, the workload of the school and the difficulty of reaching parents, no further contact was attempted. Although the sample of the parents comprised of three participants, their participation in the study was valuable as it provided feedback about this under-explored population. In line with this, Thomas (2016) refers to small samples mentioning that "*there are ways of sacrificing size by doing* *clever things such as* ‘stratifying*’, which means making sure that you get the important parts of population*” (p.6). The three participants included in the study provided rich data about the way iPads were contextualised at home, the relationship between home and school and parents’ perspectives regarding the devices’ use for autistic pupils’ SC and ER. Table 4-5 summarises the demographic characteristics of parents from School A who were included in the study.

Table 4-5: Demographic Characteristics of Parents from School A

Parents' Demographic Characteristics: School A		
Pseudonym	**Relationship to the Child**	**Family Members**
PA1	Adoptive Parent	2 Parents & 3 Children
PA2	Parent	2 Parents & 2 Children
PA3	Carers (2)	2 Carers & 1 Child

- **Autistic children**

Technology-related research often consists of studies that explore the functionality of iPads as tools (NAACE, 2014), excluding the voices of autistic individuals (Spiel et al., 2019). While the field is maturing into a different way of working, including participatory approaches, the literature review (chapter 2) highlights that there is currently limited information about autistic pupils’ perspectives and experiences of iPads. Following the aims and theoretical framework of the study, which place the learner in the centre of the relationship between technology and context, it was decided that autistic pupils should also be interviewed.

After discussion with the practitioners of School A, ten autistic pupils were purposively selected to be included in the study based on specific criteria. The pupils should a) be familiarised with iPads, b) use iPads at home, c) be able to communicate. Letter invitations were sent to the parents of the pupils, including information about the purpose and procedures of the study (Appendix 2g). After two weeks, a reminder was sent to the parents, including the consent form and the contact details of the researcher for further information. Overall, four parents provided consent for their children's participation. After a thorough discussion with the practitioners about the diagnosis and needs of the children, the researcher organised a meeting with the pupils, where their roles, rights, interview processes and the key ideas of the study were presented. Three children provided written assent to participate and one verbal confirmation. The interviews were conducted with the presence of a teacher in allocated quiet spaces in the school setting and lasted approximately 10-15 minutes. Table 4-6 presents a summary of the demographic characteristics of the children.

Table 4-6: Demographic Characteristics of Children from School A

Children's Demographic Characteristics: School A				
Pseudonym	**Gender**	**Age**	**School Year**	**Diagnosis/Additional Needs**
C1	Boy	9 years old	Years 3&4	Autism, Social Interaction difficulties
C2	Boy	6 years old	Reception & Year 1	Autism, Severe Communication & Language difficulties,Social Interaction difficulties
C3	Girl	7 years old	Years 1&2	Autism, Communication & Social Interaction difficulties
C4	Girl	8 years old	Years 3&4	Under process of autism diagnosis, Social Interaction difficulties, Challenging Behaviour, Foetal Alcohol Syndrome

The next section provides information about the context of School B, the characteristics of the participants and their selection process.

4.5.3 Data Collection: School B

4.5.3.1 General Information for School B

School B was an Academy primary community school also located in the West Midlands, which had four Resource Bases for children diagnosed with autism and Developmental Language Disorder (DLD). At the time of the data collection, the school was rated 'Good' by OFSTED and required improvement in attainment and task development. It was equipped with iPads and computers, but not all students had access to them. Also, no technology-related training was provided to teachers, and iPads were not frequently embedded in learning.

The school was purposively selected as it would be useful to study thoroughly different contexts (Special and Mainstream Autism Resource Base settings) and identify similarities or variances in the way iPads were contextualised. This decision was also informed by the online survey findings (chapter 3), which elicited information about iPad use in Mainstream (Autism Resource Base) and Special schools.

The identification of the school involved a thorough search on the Internet for Mainstream Autism Resource Base settings in the West Midlands. After discussing with the supervisors, School B was suggested as a potential choice for the study due to its previous involvement in technology-related research projects. The school was approached via email, and several meetings were organised with the headteacher to discuss the aims and processes of the study. Finally, access to the setting was granted after the researcher agreed with the headteacher's request to conduct a workshop for the staff (study-participants) on iPad applications targeting SC and ER.

Below a report of the selection process and characteristics of the participants is presented.

4.5.3.2 Participants

- **Practitioners**

Participants in School B were purposively selected as they needed to meet the following criteria a) be familiarised with iPads and b) embed technology in their teaching with autistic pupils. Like the steps followed in School A, the aim was to involve a representative population of the setting to provide in-depth outcomes of how School B integrated iPads in autistic pupil learning. Therefore, stakeholders from various professional backgrounds who taught students of different age groups were approached and introduced to the study. As seen in Table 4-7, from the five teachers and four teaching assistants working in the Resource Base at the time of the data collection, three teachers, one teaching assistant and the Lead Information and Communications Technology (ICT) technician of the school agreed to participate. However, since *"the population of interest was small, they were 'seen as expert informants"* (Gorard, 2013, p.84).

Table 4-7: Demographic Characteristics of Practitioners in School B

Practitioners' Demographic Characteristics: School B		
Pseudonym	**Role**	**Age Group of Students**
TB1	Teacher	Reception and Year 1
TB2	Teacher	Year 4
TB3	Teacher	Years 4-5-6 (Key Stage 2)
TB4	Lead ICT Technician	Years 1-6
TB5	Teaching Assistant	Year 4

The interviews took place in the school setting during working hours and lasted approximately 30 minutes each.

- **Parents**

A similar process to School A was implemented to recruit parents in School B. Following a discussion with the Autism Resource Base practitioners about the inclusion criteria of parents, ten people were purposively selected to be contacted. The selected parents needed to have iPads at home and use them with their autistic children. An invitation was sent via the school to approach the participants, including the information sheet of the study. After a reminder and three weeks of waiting four parents agreed to take part in the study.

The participants were contacted via email to arrange meeting dates and place, with three out of four interviews being conducted in the homes of the participants. Each interview lasted approximately 30 minutes, while all respondents agreed to be audio recorded. Table 4-8 presents the demographic characteristics of parents.

Table 4-8: Demographic Characteristics of parents from School B

Parents' Demographic Characteristics: School B		
Pseudonym	**Relationship to the Child**	**Family Members**
PB1	Parent	2 Parents & 3 Children
PB2	Parent	2 Parents & 2 Children
PB3	Parent	2 Parents & 6 Children
PB4	Parent	2 Carers & 1 Child

- **Autistic children**

In line with the methodology implemented in School A, the literature review findings (chapter 2) and the aims of the study, it was decided that the experiences and views of autistic pupils towards iPads should also be included in the study of School B.

Thus, following a discussion with the practitioners about the inclusion criteria of the population, five possible participants were identified. All pupils a) were familiarised with iPads, b) used iPads at home, c) were able to communicate.

To approach their parents for consent, letters were prepared, including information about the study and the participation of the children (Appendix 2g). However, despite several reminders sent by the researcher, no answer was secured. Considering the time constraints and the workload of the school, no further attempt for communication was made. Therefore, no autistic pupils from School B were included in the study.

Despite the different number of participants included from each group/setting and considering that this study is not comparative, the smaller casework provided valuable information about the researched phenomenon. In line with this, Alcorn (2016) states that *"smaller case study-like work provides the best information about how research technologies are working in context (or not), and their interactions with specific individuals"* (p.50). Hence, the focus of this study was to investigate an under-explored subject by situating iPads and autism in context and provide valuable insights into the literature without generalising.

4.5.4 Data Analysis

In this study, data analysis included analysing the data from the interviews and computing/E-safety policies of the two schools (Special and Mainstream Autism Resource Base settings). Although the dataset in each school was separately approached, the analysis process implemented was the same.

All data were analysed using thematic analysis, which is an approach that enables the identification of meanings and concepts from the data with the use of 'emerging' patterns and themes (Braun, Clarke and Terry, 2014). This method provides researchers with the flexibility to analyse data simply and tangibly (Javadi and Zarea, 2016). However, attention is required on the practical aspects of the process to yield meaningful findings. Nowell et al. (2017) mention that in thematic analysis, the data themes, concepts and categories are not predefined, and the interpretation needs to be aligned with the circumstances and context of the study. Moreover, this method is not bounded by theoretical commitments and can be applied across various theories and paradigms (Clarke and Braun, 2017).

As previously reported, this study was shaped according to the research questions, which were based on the issues that emerged from the literature review (chapter 2) and online survey findings (chapter 3). Moreover, it was conceptualised in line with Bronfenbrenner's Ecological Systems theory (1979) and Abbott's concept of 'E-inclusion' (2007), which focus on the interaction between individuals and context. Considering the different levels of analysis required for this study, it was decided that thematic analysis would be appropriate for this purpose. Therefore, this method was applied to holistically analyse the two contexts, capture perspectives about iPad practices, and identify elements from the child's direct or distal environment (micro, meso-, exo- and macrosystem) that impact iPad implementation.

King (2004) states that thematic analysis is useful for summarising key points of a large dataset and allows implementing a well-structured method to handling data. To facilitate rigorous and systematic data management in each setting, Abbott's concept (2007) of 'E-inclusion' was applied to organise the data in three broad categories a) iPads (practices), b) individuals (practitioners-parents-autistic pupils) and c) context. This categorisation provided the lenses to explore how the interaction between these three elements looked like in relation to autism and iPads in-situ. It also contributed to approaching the data in a structured way.

Following Braun and Clarke's (2006) thematic analysis phases to meet the needs of the study, the process included five stages 1) Data familiarisation, 2) Initial code generation, 3) Theme searching, 4) Theme reviewing, 5) Theme synthesis & summary, 6) Report production.

Table 4-9 summarises the data management stages of the thematic analysis as they were adapted based on the needs of the study.

Table 4-9: Qualitative Data Analysis Stages

Data Analysis Stages	Explanation of the process
1) Data Familiarisation	○ Export interview transcribed documents into NVivo software
2) Initial Code Generation	○ Identification of initial concepts/codes based on Research Questions ○ Creation of initial conceptual index
3) Theme Searching (Theory-driven analysis)	○ Sorting initial codes into themes based on Theoretical Concepts/Framework ○ Refining of initial conceptual index from stage 2
4) Theme Reviewing (Data-informed analysis)	○ Reviewing of raw data ○ Capturing of missed or new themes
5) Theme Synthesis & Summary	○ Identification of similarities and differences in themes elicited from stages 3 & 4 ○ Synthesis and categorisation of themes from stages 3 & 4 ○ Sorting of final themes according to content into three broad categories: a) iPad, b) Context c) Individuals
6) Report Production	○ Production of frindings and writing-up

Overall, the analysis involved a circular process in which the dataset a) was first analysed based on the project's research questions and goals (as emerged from the literature), b) was revisited considering the theoretical concepts and c) was analysed again to allow for exploration of ideas contained in raw data. More specifically:

- ***Stage 1: Data familiarisation***

The first step of thematic analysis included familiarisation with the content of the dataset (Ritchie, Spencer and O'Connor, 2003). Robson (2011) states that data transcription can allow researchers to understand the dataset and get an overview of the findings. In this study, the audio recordings of interviews from both schools were transcribed into Word documents and organised into three groups a) practitioners, b) parents and c) children.

Since the study included different groups of participants and different settings, all data were uploaded on NVivo 11 software. The aim was to organise and manage all transcriptions into datasets according to school context and participant groups, maintaining a sense of their holism (Cohen, Manion and Morrison, 2007). NVivo software provided tools for recording and linking data in various ways, allowing the separate analysis of each dataset and their combination at a later stage.

- ***Stage 2: Initial code generation***

Following the organisation of transcriptions on NVivo software, initial codes were produced based on interesting points of the data. According to Miles and Huberman (1994), codes are *''tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study''* (p. 56). In this study, the codes were assigned to specific chunks of data and were informed by the research questions and goals of the study. After the initial analysis, the codes were organised into a conceptual index developed in relation to the identified 'themes'. An example of the initial code generation and conceptual index is presented in Table 4-10 below:

Table 4-10: Example of qualitative initial code generation and conceptual index

Initial Code Generation		Conceptual Index
Interview Extract	**Codes**	**Initial Themes**
"We work really collaboratively between us (teachers) and we have TA8 who gives us training. But do not collaborate with any other professionals.TA8 shows us new apps that are coming out and different ways of using the iPads in the classroom. Collaboration is important. With parents we have home-school books who we write in them, we have parents evenings, they get stickers and they take them home when they are good. So it definitely helps that collaboration. We also have constant contact with the parents because of the needs of the children as well."	∘ Collaboration between teachers ∘ Lack of collaboration with associated stakeholders ∘ Collaboration with the parents ∘ Role of TA8 ∘ Training provided ∘ Professional's perspective ∘ Focus on Children's Individual Needs	∘ Collaboration ∘ Training ∘ Perspectives ∘ Practice

- ***Stage 3: Theme searching (Theory-driven analysis)***

This stage involved the creation of a conceptual framework based on Bronfenbrenner's Ecological Systems theory (1979) and Abbott's concept of 'E-inclusion' (2007). Following Bronfenbrenner's theory (1979), the initial themes from Stage 2 were revisited and allocated to the relevant systems (micro-, meso-, exo-, macrosystem). The aim was to depict their role within these environments, and their influence on how iPads were used in each context. Next, based on Abbott's concept of 'E-inclusion' and the interaction between 'technology-individual-context', the themes were categorised under three broad groups 'iPads-individual-context' to provide insights about their interplay. Table 4-11 presents an example of this stage.

Table 4-11: Example of qualitative theory-informed theme generation

Conceptual Index	**Theoretical Framework/Concepts**	
Practitioner's Initial Themes	**Bronfenbrenner's Ecological Systems Theory**	**Abbott's concept of "technology-individual-context"**
Collaboration between teachers	Mesosystem	Individuals-Context
Lack of collaboration with associated stakeholders	Mesosystem	Individuals-Context
Collaboration with parents	Mesosystem	Individuals-Context
Role of the ETC	Mesosystem (Collaboration) & Exosystem (School Culture-Structure)	Individual-Context-Technology
Training provided	Exosystem (School Culture-Structure)	Context
Professional's perspective	Microsystem	Individual
Focus on chilren's Individual Needs	Microsystem & Exosystem (School Culture)	Context

- ***Stage 4: Theme reviewing (Data-informed analysis)***

For this stage, the themes were reviewed following a data-informed process. DeCuir-Gunby, Marshall and Mcculloch (2011) state that the main concept of developing data-driven codes is to focus on the level of meaning of data. Thus, the codes were extracted from different locations of the interviews based on their content (MacQueen et al., 2008). Following Boyatzi's framework of data-driven analysis (1998), the steps to create codes involved (1) reducing raw information, (2) identify subsample themes, (3) compare themes across subsamples, (4) creating codes and (5) determining the reliability of codes.

To begin with, raw information from the transcriptions was reduced into smaller chunks, collating multiple extracts with the same level of meaning under one code. Next, the process involved identifying subsample themes from various interviews and organizing them into themes according to their content. After the reliability of the codes and themes was checked with the supervisor of the study, the final themes were created. Overall, stage four followed the same procedure implemented in stage three of the analysis, with the only difference that it focused on identifying codes-themes based on raw data. This process allowed the re-examination of the data from a different perspective to identify missed or under-explored themes.

Table 4-12 shows an example of some of the themes that emerged from the data review.

Table 4-12: Example of qualitative data-informed theme generation

Broad Category	Themes & Sub-themes	Relevant Systems
Context	*a) School's structure* ∘ E-Safety Committee ∘ Technological Resources	Exosystem
iPads & Practices	*a) Apps' selection criteria* ∘ Ease of use, cost, children's age ∘ Target skills *b) Frequency of iPad use* ∘ Use Regulation	Microsystem (based on educators' practices)
Perspectives	*a) Why iPads attract pupils* *b) Teachers' Confidence with iPads*	Microsystem

- ***Stage 5: Theme synthesis and summary***

At this stage, themes from previous analysis stages (2-4) were synthesised to eliminate any overlap. Following the theoretical framework, the final themes were named and allocated to the relevant ecological system based on their content. This process provided a structure to explore how different elements from the child's direct or distal environment impacted iPad practices implementation in context. To produce a coherent summary of the findings, the themes were grouped under the following three categories a) iPad, b) Individual, and c) Contextual Influences (Table 4-13). In line with Abbott's concept of 'E-inclusion' (2007), information was captured about how participants, iPads and context interacted in each school and relevant similarities or differences were identified. Overall, the thematic analysis provided an in-depth exploration of the researched phenomenon, yielding insights about a) the role of iPads in each setting and practices implemented, b) the perspectives of individuals regarding iPads, and c) the characteristics of each context.

Table 4-13: Example of theme Synthesis-Summary from School A

Broad Category (Abbott, 2007)	**Themes & Sub-themes -Practitioners' Interviews**	**Relevant Systems (Bronfenbrenner, 1979)**
iPad - Practices	***1) iPads as additional learning tools*** ***2) iPad regulation and frequency of use*** ***3) Target skills with iPads and examples of practices*** o *Social Communication* o Emotional Regulation ***4) Apps' selection criteria*** o Flexibility o Relevance to curriculum o Cost	**Microsystem**
Individual-Perspectives	***1) Advantages and challenges related to iPad use*** ***2) Views on why iPads attract autistic pupils*** ***3) Role of teachers' confidence and training in using iPads in the classroom***	**Microsystem**
Contextual Influences	***1) Collaboration*** o Between practitioners o Home – school communication gap	**Mesosyetm**
	2) School's Structure o The impact of E-Safety policy and committee o School's well-equipped technological resources	**Exosystem**

- ***Stage 6: Report production***

The final findings from each school are reported in the following chapters, including illustrative quotes to present their prevalence with each theme. More specifically, chapter 5 synthesises the findings elicited from the interviews and document analysis of School A and chapter 6 the findings that emerged from School B.

4.6 Conclusion

This chapter discussed the methodology used in the data collection and analysis process of this study, reporting also ethical considerations of including in research vulnerable populations. It began with a presentation of the research questions of the study, explaining how they were conceptualised based on the theory and findings from chapters 2 and 3. Next followed an analysis of the philosophical perspective of the thesis, justifying the interpretive approach adopted and reflecting on the validity of analysing qualitative data. Moreover, the chapter discussed the theoretical concepts of the study, elaborating on how Bronfenbrenner's Ecological Systems theory (1979) and Abbott's concept of 'E-inclusion' (2007) have informed the lines of enquiry and data interpretation.

Following that, the chapter presented the research design of the study which followed two case studies to collect data from two schools (Special and Mainstream Autism Resource Base schools). Next, it reported the data collection methods that involved interviews and document analysis of the schools' computing policies. The chapter concluded with the analysis of the textual data, which used thematic analysis and NVivo 11 software. It also provided information about the data collection process in each school, showing examples of the data analysis stages.

Having discussed the methodology and conceptual frameworks implemented in this study, the next two chapters, 'Chapter 5: Findings School A' and 'Chapter 6: Findings School B', will present the findings from the Special school and Mainstream Autism Resource Base setting, respectively.

Chapter 5: FINDINGS SCHOOL A

5.1 Introduction

This chapter presents and discusses the findings of School A. In line with the research aims, which were informed by the literature review (chapter 2) and findings from the online survey (chapter 3), this chapter examines:

- The cultural, structural and contextual elements of the school and their impact on iPad practices implemented for autistic pupils’ SC and ER (section 5.2).
- Practitioners’ perspectives and practices about iPads for SC and ER of autistic pupils (section 5.3).
- Parents’ views on iPads and practices implemented at home for SC and ER of autistic pupils (section 5.4).
- Autistic pupils’ iPad preferences and perspectives about iPad practices implemented at home and school (section 5.5).

The chapter provides useful insights into elements that influence the way iPads are implemented in-situ for the SC and ER of autistic pupils by collecting the views of key stakeholders and drilling down on practice details. It begins with an overview of School A, which involves information about its size, the staff, the resources, the allocation of iPads to students, the leadership and technology’s role in teaching. Then, it presents an in-depth investigation of the context of the school and its culture towards technology based on the findings that emerged from the document analysis. Finally, the chapter continues with the findings from the interviews with the practitioners, parents and autistic pupils, which are reported within that contextual understanding.

5.2 Setting School A in Context

School A was a primary state Special school for cognition and learning which supported 152 children (boys and girls) with mixed SEND abilities (including autism) between five and 11 years of age. It comprised of 12 classrooms which involved groups of pupils based on their abilities and needs. The school was technology-oriented and followed a multi-disciplinary approach to support students. Most of the staff was experienced using iPads, while one of the class teachers was the nominated Educational Technology Coordinator (ETC). The role of the ETC involved training other professionals to use iPads and sharing updates on the latest technological trends.

The school followed a broad curriculum including English, Maths, Science, Physical Education, Personal, Social, Health and Economic education and Computing. Each class had daily access to technology, with most children of Years 2-6 having a specific iPad allocated to them by the teacher. The school was well-equipped with technology and had 136 iPads, two robots, 13 computers and other technology resources such as drones, Skoog musical instruments, green screens and smartboards to support learning.

The leadership of the school was responsible for maintaining the quality of technology enhanced learning and had developed a computing and E-safety policy based on the needs of the pupils and the school. Moreover, the setting also comprised an E-safety committee of teachers and governors responsible for the safe use of technology at school and home. They also ensured that all technology-related safeguarding arrangements were fit for purpose.

Regarding iPad integration into the curriculum, the devices were applied creatively to enhance students' learning experience. Hence, the practices implemented were adapted based on the abilities and needs of the pupils. For example, this process involved consolidating pupils' understanding of the lesson through apps or content creation, encouraging group tasks or discussions based on a specific topic or even using the devices to access extra information. Practitioners used one-to-one and group activities during lessons and combined traditional teaching methods with technology to meet students' individual needs. Moreover, iPads were also used to record pupils' progress through digital observations such as photos and videos. Overall, the implementation of iPads in School A was interactive, and the devices were used as additional learning tools.

Having provided an overview of the contextual information of School A, the following section moves on to present the findings from the document analysis of the computing and E-safety policies.

5.3 Documents Analysis: Computing and E-safety policies

This section analyses the computing and E-safety policies of School A to collect information about a) school's culture and its impact on iPad practices, b) professionals' distinct technology-related roles, and c) contextual influences on technology integration. The document analysis aims to provide an in-depth exploration of the elements of the school that may directly or indirectly influence iPad practices relating to the SC and ER of autistic pupils.

5.3.1 iPad: Practices Implemented and School's Culture (Exosystem)

The first theme, namely ‘a) iPad: Practices Implemented and School's Culture’, has been grouped under Exosystem as it collects information from the policies about the school’s culture on iPad practices. According to McLinden et al. (2017), elements related to leadership, social structures (e.g. policy) or the school’s culture, may be included in this system (for more information, please see chapter 4).

- **School’s culture: Technology integration into the curriculum and child-centred approaches**

According to the analysis, the computing policy seemed to encourage the integration of technology into the curriculum. Computing was part of teachers’ planning and assessment processes and was also used to meet the individual needs of autistic pupils. For example:

> *“**All teachers are encouraged to use computing (including iPads) where appropriate and include this in their planning**… Computing can present information in new ways, which **help students to understand, assimilate and use it more readily. Computing promotes access to otherwise inaccessible areas of the curriculum.**”* (Computing policy, School A)

The policy supported the implementation of child-centred cross-curricular practices, prompting practitioners to use iPads to assist the learning of students. The school was also open to new software, allowing educators to use tablets constructively.

> *“Teachers **are encouraged to use the iPads to assist with children’s learning**. **If***

additional apps are required, the teachers are expected to ask the computing coordinator *to purchase and apply this app to the appropriate set of the school's iPads."* (Computing policy, School A)

The policy also provided recommendations for using technology to develop the ICT, literacy, entertainment, SC, independence and online safety of the students. The document also included a 'computing curriculum', which proposed technology-based activities for each class. For example:

Use iPads to:

a) ***"Make Some Noise*** *- Suggested apps: i) make music with Skoog, ii) Singing Fingers, iii) Garageband Live Loop'*

b) ***Tell a Story*** *- Suggested apps: i) Puppet Pals, ii) Chatterkids, iii) Shadow Puppet".*

The computing policy of the school promoted training to ensure that practitioners and associated stakeholders were computer literate, aware of technology integration practices and E-safety issues. Finally, the document defined the key persons' distinct roles (such as Headteacher/Senior Leaders) in ensuring that relevant staff receive training by the computing coordinator.

*"**The Headteacher/Senior Leaders are responsible for ensuring that the E-safety coordinator and other relevant staff receive suitable training to enable them to carry out their E-safety roles and to train other colleagues**… **Training has, and will continue to be, provided, by the computing coordinator for teachers and support staff to improve their computing and iPad skills…** Staff, including supply staff, will not be expected to take charge of an internet activity without training."* (Computing policy, School A)

To sum, the documentation highlighted a positive culture around technology integration in teaching, encouraging the use of iPads as additional learning tools. Practitioners were prompted to use tablets following child-centred approaches to their cross-curricular integration. According to the policy, technology seemed to be integral to school life, placing E-safety at the core of all computing teaching. Finally, the policy emphasised the role of internal and external training and knowledge sharing as elements of paramount importance for the successful and safe inclusion of iPads into teaching.

5.3.2 Individual: ICT Distinct Support Roles (Microsystem)

The analysis also focused on the role of key persons who were responsible for implementing iPads in learning. The theme, namely 'b) Individual: ICT Distinct Support Roles', has been grouped under Microsystem as it describes practitioners' roles in facilitating learners' access to iPads and learning (for more information, please see chapter 4).

According to the findings, educators had distinct roles concerning their responsibilities with technology. The analysis showed that the school consisted of a network of practitioners who catered for the training of the staff and pupils' E-safety. This group included a network manager, an E-safety coordinator, the E-safety committee, a Child Protection and Safeguarding designated person/officer, an ICT technician and the Educational Technology Coordinator (ETC). According to the policy, the forementioned professionals were encouraged to work collaboratively to establish the appropriate use of technology at school.

- "The E-safety coordinator/Officer takes a day-to-day responsibility for E-safety issues and has a leading role in establishing and reviewing the school E-safety policies/documents."

*- "**The computing coordinator ensures that teachers have a wide variety of software and apps for iPads** (**suitable for the curricular areas and the pupils**) … Sets of iPads are also available to be used inside classrooms."* (Computing policy, School A)

Interestingly, the E-safety committee was the connecting link between the computing professionals and practitioners as it involved a wide range of teachers' representation. The findings revealed that the role of the committee was to provide E-safety consultation to school leaders, staff, pupils and parents about areas of concern.

> ***"The E-safety committee provides a consultative group that has wide representation from the school,*** *with responsibility for issues regarding E-safety and the monitoring the E-safety policy including the impact of initiatives… Members of the E-safety committee will assist the E-safety coordinator (or other relevant person, as above)* ***with consulting stakeholders – including parents/carers and the students/pupils about the E-safety provision.****"* (Computing policy, School A)

Overall, the policy analysis showed that School A adopted a structured approach to ensure appropriate and responsible technology use throughout the curriculum. The process involved the creation of a technology-related network that included representation from practitioners across the school. Professionals were allocated specific roles drawing on their skillsets, knowledge and experiences. The findings revealed that consideration was given to the role of the E-safety committee in establishing collaboration and sharing values over online safety between practitioners, parents, pupils, and school leaders.

5.3.3 Contextual Information (Mesosystem and Exosystem)

The last theme that emerged from the document analysis provides information about contextual elements that may have influenced the iPad practices in School A. The sub-themes under this category relate to i) collaboration between key stakeholders and ii) school's structure. 'Collaboration' has been allocated to Mesosystem to depict the interaction between elements of the Microsystem (e.g. practitioners, parents and the learner) and 'School's Structure' under Exosystem as it provided information about the technology-related system of the school (for more information, please see chapter 4).

- **Collaboration**

According to the school's policy all practitioners in School A received regular training and updates about practices relating to using iPads in the classroom and keeping children safe online. Key role in this process seemed to have the E-safety coordinator/officer whose role was to collaborate with educators to raise the school standards with technology. For example:

> *"**The E-safety coordinator/officer (or other nominated person) will provide advice/guidance/training to individuals as required…**Teaching staff are responsible to keep E-safety coordinator informed of the use of computing within the classroom. To provide material for class web page. **Where appropriate to follow up training provided with activities in class.**"* (Computing policy, School A)

Knowledge exchange with external agencies was also among the school's priorities. According to the analysis, the leadership team of the school favoured the professional development of computing/E-safety coordinators by organising training sessions with local authorities and the Department for Education.

> *"**The E-safety coordinator will receive regular updates through attendance at external training events** and by reviewing guidance documents released by relevant organisations…**Staff have the opportunity to access educational materials and good curriculum practice, to communicate with the advisory and support services, professional associations and colleagues**…"* (Computing policy, School A)

Also, the computing policy prompted the maintenance of the school's bonds with the community. This was implied to happen in practice by working together with the governors, visitors, volunteers, parents/carers, children and the community users concerning the appropriate technology use. The policy also favoured the role of collaboration between home and school in keeping children safe online. For example, practitioners were encouraged to disseminate online safeguarding practices with parents, including printed information with internet websites, instructions about safe internet use or workshops.

> *“The school will therefore seek to provide information and awareness to parents and carers through:* ***curriculum activities on the website, letters, newsletters, websites, parents/carers evenings/workshops, high profile events/campaigns, e.g. Safer Internet Day.”*** (Computing policy, School A)

Similarly, the collaboration between practitioners and pupils seemed to be of equal importance in keeping children safe online.

To conclude, the findings showed that the policy promoted interdisciplinary collaboration regarding iPad use in the setting. The school provided opportunities for knowledge sharing between school staff and external agencies to facilitate practitioners’ continuous professional technology-related practices. Similarly, educators were encouraged to maintain communication links with parents/carers about the online safety of children while training was also provided to pupils.

- **School’s structure: resources (Exosystem)**

School A was well-resourced with hardware and software. Some of the available hardware involved iPads, computers, assistive technology, audio-video recorders and digital cameras. The policy highlighted that all classrooms should be equipped with computing devices to support pupils’ learning.

"This (Computing) includes the use of ***computers, iPads, programmable toys and control kits*** *(e.g. Pixies, Beebots, remote control toys),* ***assistive technology*** *(e.g. overlay keyboards, touch screens, switches),* ***sensors and probes*** *such as temperature, light sensors, sound sensors,* ***electronic musical instruments*** *including Sound Beam,* ***audio and video recorders, telephone and fax, digital cameras, scanners, voice-operated equipment, the Internet****."* (Computing policy, School A)

Regarding software, the policy encouraged the implementation of both topic-specific and open-ended apps, which were regularly reviewed by teachers based on the needs of the pupils. For example:

*"****A good selection of subject-specific and open-ended use software is available*** *on the school network…****Resources' needs are identified by reviewing the current status and discussion with teachers.****"* (Computing policy, School A)

Overall, the findings from the document analysis revealed that School A was a setting that was equipped with a variety of technological devices that were regularly updated and maintained. Moreover, the selection of hardware and software seemed to be based on the needs of pupils, while the policy implied that school provided teachers with the opportunity to implement both open-ended and topic-specific apps in their teaching. It was also mentioned that a wide range of technological equipment was available for students, providing opportunities for personalised learning experiences.

5.4 Examining the Views of Practitioners on iPad Practices for SC and ER

The ten practitioners from School A involved in the semi-structured interviews were five teachers, a teaching assistant, an assistant SENCO, a Quality Standards and Performance Officer, an Educational Technology Coordinator and a Speech and

Language Therapist. All of them used iPads in their classroom and taught autistic pupils of different age groups.

5.4.1 iPad: Practices Implemented (Microsystem)

The first theme, namely 'a) iPad: Practices Implemented', has been assigned to the Microsystem because it provided information about the iPad practices for SC and ER that educators implemented in-situ and directly influenced children (for more information, please see chapter 4). The analysis of the findings revealed four sub-themes: i) iPads as additional learning tools: child-centred use, ii) iPad regulation and frequency of use, iii) target skills with iPads and examples of practices and iv) apps' selection criteria: flexibility, relevance to curriculum and cost.

- **iPads as additional learning tools: Child-centred use**

More than half (*n*=8) of School A participants mentioned that they used iPads with autistic pupils as additional learning tools. The findings revealed that educators implemented tablets across the curriculum to personalise the learning of students and provide accessibility. For example:

Participant TA7: *"iPads have been a positive experience because they are tools that children can use,* ***so they provide access to learning.*** *So, for* ***all the skills that we are teaching in the curriculum, we can use iPads to support learning****."*

Practitioners used iPads during instructional time to deliberately support children's skills within curricular areas. Five participants emphasised the importance of individuality that iPads offered to autistic students, stating that they allowed them to focus on specific target skills based on their needs.

E.g. Participant TA2: *"With the iPads,* ***you can set different settings based on the target skills that you want the child to develop.*** *For example, on the 'Hairy phonics' app, you can choose specific letters that you want the child to work on."*

The findings also revealed that teachers used apps based on pupils' interests, thus prioritising learning through involvement. This statement is highlighted by the example below:

Participant TA2*: "…***We usually do not follow strict guidelines.*** *Some apps will be free flow.* ***The children choose what they want to do*** *because they are learning through their* ***involvement."***

Overall, the findings showed that the way iPads were used was adapted based on the needs of students. Hence, the practices were personalised to engage pupils in learning using child-centred approaches. IPads were directed by practitioners but were used constructively, shifting learning from teacher-centred to child-centred.

- **iPad regulation and frequency of use**

Practitioners in School A reported that iPad management played an essential role in teaching. The data showed that when educators were asked how they regulated iPad use, they elaborated on the strategies they used to inform pupils about their remaining time on the devices and the factors that influenced their frequency of use.

More than half of the participants (*n*=8) reported that iPads were used daily, explaining that their frequency depended on children's interests and abilities.

E.g. Participant TA3: *"**The duration of the use depends on the child.** For example, I have a child who really loves watching videos. She will do her task, and then she will have 5 minutes reward time on the iPad. Other children might be using it for 10-15 minutes to complete an activity."*

Two out of the ten practitioners indicated that the frequency was also related to the age of the children. For example, one teacher (TA9) explained that for younger children, sessions were fewer and lasted for shorter periods due to their tendency to isolate themselves from their peers when using iPads.

Regarding the management of the devices, four practitioners mentioned that they used timers. At the same time, four other teachers stated that they used visuals such as ‘now and then’ cards to inform students about the remaining screen time or transition between tasks.

E.g. Participant TA7: *“We use resources in the classroom. We have a **‘now and next’, so there will be a symbol showing what they are doing ‘now’.** For example: ‘Now iPads but next Maths.’ That way, they can see that visually …They generally accept that. We often do it the other way around: You do your Maths now, and then you will get the iPad.”*

Finally, three practitioners related the iPad use to the lesson-management skills of the practitioners. In line with this, reference was made to the control settings of the iPads which allowed them to lock the devices into specific apps.

E.g. Participant TA8: *“It is about behaviour management in the classroom so to be fair it is not down to the device; it is down to the teacher…**There are tools available to regulate the iPads use. For example, it is now a lot easier to lock apps and isolate the activity that the child accesses on the iPad.”***

The findings showed that the time students spent on iPads depended on their age, abilities, and interests. Overall, School A educators were well-informed about strategies related to regulating students' screen time, focusing on structured approaches. Some of the reported strategies involved timers, ‘now and then’ cards, routines and use of the devices' lock settings. Practitioners also believed that the use regulation of iPads was related to the management skills of the teachers.

- **Target skills with iPads and examples of practices**

The findings from School A showed that practitioners used iPads to develop pupils' skills, knowledge and understanding and regulate their emotions and behaviour. Their application was noted primarily for SC and academic skills, with fewer themes relating to ER. Teachers intentionally used iPads to support curricular areas and planning, providing specific and spontaneous learning experiences. The findings related to SC and ER are reported below, including examples of teachers' practices.

    - **Social Communication (SC)**

Eight out of ten participants mentioned that they used iPads to develop the SC of autistic pupils. Educators stated focusing on communication, engagement and social understanding, which according to the literature review (chapter 2), constitute elements of the broader SC term. The analysis revealed that iPads were used as multimodal learning tools for SC. For example, participants from different disciplines (such as Science, Maths or the Speech and Language Therapist) reported embedding tablets into the curriculum in various ways. Some practical examples of SC use involved asking students to video and audio record science experiments, teaching them to communicate via e-mail or symbols, consolidating pupils' understanding of the lesson through apps, and encouraging group tasks-discussions.

> E.g. Participant TA1*: "They might take a picture,* ***and then voice record what is happening in the picture.*** *For example, if we do a science experiment, they might take a video… there is an app called 'ChatterPix' with which* ***they can record themselves talking.*** *They use that quite a lot so they can take pictures, create a 'mouth' on the picture and make the picture speak."*

Five teachers also stated that they used tablets to empower students' SC by engaging them in activities that developed sharing and social skills. For example, TA5 mentioned using the 'Osmo Coding' app to engage students in tasks that required social interaction. Similarly, TA8 referred to another app called 'Film making', which enabled children to combine target skills (e.g. SC) and iPad management micro-skills (e.g. video recording).

E.g. Participant TA8: ***"I think we can make some amazing steps with iPads for communication and social skills because we learn to do things together and in a way that is different...****Making a film is the prime example...one can be the cameraman; one can be the director… it is about creativity and careful planning…"*

All practitioners favoured the use of iPads to develop autistic pupils' SC, targeting, in most cases, the development of more than one skill such as communication, engagement and socialisation. Educators reported that the implemented practices were adjusted based on the needs of the students, highlighting the role of their organisational skills in this process. Overall, School A practitioners seemed to be informed about different apps that could be used for SC, mentioning, among others, 'Osmo Tangram, Shadow Puppet, ChatterPix, Chatterkid and PicCollage' apps. A complete list of the reported applications for SC is presented in Appendix 5.

- **Emotional Regulation (ER)**

Contrary to SC, educators did not frequently use structured activities with iPads to develop autistic students' ER. The data analysis showed inconsistency in the way tablets were used for this developmental area, with practitioners being uncertain about what the term involved. To avoid any misunderstandings, an explanatory definition of ER was introduced to the practitioners before the interview.

Interestingly, after the researcher reminded teachers what ER entails, educators gave more examples of iPads' use for ER. However, the participants referred to motivation and engagement as sub-elements of ER. For instance, three teachers explained that they used iPads as a reward to motivate students to complete their work. TA4, TA9 and TA1 expressly indicated that pupils could use iPads only after completing specific learning tasks.

E.g. Participant TA4: *"If they want the iPad and are good,* ***it is a prize for them and a reward that they like****."*

E.g. Participant TA1: *"We use iPads* ***definitely for motivating kids.*** *They can be really good because the work they might find boring on paper they love doing it on the iPad".*

Concerning regulating emotions, six practitioners stated that they used iPads to keep children calm or reduce challenging behaviour when they were distressed. For example:

Participant TA3: *"****They calm down with iPads.*** *It is a lot easier to calm because the iPad is very engaging.* ***The distress reduces when they work on tablets.*** *If they are doing an activity on the tablet most of the times, they are happy.* ***The iPads help them to be quiet, calm and focused."***

Only four teachers mentioned specific applications to teach autistic students' emotional recognition. Some of the examples involved using face pictures of animations to discuss different expressions and feelings.

E.g. Participant TA2: *"In the afternoon, we follow the wellness curriculum and some of that is about emotions.* ***We have circle time where we talk about how we are feeling, so then in the afternoon, we will have apps available for the children to use on the iPads and discuss feelings.****"*

Among the reported apps were 'ChatterPix, Book Creator and Seesaw', which teachers adjusted based on the needs of the pupils and the content of the lessons. Interestingly, participants stated that none of the mentioned apps was designed for ER but selected 'flexible' apps for this developmental area.

To sum up, the findings showed that the use of iPads for ER was not the highest priority of practitioners in School A. This may be related to educators' lack of familiarity with the term and relevant apps. Regarding ER, practitioners reported using iPads as a tool to calm pupils and regulate their emotions. Also, many participants referred to skills such as reward or motivation. Similar to SC, the implemented practices for ER were mainly free-flow and were adapted based on pupils' age, needs and teachers' perceptions of what ER involved.

- **Apps' selection criteria: Flexibility, relevance to curriculum and cost**

A criterion that practitioners considered for selecting applications appeared to be the ease of use of the software. Five out of ten educators commented that they selected easy and flexible apps to enable the generalisation of skills and implementation of learning in different subjects. For example, TA8 mentioned:

Participant TA8: *"**I choose apps that are not subject-specific because the generalisation of skills is a big issue for me.** I try to keep the process as simple as possible. This tends to have a bigger impact on children because then **they cross apply the learning to such a variety of subjects."***

Another participant (TA6) referred to the content of the apps and their relevance to the curriculum. At the same time, four other educators mentioned cost as an essential criterion. For example:

Participant TA6: *"I choose apps based on how easy it is for the children to use them independently and **how well they link to the curriculum."***
Participant TA7: *"**One of the factors is cost.** We have to ask the school if we can have them as there are 100+ children in the school, so it is a lot of money..."*

Regarding the selection process, practitioners reported acting as researchers to identify apps with the procedure involving searching online or collaborating with other colleagues.

E.g. Participant TA1: *"**I have done observations of other people's lessons,** and I have seen them using new applications. Like when I was in my Qualified Teacher year… **if I saw other teachers using an app and I liked it I would use it in my classroom."***

However, despite teachers' initiative to search for apps, one participant acknowledged the cognitive energy and time devoted to decision-making, welcoming the help from educational databases in identifying good-quality software.

E.g. Participant TA7: *"**Obviously everyone is really busy** and we want to do exciting things but not everyone knows where to find good apps. **So maybe if there was a database that would have some really good app ideas for people in education or people with special needs children…**That would be really useful."*

Overall, the findings revealed that flexibility, relevance to curriculum and cost were among the top criteria for the selection of the apps. The process involved teachers' personal online search or recommendations from colleagues. The data showed that despite the confidence of educators in selecting apps, guidance and support from external agencies guidance were welcome.

5.4.2 Individual: Practitioners' Perspectives (Microsystem)

The next theme, 'b) Individual: Practitioners' Perspectives', has been grouped under Microsystem because it analyses participants' personal views on technology (for more information, please see chapter 4). Practitioners were asked to express their views regarding iPads to understand their perspectives towards using the device for SC and ER and the role of confidence in practice. The findings revealed three sub-themes: i) advantages and challenges related to iPad use, ii) views on why iPads attracted autistic pupils, and iii) the role of teachers' confidence and training on iPad practices implemented in practice.

- **Advantages and challenges related to iPad use**

Four educators mentioned that one of the advantages of iPads was their positive impact on students' independence. The autonomous use of tablets provided pupils with the ability to have independence while learning. Practitioners reported that independence seemed to be related to the devices' ability to be personalised based on the needs and preferences of the students.

E.g. Participant TA1: *"**It gives them independence;** it gives them a bit of control over what they are doing **according to their needs** … **they can change the font...** It is just easy for them to use."*

Another teacher stated that iPads allowed students to work on tasks without guidance providing a self-sufficient way of learning and expressing themselves. Learning customisation and access to information allowed students to interact with the material rather than receive the information.

E.g. Participant TA5: *"Teachers obviously use the iPads in different ways...for recording or assessment, but in terms of children, **it has to be something that needs to be done independently during most lessons."***

Two teachers also reported that iPads permitted the cross-application of taught skills in different lessons encouraging, knowledge transfer in different situations.

E.g. Participant TA3: ***"iPads provide pupils with the ability to transfer knowledge****. For example, they can do something in one situation but also in another. So, iPads give another platform for knowledge to be implemented."*

E.g. Participant TA8: *"**They can cross apply the skills they have learned in one app with various others, which is for a child with autism to cross apply things is pretty unbelievable.**"*

Regarding the challenges related to iPad use, five participants noted isolation and obsession as some concerns affecting the successful use of iPads with pupils of younger ages. For example, the Teaching Assistant from Reception/Year 1 stated that:

Participant TA9*: "I think we use them quite well in our classroom with guidance.* ***Because if we left them alone with the iPads only, they would be stuck in their world."***

Similarly, another educator mentioned:

Participant TA7*: "**The only thing that I would say for our autistic children can become quite obsessive with the iPads,** and that can have a negative effect when you take it away from them."*

Overall, School A practitioners appeared to favour the positive impact of iPads on pupils' independence and transfer of knowledge, showing an overall positive attitude towards the devices. Despite the challenges reported by five participants, educators mentioned that it was their responsibility to organise the lesson accordingly to avoid obsession or isolation.

- **Views on why iPads attract autistic pupils**

Seven out of ten practitioners mentioned enjoyment and attractiveness as possible reasons for pupils' interest in iPads.

E.g. Participant TA9: *"**They are very colourful, very easy to use, very accessible** they are a lot of lovely apps out there that they can interact with."*

E.g. Participant TA1: *"iPads are something they are used to.* ***They have lots of colours and sounds, and you know children love playing games. iPads are more attractive and exciting than a piece of paper or a worksheet."***

The quotes above show that teachers believed that children enjoyed using iPads as they found them more entertaining than traditional teaching methods. A few teachers (*n*=4) also referred to the predictability and repetitiveness of the devices. For example, the TA10 mentioned:

Participant TA10: ***"They are predictable… I mean, certainly, the apps that I use, they are always going to be the same each week,*** *and children know what the reward of the app is going to be."*

Similarly, two other teachers highlighted that repetitiveness provided children with confidence in using the apps independently as they knew what to expect.

Participant TA6: *"They know what to do with them.* ***They like the repetitiveness of them."***

Finally, four teachers mentioned that iPads appeared to attract autistic pupils due to their ease of use. For example, one educator referred to iPads' usefulness and ease of use from students with physical disabilities.

Participant TA7: ***"I had a student that could isolate only one finger. He was terrified of the computer, but with the iPad, he could complete the tasks!*** *So, that was when we started using the iPads even with students with severe difficulties. Because they could make something that was exciting and easier for them and it was also really good quality!"*

In sum, educators referred to iPads' predictability, attractiveness, and ease of use as possible reasons for autistic pupils' interest in them. Their views also agreed with the points raised earlier about the advantages of iPads.

- **Role of teachers' confidence and training in using iPads in the classroom**

All teachers in School A agreed that confidence influenced how they implemented iPads in the classroom. For example, TA10 mentioned that confidence in using technology affected practitioners' interest in searching for new apps and practices.

E.g. Participant TA10: *"**I think that if you are used to using iPads, then you perhaps get more interested in them, and you would look and find out more applications.** For example, you would go on blogs to get more ideas about iPad activities."*

In line with this, two other educators expressed the view that confidence also impacted the productivity of the lesson as more confident teachers used iPads more creatively. For example:

Participant TA4: *"I have been on 'Apple' training, so I feel that I am quite confident with a lot of apps. **Yes, it does affect other members of staff that have not had training yet. You have to make sure that members of staff are confident; otherwise, your lesson is not as productive as it could be. It is more limited.** But confidence definitely affects practices. If you are not confident, it impacts on the lesson."*

All practitioners in School A also believed that there was a link between confidence and training. For example, educators reported that training positively impacted their confidence in using iPads, highlighting the influential role of the Educational Technology Coordinator (ETC) in sharing relevant knowledge between teachers. Moreover, they stated that training and confidence also affected iPad practices implemented in practice shifting the attention from the use of tablets as rewards to additional learning tools.

E.g. Participant TA7: *"When we first bought the iPads, 2-3 years ago, we had 12 classes. **Only three classes of the 12 were using iPads effectively. Most of the other classes were using them as a reward. But then we had lots of training every week after school to learn how to use certain apps. We had loads of training, and then everybody became more and more confident.** So now everybody is using them in teaching, but we still have ongoing training."*

Overall, the findings implied a link between confidence and effective iPad use in the classroom. According to participants' responses having knowledge and skills in teaching with tablets provided educators with confidence in adapting their practices and identifying new apps following the needs of the learner. In line with this, practitioners also recognised the role of the ETC in the process, who was responsible for providing training.

5.4.3 Contextual Influences (Mesosystem and Exosystem)

The sub-themes that emerged under the broad category 'c) Contextual Influences' related to i) collaboration and ii) school's technological resources. These sub-themes describe elements in the environment of the school that may indirectly influence the way iPads are implemented in practice. Thus, the category 'Contextual Influences' has been allocated both to Mesosystem and Exosystem based on the content of the two sub-themes. For example, the sub-theme 'Collaboration' has been placed in the Mesosystem as it describes the interactions between practitioners and practitioners-parents. Besides, 'School' structure' has been allocated to Exosystem as it refers to the support that the school provided to practitioners concerning iPad use in the setting (such as policy, E-safety committee and technological infrastructure) (for more information, please see chapter 4).

- **Collaboration (Mesosystem)**
    - **Between practitioners: The role of Educational Technology Coordinator (ETC)**

Seven out of ten practitioners highlighted the importance of collaboration for the successful use of iPads in the classroom.

E.g. Participant TA5*: "Teachers need to be confident with the iPads before using them with the children.* ***The Educational Technology Coordinator does a lot of training... He organises lots of teacher training in the afternoons straight after school.****"*

Practitioners also acknowledged the role of the ETC in facilitating training and sharing good iPad practices. The findings revealed that TA8 was specialised in iPads due to his continuous professional development from external agencies and personal search. All teachers stated that TA8 helped them become confident users of technology by keeping them updated about the latest technological advancements. He was also the connecting link between practitioners and researchers, as he encouraged the involvement of the school in state-of-the-art technology-related research projects.

E.g. Participant TA3: ***"I think showing other people how to use the iPads is very important.*** *I am not a technology wiz, but I am happy to do it. It is a big thing about* ***being able to share knowledge with other teachers."***

The quote above highlights that knowledge sharing appeared to be an essential element of the school's ethos for maintaining the technology support network within the setting. Moreover, the positive role of interdisciplinary collaboration between practitioners and external agencies (e.g. teachers from other schools, educational psychologists) on iPad practices was another reported reason for the overall school improvement and student success.

E.g. Participant TA4: *"**We have multi agencies and staff coming here to work with the children and see what children do on iPads… It is important to exchange ideas with other professionals…**It all depends on the professionals' confidence… whether we use it effectively or not."*

Overall, the findings showed that all educators acknowledged the role of collaboration between professionals in sharing good iPad practices. Participants believed that the ETC was important in providing training and developing educators' confidence in using the devices. Hence, knowledge sharing, training, and interdisciplinary collaboration influenced the way iPads were used in School A for autistic pupils' SC and ER.

- **Home – school communication gap**

All participants recognised the essential role of collaboration between home and school for children's progress.

E.g. Participant TA3: *"I think that with any student,* ***the collaboration between parents and teachers has to be good****.* ***We need to work towards the same things and particularly with children with autism.*** *They need that support.* ***They need structure, a routine to have specific steps in place that will be followed wherever they are…***

However, the findings revealed that only half of the educators (*n*=5) seemed to communicate with parents about iPad practices and apps. In cases where teachers facilitated communication, it involved parent workshops or written/verbal feedback on the preferred apps of children.

E.g. Participant TA8: *"****Yes, we run E-safety workshops. They open parents' eyes to the online risks…****we go through iPads' settings and how to restrict apps."*

Three participants mentioned that they mainly contacted parents about iPads when they identified that children made hazardous use of the devices at home. For example, educators reported that some indicators involved children's use of offensive language or discussions with their peers about inappropriate content.

E.g. Participant TA2: *"We had a boy who was using an iPad at home and had access to everything, including 'YouTube'.* ***Thus, his language was not appropriate, so we had to speak with mum and ask her to block the app. She did it, and his language was improved****."*

Three teachers believed that the lack of collaboration between home and school was related to parents' lack of understanding of the educational dimension of technology. For example:

> Participant TA8: *"**As long as the parents realise that this is not a toy and a reward, but it is a tool that we use for educational purposes. It is not a child-minding device**. **And that is a hard thing to understand** because they see it as a home device, and they cannot necessarily understand what we do in our context."*

In sum, the findings revealed a communication gap between home and school relating to iPad use. Educators reported that the different perceptions of parents regarding iPads and the time constraints did not provide opportunities for the exchange of ideas. However, a few practitioners encouraged home-school collaboration by organising workshops or contacting parents about the safe use of the devices.

- **School's structure (Exosystem)**

This theme refers to the support that the school provided to practitioners concerning iPad use in the setting. The data explored the organisational structure of the school to identify environmental and cultural factors that impacted the learning of students with iPads.

  - **The impact of E-safety policy and committee**

E-safety was a topic that was frequently raised in School A. The findings showed that it was amongst the top priorities of the school as the setting had set an E-safety committee and policy to keep pupils' safe online. A key aspect of this process appeared to be the collaboration between school and home. Educators reported that according to the policy, it was the school's responsibility to involve parents in training and inform them about the safe use of tablets. However, the findings revealed that collaboration between parents and practitioners was not always feasible.

E.g. Participant TA7: *"We have E-safety training. We do it in school as part of our PSHE curriculum, and we offer workshops to parents occasionally.* ***Our biggest problem is that not many parents attend the events. Even if they do, we do not get the ones that need to be informed about E-safety… so that is a big problem."***

Practitioners seemed to be particularly concerned about the use of iPads at home. Thus, it was reported that the school had put in place a structured two-way approach to overcome potential online harm. For example:

Participant TA7: *"If we hear children talk about an inappropriate app,* ***we speak to children and phone their parents and discuss our concerns."***

Moreover, to eliminate access to online hazards at school, educators mentioned restricting children's access to specific apps.

E.g. Participant TA9: ***"We tend not to let them go on Google, social media or anything like that. We have got an E-safety folder with guidelines that we use in this school. We know how to keep children safe while using the iPads*** *because we find that a lot of them, especially at home, do not know how to use the iPads correctly."*

Overall, School A was reported to have a structured approach to keep students safe online, following a framework specifically designed for safe iPad use. Similarly, practitioners were well-informed about the relevant processes if they identified harmful use, which involved communication with parents and children. Regarding the online safety at home, the findings revealed a communication gap between home and school, despite the encouragement from the E-safety policy and committee for collaboration and regular updates between educators and parents.

- **School’s well-equipped technological resources**

The term ‘resources’ refers to the technological equipment and applications that School A provided to pupils to enhance their learning experience and entertainment. The findings showed that the school was well-equipped with electronic devices owning 136 iPads, two robots and 13 computers. Practitioners reported that children in Years 2-6 had their personal devices, while Reception and Year 1 students shared iPads due to their young age.

E.g. Participant TA1: *“**They all have their own iPads.** They all have their name on the back of the device, so it is easy for us to keep track of, what they have done, the pictures they have taken. **All their work is on the iPad.”***
E.g. Participant TA6: *“**‘Osmo Coding’ is an app which has a little mirror that stands on the iPads. You can use physical objects to interact with the iPad,** for example, a letter if you are playing a spelling game…There is also a coding game where you have to stack the items together according to the code and that way, children can interact with the iPad. **As a school, we have also recently bought the robots ‘Dash and Dot’. Again, you use the iPad to control them.**”*

Overall, participants revealed that School A had various technological resources to meet the needs of autistic pupils and supplement their teaching experience. The findings showed that the school particularly invested in iPads and provided pupils with the opportunity to access them daily for learning and entertainment purposes.

5.5 Examining the Views of Parents on iPad Practices for SC and ER

This section presents the findings gathered through semi-structured interviews with three parents of autistic pupils from School A. The data have been organised into three broad themes to explore: a) iPad practices implemented (Microsystem), b) individual: parents' perspectives (Microsystem), and c) contextual influences (Mesosystem and Exosystem).

5.5.1 iPad: Practices Implemented (Microsystem)

The first theme, namely 'a) iPad: Practices Implemented', has been assigned into Microsystem as it provided information about the iPad practices for SC and ER that parents implemented at home and directly influenced autistic pupils (for more information, please see chapter 4). The analysis revealed three sub-themes i) child-centred use, ii) iPad regulation and frequency of use, iii) target skills, and iv) E-safety practices.

- **Child-centred use**

All parents mentioned that the use of iPads at home was child-centred, providing pupils with the opportunity to select their preferred apps. Among the most frequently mentioned applications was 'YouTube', with parents reporting that children enjoyed watching 'real-world' videos such as documentaries or clips of other people's lives.

E.g. Participant PA1: *"**She is so controlling as to what apps are on her iPad**… She likes watching clips about how the world works…She likes to watch videos of real people when they are doing activities like playing games. **Perhaps she wants to know what life is like, what growing up is like, and how people live their life. For example, how they go to school and what others might want to do when they grow up.**"*

Parents also stated that their children seemed interested in using iPads as a walkthrough for everyday experiences. Another parent indicated that her child enjoyed watching documentaries with educational content or accessing school apps.

E.g. Participant PA3: *"**She watches videos because she loves dinosaurs, insects, creepy crawlies, slugs, anything like that.** She also watches on 'YouTube' loads of other videos like fire alarms. **Especially when they do fire safety practice at schools. She also has educational games on the iPad at home that they also play at school.**"*

Overall, the findings revealed that the way iPads were used at home was guided by the needs of the children. Pupils appeared to be intrigued in accessing apps of their interest, while in some cases, iPads provided opportunities for knowledge sharing between home and school.

- **iPad regulation and frequency of use**

All parents reported that children had daily access to iPads at home, following, in most cases, a structured routine based on children's individual needs and purposes of use. For example, one parent mentioned that her child used the iPad every morning as a motivator to complete her routine.

E.g. Participant PA1: *"When she wakes up in the morning, **she has her little routine.** If she does not follow her routine (for example, brush her teeth, have breakfast), she is not allowed to go on her iPad. **If she does what she needs to do, then she has 10 minutes to go on it before she goes to school.**"*

Another parent whose child had communication difficulties stated that her son played on the iPad for a specific time during weekdays unless he used it for communication purposes.

E.g. Participant PA2: *"**After school from about 5 to 6 pm,** he will be on the iPad. **He can have it also throughout the day only if he needs to tell me something**. **At the weekends, it tends to be more often** as he gets bored watching TV, and he asks for the iPads **to watch 'YouTube' videos and play games."***

Speaking of regulation, two parents reported implementing specific strategies to control the screen time of the children. For example, one parent (PA1) used distraction as a method, while another parent (PA2) time warnings.

E.g. Participant PA1: *"We always have a battle. Sometimes it is a bit harder than others.* ***It is the distraction that works with our daughter… We need to think of things to get her away from the iPad, and it is not easy.*** *She just loves it."*

Interestingly, two out of three parents reported being concerned about regulating the iPad use of their children as the process was often challenging due to the pupils' interest in technology.

In sum, the findings showed that all parents preferred to regulate the use of iPads by following structured approaches based on children's individual needs and target skills. It was also reported that children had daily access to tablets, following a specific routine. Parents mentioned implementing specific strategies to regulate children's screen time highlighting, that in some cases, the process was challenging.

- **Target skills**
    - **Social Communication (SC)**

Parents reported using iPads at home as communication tools, with two out of three mentioning that tablets positively influenced the SC skills of their children. For example:

Participant PA2: *"**His speech has come a long way…The iPad has helped him with communication because it enables him a lot to develop his speech. There is an app where you choose pictures of what you want.** For example, if you want something, you can say 'I want' and pick the object or what you want to do from the iPad...* ***He started speaking after using the iPad. He could only say limited words, but now that he has started using the 'Flashcards' app he can speak."***

Another parent referred to 'YouTube' as the application to have a significant impact on her child's communication skills:

E.g. participant PA3: *"The iPad has helped her a lot.* ***Because applications that she plays on the iPad and videos that she watches on YouTube, help her with her talking and communication. She has improved a lot because, at one stage, she would hardly talk at all."***

PA1 also stated that her child preferred to use iPads as alternative communication tools to interact with family members and friends. The process involved using messaging apps or engaging and discussing with the family topics of interest.

E.g. participant PA1: *"I would probably say there are things on the iPad that she watches and excite her. She is very interested in them.* ***If there is a video on 'YouTube' with somebody playing 'Roadblocks', and she is very interested in that, then she will come and talk to us about it."***

The results suggested that iPads were used a lot at home for the communication of autistic children. Parents seemed to be interested in software that facilitated communication, especially for children with severe difficulties. According to the findings, participants were optimistic about the positive impact of tablets on pupils' SC skills, highlighting that children's needs and preferences influenced the selection process of the apps.

- **Emotional Regulation (ER)**

Parents also mentioned that they valued the use of iPads to support children's behaviour, such as to express feelings, calm down or behave. For example, one of the parents reported that her child used emojis and text messages to communicate her emotions with the family.

E.g. participant PA1: *"She will sometimes record something which says, 'Mummy, come here now!' and she can be furious if you do not respond immediately.* ***She also often sends one of those emoji faces to express how she feels."***

Another parent (PA2), whose child had difficulties expressing his emotional state, reported using tablets for ER. For example:

Participant PA2: ***"We use iPads, especially for emotions because if he is hurt, he cannot really tell you how he feels****. But after we see pictures or video clips on the iPad, he can tell me what is wrong."*

Interestingly, all parents also mentioned that iPads helped their children stay emotionally regulated in situations they found stressful. They also reported that iPads allowed their children to stay focused on specific tasks, coping that way with anxiety or sensory overload.

Participant PA2: *"****If he is angry or having a meltdown, iPad can calm him down****. For example, he takes the iPad, goes to the corner of a room,* ***stays focused on the apps and eventually calms down."***

Finally, one participant stated using the iPad as a motivator to reduce the child's inappropriate behaviour.

Participant PA1: ***"The iPad is a motivator for her****. We have been working a lot with her on the way she speaks to us, and sometimes she does lash out, hit and kick – so we have been working a lot on being kind…****Most of the times, she will behave because she knows that this is the only way to get the iPad."***

In sum, the findings showed that parents used iPads as assistive tools to regulate the emotions of children. Tablets were reported to help pupils reduce distress and anxiety, with one participant mentioning using the iPad to reduce challenging behaviours.

- **E-safety practices**

The next point that came up from the data analysis was related to the practices implemented at home for the E-safety of the children. Interestingly, all parents appeared to be well-informed about iPads' parental control options mentioning that they used passwords to lock apps and keep children safe online.

E.g. Participant PA2: *"**You can put parent control on the iPad, and you have to type in passwords for certain things, so he will not be able to access them.** He sometimes comes over and asks, 'Password?' and I say, 'You cannot go on that website. **So, this feature blocks the application or webpage. Most things get filtered out so he cannot go on them."***

Parents reported being particularly concerned with the online safety of the children due to their vulnerability, mentioning that they preferred to check their activity regularly. For example, PA1 stated that she frequently monitored the child's online use by checking the browsing history of the tablet.

E.g. Participant PA1: *"There are a couple of 'YouTubers' that my daughter is following, **so it is quite hard to keep track of the content that she accesses**. **But every couple of weeks** with the help of my son after she has gone to sleep**, I will have a look at what she has been watching and make sure everything is okay."***

The same parent also expressed concern about her child accessing applications or websites requiring online payments or involving harmful content.

Overall, all parents were aware of online hazards and seemed to be informed about keeping children safe. The findings revealed that all participants used passwords and parental control settings on their children's iPads. At the same time, one parent also reported checking the browsing history of the tablet as an extra precautionary measure.

5.5.2 Individual: Parents' Perspectives (Microsystem)

The next theme, 'b) Individual: Parents' Perspectives', has been grouped under Microsystem because it provides an overview of the personal views of the participants on advantages-challenges of tablet use and training (for more information, please see chapter 4).

- **Advantages-challenges of iPad use and views on training**

All parents favoured the positive impact of iPads on developing various skills of autistic pupils. For example, two parents stated that tablets provided children with opportunities to familiarise themselves with life skills, recognising the potential to implement them in real-life situations.

E.g. Participant PA1: *"**She sees what life is like, what growing up is like and how people live their life…**how they go to school and what you might want to do when you grow up…everyday skills. I think that as she grows up, these sorts of things will be so important to her. **For example, how to look after herself, how to manage money and how to go shopping or ring the Doctors because she is going to have a very different life to what we have.**"*
E.g. Participant PA2: *"**He is acting out things that he saw on the iPad**. Like he watches other kids play games and then he does his own role play."*

Reference was also made to the positive impact of iPads on enhancing the SC and academic skills of pupils. For example, one participant mentioned that she used tablets to develop her child's Maths and Literacy skills.

Participant PA3: *"**I think they can help a lot with communication**. They can also help them a lot with many other skills like **Maths or reading the alphabet letters.**"*

Interestingly, only one parent expressed concerns about iPad use, stating that one of the difficulties was her child's difficulty in distinguishing reality and 'virtual reality'. More specifically, PA1 mentioned:

> *"**If it is something that she is super interested in then she believes that everything that she watches is real**…There is no way of convincing her. **She believes 100% of what she sees, and we have to go down the route of explaining everything to her...** She totally believes everything that is on the tablet, **and she gets really scared.**"*

However, parents did not mention other challenges relating to iPad use. Finally, all three participants appeared to be open to receive iPad training.

> E.g. Participant PA1**: *"Receiving training would be great*.** ***I am not massively into technology****. I have a phone and a laptop but I only do the basics on them.* ***My child knows a lot more. It would be nice to know a bit more about how to use them and be more effective with her."***

In sum, the findings revealed that parents encouraged the use of iPads at home as they provided opportunities to develop specific skills. Parents mentioned iPads' ability to develop pupils' communication, academic and life skills. Only one parent referred to the difficulty of explaining to children that online media is not always accurate. Finally, all parents appeared to be open to receiving guidance on using the devices for the SC and ER of their children.

5.5.3 Contextual Influences (Mesosystem)

This theme analyses contextual elements that may have influenced the way iPads were implemented at home. Considering that participants elaborated on their collaboration with other parents and practitioners, the sub-theme has been allocated to Mesosystem (for more information, please see chapter 4).

- **Collaboration**

A recurrent theme in the interviews was the lack of home-school collaboration regarding iPad use. In two cases, participants mentioned that the communication was restricted to receiving a list of applications that children used at school. However, even in this case, educators did not guide parents on how to use the apps, their content or target skills. At the same time, the frequency of this exchange of information appeared to be rare. One parent mentioned that the home-school gap regarding iPad use was related to the variety of apps used at school, the different target skills in the two contexts, and teachers' limited time to keep parents updated.

E.g. Participant PA1: *"**Sometimes the school sends home a list of apps that they use at school**, things you could use with your children at home, **but you do not get much communication**. **The last time that I received a list was probably a year ago or maybe even a bit longer.**"*

Interestingly, participants seemed to favour the collaboration with other parents either face to face or via online groups. This mainly involved seeking advice about apps or sharing iPad experiences and practices. For example, one parent reported that she asked advice from her sister to select apps, while another participant mentioned joining online autism groups.

E.g. Participant PA2: ***"It is other parents that suggest apps. For example, on 'Facebook' there are pages which I join and speak to other parents. They suggest different apps based on what helped their children.*** *So, I try them, and then I give them to my child."*

Overall, the data provided insights into the collaboration gap between home and school relating to using iPads. Parents attributed the lack of knowledge sharing to the limited time of the practitioners and the distinctive use of iPads between home and school. However, participants mentioned alternative ways of exchanging ideas about iPads through networking with other parents.

5.6 Examining Autistic Pupils' Views on iPads

This section discusses the findings gathered through structured interviews with four autistic children from School A. The data have been organised into two broad themes to explore the perspectives of children on a) iPad practices implemented at home and school and b) individual: children's preferences and feelings of iPads.

5.6.1 iPad: Practices Implemented at Home and School

This theme, namely 'a) iPad: Practices implemented at Home and School', has collected information about children's perspectives on iPad practices implemented at home and school. The analysis of the findings revealed two sub-themes: i) home and ii) school which are presented below.

- **Home**
  - **Child-centred use: iPads as communication / entertainment tools**

The findings from the interviews showed that iPad use at home was child-centred as pupils selected the applications based on their interests and needs. More specifically, two children mentioned that they preferred using tablets to communicate with their friends and family via online platforms or texting apps.

E.g. Participant C2*: "**You can use 'Facetime' to speak to people**. Like your family and friends, **and you can also use it to send messages**."*

C4 expressed the view that she used the tablet to play online games, which also allowed her to communicate with her peers.

C4: *"I like playing games on the iPad. I like playing for fun, and* ***I play games that you can play with friends.***

I: *Do you communicate with your friends through the game?*

C4: ***Yes.***

I: *How do you do that?*

C4: ***Normally, I just type my messages online, and I send them over to them****."*

Although most of the children could not justify why they preferred iPads over face-to-face interaction, there was one child who mentioned that she found the process easier.

E.g. Participant C4*: "****I prefer texting mummy; it is easier.*** *At first, I did not know about it, but now I know."*

The participants stated that iPads were entertaining, and they used them both for recreational purposes and to learn new things.

C1: *"****I watch on 'YouTube' videos with people and I learn about things.***

I: *Do you mean that you like learning things with the iPad?*

C1: ***Yes, it is fun!... I use the iPad to watch videos."***

Another child also referred to the use of the iPad as a calming tool. The participant mentioned that when he felt stressed or upset, he watched videos to alleviate these feelings.

E.g. Participant C2: *"****I can look at videos for calming down when I feel stressed****… Like* ***focus and patience****."*

Overall, the findings revealed that children used the tablets at home in a more relaxed, free-flow way. The applications were selected based on children's interests and needs, and they mainly used them for communication, entertainment, or relaxation. Among the most frequently mentioned apps were ‘Minecraft’, ‘Book Creator’, and ‘YakiT Kids’ that pupils could also access at school.

- **Practices for iPad regulation**

All children had daily access to iPads at home. Two pupils reported using tablets without asking for permission, and two others after gaining consent from their parents. However, all children followed very structured routines with the iPad, which involved spending specific time on the device. Tablets were also used as transition tools between tasks.

E.g. Participant C4: *“**In the morning I go on the iPad until my bus comes** and again **after school, I normally play with the iPad.** After that, I go outside to play, **and I can have it again when I come back in**.”*

The findings revealed that parents regulated screen time by giving children reminders. For example, in one case, the iPad was put away before bedtime, and in another case, when charging.

E.g. Participant C1: “***When my mum tells me to charge it,** for example when I go places, like my nanny’s or my cousin’s, **it is then that I know that I can just do something else. Like play on the trampoline or read one of my books.”***

In sum, the analysis showed that autistic children had daily access to iPads at home, with half of them asking permission from their parents to get the devices. Regarding regulation, children followed a specific routine with parents controlling screen time via reminders.

- **School**
    - **Practitioners' regulation of iPads**

Children reported that practitioners were the ones who were responsible for iPad use at school. All students mentioned that teachers controlled the frequency and duration of screen time using specific strategies such as timers or reminders.

*"**I:** How do you know that it is time to put the iPad away? Is your teacher telling you, or do you have a timer?*

C3: The teachers tell us.

***I:** Is she giving you a reminder?*

C3: Yes"

Children also mentioned that only practitioners selected the type of software they could access at school, as pupils were not allowed to download content without supervision. Thus, tablets were locked to specific applications and were used as additional learning tools.

E.g. Participant C1: *"**I would only use them if my teacher says so. So, I always have to do the things that I need to do…if I use the iPad at school, I can only watch 'YouTube', but if I play with the iPad at home, I can play games because I have more games than other persons on the iPad**…. I do, and I can play games, but the only thing is that **I cannot use the App Store because the teachers do not have it on the iPad…they don't want us to download games."***

Interestingly, despite the structured use of the iPads in School A, the findings showed that there was space for collaboration and exchange of ideas between children and practitioners. The quote below presents an example where learning was transferred from pupils to teachers.

E.g. Participant C4: *"With 'Book Creator' and 'Yakit Kids' apps, **teachers taught us how to use them.** When I learnt how to use 'Book Creator', **I also helped one of my teachers***

because she did not know how to use it. I helped her to use 'Book Creator', and then she learned how to use it."

Overall, the results suggested that iPads in School A were used in a structured way, with teachers controlling screen time and the content of the apps. One of the priorities of practitioners was keeping children safe online during learning. Finally, the involvement of both teachers and children in iPad practices was significant, as School A encouraged knowledge sharing.

5.6.2 Individual: Children's Preferences and Feelings of iPads

The second theme, 'b) Individual: Children's Preferences and Feelings of iPads' has provided information about children's views of iPads. The analysis of the findings revealed one sub-theme, namely 'Preferences' which was divided into i) peer collaboration and ii) reasons why autistic pupils like iPads and feelings when using the devices.

- **Preferences**
    - **Peer collaboration**

The findings showed that pupils preferred using iPads on their own rather than sharing them with their peers. Only one child mentioned that he collaborated with peers to show them how to use the devices when needed.

E.g. Participant C1: *"**Yes, I help my friends**. If they do not know how to use the iPad, **I show them what they can do with it.**"*

Similarly, another participant reported that she worked together with her peers on iPads only when her teacher asked her.

E.g. Participant C4: *"**Sometimes we have to collaborate to complete a task at school**... But I like playing games, I like playing for fun, and I prefer games that you can play with friends."*

The findings revealed that when children were asked to choose between a) playing on iPads and b) playing with friends, they seemed to prefer face-to-face games. This was also reported by children with communication difficulties who mentioned that they enjoyed spending time with their friends.

In sum, children stated that they favoured working on their own on iPad activities. However, they were positive in helping their peers when needed or sharing tablets to complete learning tasks if prompted. Finally, that all children seemed to prioritise face-to-face play over computer-based games.

- **Reasons why autistic pupils like iPads and feelings when using the devices**

Pupils seemed to like iPads due to the variety of apps that the devices offered. In addition, children found tablets entertaining, and they mainly used them at home for recreational purposes.

"I: *Do you like using iPads?*

C2*:* *Pointing to the picture with the answer* ***"Yes".***

I: *Why do you like using them?*

C2: ***They are fun."***

Similarly, another child mentioned:

Participant C1*: "**I have more fun on the iPad** and **more things to do,** such as games."*

Participants were also asked to report on their feelings when they used the devices. Interestingly, all four children mentioned that they felt happy when accessing iPads as they used them based on their interests and needs.

E.g. Participant C1*: "**I am happy when I use iPads** because I like playing with my friends and family, and I like watching videos."*

Contrary to that, some children reported feeling sad or anxious when tablets were taken away from them. For example:

Participant C4: ***"I feel sad when I have to stop using the iPad as I really like it,*** *and I do not want to put it away."*

I: How do you feel when it is time to stop using the iPad?
C3: **Pointing to the *'anxious face'* photo on the questionnaire**.

In sum, all children were attracted by iPads as they found them entertaining. Pupils reported that tablets allowed them to access various apps based on their interests and needs. When participants were asked how they felt when they used iPads, they referred to happiness. At the same time, half of them mentioned feeling sad or anxious when tablets were taken away from them.

5.7 Conclusion

This chapter presented and discussed the findings from School A. The data were collected through interviews with ten practitioners, three parents, four autistic pupils and analysis of the school's E-safety and computing policies. The findings provided answers to three of the main research questions, as summarised below:

1) ***What are the iPad practices that educators and parents implement for the SC and ER of autistic pupils?***

- ***Educators' iPad practices (Microsystem)***

The practices of educators seemed to impact the learning of autistic pupils in School A, as they shaped the use of iPads during the teaching process. The findings revealed that practitioners used tablets across the curriculum in various ways, following child-centred pedagogies and using tablets as multi-modal learning tools to target more than one skill. SC and academic skills were among their highest priorities, while fewer participants referred to the use of structured activities for ER. Communication, engagement, social skills were some of the teachers' target skills, while emotional recognition and behaviour management were less frequently mentioned. Overall, participants reported being ambiguous on what the term ER involves showing inconsistency in the practices implemented for this developmental area. The findings also revealed that the selection criteria of apps were related to software's flexibility, relevance to the curriculum and cost. Finally, participants stated that they searched online or collaborated with colleagues to identify effective apps.

- ***Parents' iPad practices (Microsystem)***

Parents also followed child-centred approaches for the iPad practices implemented at home. All participants reported using iPads based on the interests of children which in most cases involved recreational uses and ER. Among the preferred activities of pupils were viewing videos on 'YouTube' and playing games. Parents mentioned that they were supportive of the skills and knowledge that pupils gained by iPads highlighting their positive impact on SC and ER. Children had daily access to tablets at home, with parents regulating their use following specific routines.

Participants reported prioritising the use of tablets for supporting children's behaviour, emotions, facilitating communication and making the transition between tasks easier. Parents also articulated that iPads' use for SC and ER positively influenced their family balance and children's target skills. Finally, all participants appeared to be well-informed about online hazards conducting frequent checks and implementing parental control settings.

2) ***What are educators', parents' and autistic pupils' perspectives on iPad use for SC and ER?***

- ***Educators (Microsystem)***

Participants in School A reported being optimistic about the positive impact of iPads on autistic pupils' SC and ER. Educators mainly referred to the potential of iPads to facilitate independence and transferability of skills in different subjects and contexts. In line with this, predictability, attractiveness and ease of use were identified as the characteristics that engaged autistic pupils in iPad activities. Regarding the successful use of iPads for SC and ER, participants referred to the essential part of the devices' management, highlighting the role of confidence. Practitioners also recognised the influence of the Educational Technology Coordinator in training school staff and sharing good practices.

- ***Parents (Microsystem)***

Parents mentioned that iPads provided opportunities for the development of autistic children's SC and ER. Participants mainly referred to the advantages of the devices in developing pupils' communication, academic and life skills. One parent only stated that the iPad confused her child distinguishing reality and virtual reality. Overall, parents revealed that although their children's interests guided iPad use at home, they were open to receive training on practices for developing pupils' SC and ER.

- ***Pupils***

Children reported using the devices recreationally at home and for educational purposes at school. All participants stated that they enjoyed the variety of entertaining apps that iPads offered, which were selected based on their interests. Reference was also made to the use of the devices for communication and social networking. Moreover, one child reported using iPads for calming purposes. Children mentioned that they preferred not to share tablets, although they appeared to be open to work collaboratively if needed. Overall, pupils reported feeling happy when using iPads and sad/anxious when tablets were taken away from them.

3) What are the reported contextual influences (enablers and barriers) to iPad adoption at home and school for SC and ER?

Collaboration and the structure of the school were among the reported contextual influences that positively impacted iPad use for SC and ER in School A. The findings revealed that School A had formed a technology-oriented collaborative network that provided opportunities for sharing good practices. In addition, the Educational Technology Coordinator was essential in facilitating training, creating links with external agencies, and developing the confidence of educators in using the devices.

School A was reported to follow a structured approach to ensure appropriate and responsible use of iPads. Participants stated that the school had allocated distinct ICT roles to professionals and had set an E-safety committee to ensure the online safety of the children. The findings also revealed that the school was well equipped with iPads providing daily access to technology for learning and entertainment. Despite that, there was a lack of collaboration between practitioners and parents. The data showed that although the school provided support and teachers understood the importance of co-operation with parents, there was a communication gap between home and school relating to iPad use. Practitioners attributed this to parents' different perceptions of iPad use and time constraints. At the same time, parents stated this was related to practitioners' lack of contact due to their busy schedule.

The next chapter moves on to present the findings from School B.

Chapter 6: FINDINGS SCHOOL B

6.1 Introduction

This chapter presents and discusses the findings of School B. In line with the research aims and the conceptual framework of the study, this chapter presents the following:

- The school's cultural, structural and contextual elements and their impact on iPad practices implemented for autistic pupils' SC and ER (section 6.2).
- Practitioners' perspectives and practices about iPads for SC and ER of autistic pupils (section 6.3).
- Parents' views on iPads and practices implemented at home for SC and ER of autistic pupils (section 6.4).

The chapter provides an in-depth exploration of the elements that influence the way iPads were used in School B for the SC and ER of autistic pupils. It begins with an overview of School B, which involves information about the type of school, its size, the resource bases, the number of iPads in the setting, the allocation of tablets to students, the Lead ICT technician and technology's role in teaching. Next, it analyses the E-safety policy of the school to provide a sense of the context and then continues with practitioners' and parents' findings, which are reported within that contextual understanding.

6.2 Setting School B in Context

School B was an Academy primary community school that educated 250 boys and girls per year, between the ages of five and 11. At the time of the data collection, the school comprised four resource bases for children diagnosed with autism and Developmental Language Disorder (DLD) and supported 36 pupils. The class sizes ranged from six to 12 pupils, and each class had one SEN teacher and one/two teaching assistants depending on the number of students. All children in the resource base had Education Health Care Plans (EHCPs) and were referred to the school by the local authority SEN Assessment and Review team (SENAR). Resource bases provided individualised learning to children, including weekly visits to the school's mainstream classes for a few hours.

Educators followed the National Curriculum within resource base classes, but the lessons were differentiated and personalised to meet each child's needs. For example, autistic pupils had adapted timetables and the focus was on addressing their social, communication and sensory needs. Teaching approaches were based upon structured teaching practices and incorporated the use of specific autism-related training programmes.

Regarding iPads, the school had 36 devices in total, six of which were allocated to the resource bases. Hence, not all students had access to them due to the limited number of devices. Moreover, the staff was not experienced in embedding technology into learning as the school provided no training. Although School B had a Lead ICT technician, his impact on iPads' implementation in-situ was limited, with his experience with iPad software for autistic pupils being restricted. Overall, School B was not technology-oriented, and iPads were not integrated into learning. In contrast, they were mainly used for recreational purposes or to calm pupils down. Finally, the school did not have a computing policy but adopted the Trust's E-safety policy to meet any technology-related issues.

Having provided an overview of the contextual information of School B, the following section moves on to present the findings from the document analysis of the E-safety policy.

6.3 Document Analysis: E-safety Policy

This section discusses the E-safety policy to collect information about a) the school's culture and practices implemented, b) the ICT support roles, and c) contextual influences on technology adoption. The analysis highlights elements of the environment that may directly or indirectly impact iPad practices used for autistic pupils' SC and ER.

6.3.1 iPad: Practices implemented and school's culture (Exosystem)

The first theme, namely 'a) iPad: Practices implemented and school's culture', has been allocated to Exosystem. It collects information about the technology-related culture of the school and how it influenced iPad integration into learning (for more information, please see chapter 4).

According to the findings School B, did not have a separate computing action plan at the time of the data collection but adopted the E-safety policy of their Trust to cover the use of technologies.

*“**The directors of the multi-academy Trust have adopted this policy to help the trust meet its responsibilities for safeguarding and educating children**, for regulating the conduct of employees and for complying with legislation **covering the use of information and communication technologies and digital and mobile devices.”*** (E-safety policy, School B)

The findings revealed that the school recognised social media and social networking to enhance the learning and communication of all pupils. However, no reference was made to the methods that this could be achieved. In contrast, the focus was on E-safety measures that staff needed to follow to keep children safe online.

*“**Social media and social networking technologies can serve as powerful tools to enhance education, communication and learning for all pupils, staff members and board trustees. The policy recognises that when used correctly, social media and social networking can provide both educational and professional benefits**…Staff should treat professional social media space and communication like a classroom and/or a professional workplace. **The same standards expected in professional settings and security are expected on professional social media sites.**”* (E-safety policy, School B)

The document analysis showed that practitioners, volunteers, support staff and governors were encouraged to integrate E-safety in the school's curriculum and adapt it accordingly based on their needs. Interestingly, no reference was made in the document about how educators could embed it successfully into the learning process.

*“**Employees are responsible for consultations about this policy and its application, including E-safety within the curriculum**…They are also responsible for using information and communication technology **in accordance with this policy and the training provided.**” (*E-safety policy, School B)

As expected, the document's main points related to the safeguarding of the students and their training by school staff about online hazards.

*"**Pupils are expected to use information and communication technology systems and devices as they have been taught** and in accordance **with the academy's behaviour policy and the instructions given to them by staff."*** (E-safety policy, School B)

The findings revealed that the multi-academy Trust was responsible for the training of the school. However, although staff and children were prompted to receive training on using technology safely, no reference was made in the policy about the type and frequency of training that the individuals should receive.

*"**The academy provides all employees with training in E-safety relevant to their roles and responsibilities** and that training is also provided to volunteers and directors/governors who use information and communication technology in their capacity as volunteers or directors/governors."* (E-safety policy, School B)

Overall, the analysis showed that although the policy seemed to encourage technology use in the setting, there was no clear guidance on how this could be achieved. Moreover, the focus was on E-safety, while the school's culture around technology did not promote innovative practice or sharing of learning and collaboration.

6.3.2 Individual: ICT Support Roles (Microsystem)

The analysis also explored how School B allocated the ICT support roles and their responsibilities to technology use in the setting. The theme, namely 'b) Individual: ICT Support Roles', has been grouped under Microsystem as it describes the direct impact of professionals' roles in technology implementation (for more information, please see chapter 4).

The individuals responsible for E-safety in School B were the a) board of directors, b) Head of the academy and c) school staff. The policy defined these three groups, which followed a very structured vertical hierarchy. Hence, the findings revealed that the board of directors was expected to ratify and review the E-safety policy acting as a connecting link between the local authority and the school. Moreover, the role involved securing information technology services for the safeguarding of the pupils.

*"**Directors are responsible for ensuring that proper procurement procedures are used if they decide to purchase information technology services from an external contractor** and that city council or other reputable specialist advice is taken on the specification for those services to ensure **proper security and safeguarding of children."*** (E-safety policy, School B)

Regarding the Head of the school, the findings showed that his/her responsibilities involved coordinating the school staff to implement the policy properly. Also, his/her duties were to ensure that all staff received relevant training and included E-safety in the curriculum.

*"The Head of the Academy is responsible **for ensuring that there is effective consultation with all employees, and other users of the academy's information and communication technology systems** to take account of the particular features of those systems **and educational, technical and administrative needs**…"* (E-safety policy, School B)

Finally, school staff seemed to be responsible for implementing the policy appropriately, attending training and reporting misuse of technology to the designated E-safety person.

*"Other employees are responsible **for undertaking such responsibilities as have been delegated**…**participating in training in E-safety** provided by the academy and in consultations about this policy and its application**, including E-safety within the curriculum…reporting any suspected misuse or problem to the person designated by the academy for this purpose.**"* (E-safety policy, School B)

Interestingly, the policy did not provide information about the role of the Lead ICT technician. Similarly, the role of the E-safety designated person was confined to supporting staff, without recommending how this could be achieved.

> *"**The Trust will undertake regular reviews of the safety and security of its information and communication technology systems**. **Particular attention will be paid to secure password protection and encryption for devices located in the academy and mobile devices.** The Trust's systems will also provide for filtering internet access for all users, **preventing access to illegal content, and with additional filtering for different groups of users for inappropriate content."*** (E-safety policy, School B)

The findings highlighted that volunteers, support staff, and other employees were expected to attend training and use technology according to the policy of the school.

To conclude, the analysis showed that the ICT support staff worked independently towards the safe use of technology in the classroom. Interestingly, no collaborative model was identified in sharing iPad practices, as key staff roles seemed to follow a vertical hierarchy with distinct responsibilities. Finally, none of the reported technology-related roles influenced each other, as the focus was mainly on online safety and training.

6.3.3 Contextual Information (Mesosystem)

The last theme that emerged from the document analysis provides information about contextual elements that may have influenced the iPad practices of School B. The sub-theme under this category relates to collaboration and has been allocated to Mesosystem to depict the interaction between elements of the Microsystem (e.g. practitioners, parents and the learner). For more information about this categorisation, please see chapter 4.

- **Lack of collaboration**

The findings revealed no reference to interdisciplinary collaboration within the E-safety policy of School B. Thus, collaborative partnerships for technology integration were not encouraged, and staff were informed about relevant updates from the senior personnel.

*"**The directors expect the Heads of the Academy to arrange for this policy to be published to all employees and volunteers in the academy** and for necessary instructions and guidance, **particularly on acceptable use, to be given to pupils in a manner suited to their ages and abilities."*** (E-safety policy, School B)

Although the training was given high priority across the trust, the policy did not provide information about the designated trainer or the frequency and type of training that should be provided.

*"**Directors/governors are expected to follow the policy in the same way as volunteers are expected to follow it, including participating in E-safety training** if they use information and communication technology in their capacity as academy directors/governors…**Volunteers, directors and governors who use information and communication technology during their work will be offered the same training as employees."*** (E-safety policy, School B)

Last but not least, the findings showed that although the carers and community users should also receive updates about the E-safety policy and practices, there was no clear guidance about how it could be achieved.

Overall, the policy of the school did not seem to encourage collaboration and knowledge sharing between members of the staff. Similarly, no reference was made to ways of facilitating co-operation between school and home, as the focus was on the online safety of the children. Finally, it was revealed that technology-related practices and interdisciplinary collaboration were not among the highest priorities of the school.

6.4 Examining the Views of Practitioners on iPad Practices for SC and ER

The practitioners involved in the semi-structured interviews were three teachers, one teaching assistant, and the Lead ICT technician. Participants taught autistic pupils of different ages and started integrating iPads more consistently into their teaching after training was provided to them by the researcher. As previously mentioned in chapter 4, training was not planned as part of the data collection process but was one of the headteacher's requirements to give the researcher access to the setting. Thus, the findings reported in this chapter reflect educators' previous experiences with iPads and their views on the new practices implemented after they completed the one-day training.

6.4.1 iPad: Practices Implemented (Microsystem)

The first theme, 'a) iPad: Practices Implemented', has been allocated to the Microsystem. It presents iPad practices for SC and ER that School B participants implemented and directly impacted the learning of pupils (for more information, please see chapter 4). The dataset analysis has identified the following four sub-themes i) iPad use for recreational and educational purposes, ii) iPad frequency of use, iii) target skills with iPads and examples of practices, and iv) apps selection criteria: ease of use, target skills, cost, age.

- **iPad use for recreational and educational purposes**

Three out of five teachers reported using iPads for recreational purposes before receiving training. For example, a teacher of pupils of younger ages (Reception/Year1) mentioned allowing students to access specific games for entertainment. Another participant also stated that she used iPads to reward pupils or record their progress.

E.g. Participant TB1: *"Before training,* ***they tended to use the iPad only for play****; it was always the same game app 'Minecraft'."*

E.g. Participant TB2: *"First,* ***we used to use iPads, for taking photos*** *like a glorified camera* ***to capture the highlights of the day****…And, before the training,* ***I was just using iPads as a reward system.*** *For example, I used 'ClassDojo' as an interactive reward system for kids."*

Contrary to these points, only one practitioner inferred embedding tablets into teaching to reinforce the learning experience of pupils. According to the findings, TB3 appeared to use iPads to assess students' understanding, provide an alternative learning experience, enrich traditional teaching methods or encourage knowledge sharing between peers. For example:

Participant TB3*: "We currently use the iPads* ***mainly to reinforce the learning that has happened in the class previously…*** *We bring iPads in after the main teaching has been delivered,* ***and we use them to reinforce, discover and find out what the students have learnt.*** *With iPads, they can make mistakes and correct themselves automatically.* ***Or we use iPads as an information technology tool to write up things they may have already written or researched in different media*** *rather than just using pen and pencil all the time. So we get them to write comics, newspaper reports, that sort of things… We can also refer back to the time when students completed iPad tasks and* ***ask them to present them to their peers.****"*

The findings revealed that TB3, a confident user of iPads, used tablets more creatively, integrating them into learning as additional learning tools by focusing on students' individual needs.

The Lead ICT technician expressed the view that teachers should use iPads to support the curriculum highlighting the need to balance teachers' roles, traditional teaching methods and technology use. Moreover, TB4 reported that technology should be adapted according to the needs of the students to benefit their learning.

E.g. Participant TB4: *"We are in a technology era and being able to use technology in classes is very good.* ***However, we need to find a neat balance between the two and not go overboard…*** *I think* ***iPads are just a single consumer device; they were never essentially made for mass education…*** *if I was a parent and I had a child who had autism, and I knew exactly what side of the spectrum they were on****, then obviously I would find apps that would support them.****"*

Overall, educators mainly used iPads for recreational purposes, with only one participant reporting embedding tablets into the curriculum to enhance the learning of pupils. Interestingly, after the training was completed, all educators appeared to be positive towards using iPads for educational purposes focusing on meeting the individual needs of pupils. Hence, the analysis identified a possible link between training, teachers' confidence and the use of iPads as additional learning tools.

- **iPad frequency of use**

The frequency of iPad use in School B depended on a) children's behaviour, b) devices' availability, and c) practitioners' confidence in using tablets. According to the findings, all participants reported using tablets before training at least once a week, depending on the behaviour of children. For example, TB3, a teacher of a mixed class of autistic young boys (Year 4-6), stated that the emotional state of the students influenced the frequency of iPad use in the classroom.

E.g. Participant TB3: ***"The children in my class, if they get frustrated with something, they can cause damage.*** *We had an incident recently; the iPad was not doing what the child wanted to do,* ***and the device did not 'survive'!"***

In another example, a teaching assistant (TB5) highlighted that the limited availability of the devices obstructed teachers from embedding them consistently into teaching. As she noted, 36 autistic pupils in the resource base shared only six iPads.

E.g. Participant TB5: *"…we usually have the iPads once a week.* ***Because they are used across all the resource bases, so it is hit and miss if we can have them or not.*** *We might have all of them in our class or just one.* ***We can have all six, but this usually happens once a week.****"*

Interestingly, educators mentioned that the frequency of iPad use increased after training, from one to three days per week. Teachers reported feeling more confident in using tablets to enhance the learning experiences of pupils.

E.g. Participant TB4: *"Some classes will use the iPads once a day to benefit the lesson, while other classes will not use them for months.* ***Again, it really does come down to teachers and how willing or confident they are to use them."***

In sum, the evidence showed inconsistency in the frequency of iPad use in School B. This was related to children's behaviour, tablets' availability, and teachers' low confidence in embedding technology into learning.

- **Target skills with iPads and examples of practices**

This section refers to the target skills that the practitioners focused upon when using iPads in the classroom with autistic pupils. The findings revealed that although

School B educators were not confident users of technology, they seemed to value the positive impact of iPads on SC and ER.

- **Social Communication (SC)**

All educators reported favouring the use of iPads for developing SC skills. Participants mentioned focusing on a) communication, b) socialisation and c) engagement which, in line with the literature review findings (chapter 2), are elements of the broader SC term.

Over half of the interviewees (*n*=4) revealed that they started using iPads to develop autistic pupils' communication skills after the one-day training. The analysis showed that tablets were embedded in teaching in various ways and subjects, depending on the needs of the students. For example, participants highlighted using iPads to record pupils' voice, develop independent communication or encourage the beginning of discussions.

E.g. Participant TB1: *"**The app you showed me during training was really effective.** I am so happy with that because **it is really good for developing communication. They like to record and hear their voices…It encourages them to talk.** I am really happy with that one."*
E.g. Participant TB3: ***"iPads have improved the vocabulary in the classroom.** One of my students is very articulate and can use big fancy words. If he does not understand a word, he will find out on the iPad what it means **and then bring that into the classroom for discussion with the group. He can provide examples and help others develop their language."***

Another teacher referred to the use of iPads for the development of children's social skills. TB2 commented that tablets provided opportunities for collaborative work, interaction and engagement.

E.g. Participant TB2: *“**Once they are recording things, they are sharing their work.** They are commenting on each other’s performance, such as encouraging each other to do more work... **They have been very eager to listen and watch each other’s performance or work together**.”*

In line with this, two-thirds of the participants said iPads attracted autistic students’ attention and encouraged exchanging ideas. This was facilitated either via online games or educational apps that involved collaborative tasks. Educators referred to the importance of understanding children’s interests and using iPads imaginatively.

E.g. Participant TB3: *“**We have used the Minecraft game as a social interaction tool because they are very good at interacting within the game with each other.** If you place the students around the table next to each other and ask them to discuss about iPads, it usually does not work. **However, once they are in the game as a character, you see a lot of language and conversation coming out between them in that sense.”*** (School B, TB3)

Participants reported using flexible apps to develop pupils’ SC which they applied across the curriculum. This could be related to the fact that most applications introduced to them during the one-day training were not subject-specific. Among the most frequently mentioned apps were ‘Book Creator, Yakit Kids, ChatterPix, Writing Wizard and Minecraft’.

E.g. Participant TB2: *“**The training** we had with you on different apps (such as ‘Book Creator, Yakit Kids, ChatterPix and Writing Wizard’) **was really useful as it opened my eyes to the flexibility of apps available and the use of iPads as communication tools.”***

Overall, practitioners commented on the positive impact of iPads on autistic pupils SC skills, providing examples of their use as multi-modal learning tools after the one-day training provided to them. Educators adapted the apps based on the needs and interests of students and followed child-centred pedagogies in their practice. The selection of apps involved mainly flexible software that could be applied across the curriculum, using iPads as multi-modal learning tools. Practitioners reported seeing the positive impact of tablets on pupils' communication, socialisation, engagement and imagination, referring mainly to apps introduced to them during training.

- **Emotional Regulation (ER)**

Participants appeared to be unsure about what ER involved. Although a definition was provided to them before the interview, they referred to reward and motivation as elements of ER. For example, when educators were asked about the use of iPads for ER, they all reported applying tablets to reward the good behaviour of children.

E.g. Participant TB4: *"**Lots of children will have iPads as a reward if they behave or do their work well.** They will be rewarded with some iPad time at the end of the school day."*

Similarly, another participant referred to the use of iPads as motivators to encourage children to complete learning tasks or transition from one activity to another. For example:

Participant TB2: *"It depends on the reason. If the child opts out of work, we would say **'Work first and have the iPads'**. **So, we would use it as a motivator."***

Interestingly, the use of iPads as rewards/motivators was also associated with the decrease of children's challenging behaviours, implying tablets' use as behaviour management tools. The findings revealed that iPad use in the class also concerned minimising anxiety and preventing the escalation of children's outbursts. For example, TB3 and TB1 stated that when autistic individuals experienced high levels of anxiety, they were given iPads as distractors to calm down, involving a free flow use of apps.

E.g. Participant TB3: ***"We use them as distractions. If they experience high anxiety, we will use them as calming tools to distract them from what is happening and what made***

***them angry**. That will be a very short couple of minutes … Once they are back down and calm, we will remove the iPads from them, and we will be able to discuss with them what has happened.”*

To sum up, the findings revealed that educators were not familiar with the term ER and referred to reward or motivation as elements of this developmental area. However, it was reported that tablets indirectly impacted the ER of pupils as they were used as calming tools to regulate anxiety and reduce challenging behaviour. Finally, the participants did not report specific apps for ER as tablets were used in a flexible, free-flow way for this purpose.

- **Apps selection criteria: Ease of use, target skills, cost, age**

Teachers reported various criteria for selecting apps, mentioning their ease of use, cost and children’s target skills, and age.

The identification of easy-to-use apps appeared to be one of the highest priorities of practitioners for selecting software. Four educators stated that they preferred software that allowed pupils to achieve goals independently without direct guidance.

E.g. Participant TB3: *“…Children can click and delete,* ***so it is easy to fix their mistakes independently.*** *They can experience success quickly,* ***and iPads can keep them on the right track without teachers' continuous guidance.*** *In addition,* ***they can achieve small educational goals.****”*

Reference was also made to the cost and maintenance expenses of apps showcasing the fixed budget of the school in purchasing new software or devices. For example, the Lead ICT technician mentioned:

Participant TB4: *“Obviously, with technology and working with children, iPads tend to get broken, and as soon as you have a broken screen on an iPad it is like £100 to replace it.* ***It suddenly becomes costly, especially if you have 100 iPads all running off the same Apple™ ID.****”*

Interestingly, another teacher referred to the cost of apps, providing a different viewpoint to the one mentioned above. TB1 expressed her criticism about the school funding distribution and the lack of collaboration between school leaders and teachers regarding technology. For example:

Participant TB1: *"**They should be asking teachers which apps to purchase because we know what children need.** When I say 'Okay, let us try something new', they respond that **it is too expensive.** The amount of money these kids bring to school is a lot, but where is this money?'. They should use part of it to buy apps, but they prefer to use it to buy new doors, windows or desks."*

Another selection criterion was the flexibility of apps to meet the individual needs of autistic pupils. Teachers mentioned focusing on various skills based on the interests and abilities of children. For example:

Participant TB3: *"One lad is fascinated with science experiments. So, he will go on the iPad, play around with **it and bring back to the class information about experiments."***
Participant TB4: *"But in terms of what we pick, essentially, **we look for educational apps to suit the children of our school."***

Finally, one participant mentioned as a criterion age appropriateness, highlighting that he selected apps that did not promote violence or harm, showing the school's priority in keeping children safe online.

The findings collectively revealed that the ease of use and cost of apps were educators' highest priorities for selecting apps. Participants reported that the school provided restricted funds for technology investments, excluding the involvement of educators from the process. Overall, teachers showed their preference in using flexible apps to meet pupils' individual needs, considering children's age and content appropriateness.

6.4.2 Individual: Practitioners' Perspectives (Microsystem)

The next theme, namely 'b) Individual: Practitioners' Perspectives', has been allocated to Microsystem. It discusses participants' views on iPads and provides insights about their direct impact on tablets' use in the classroom (for more information, please see (chapter 4). The analysis revealed three sub-themes i) advantages and challenges related to iPad use, ii) views on why iPads attract autistic pupils, and iii) role of teachers' confidence and training in using iPads in the classroom.

- **Advantages and challenges related to iPad use**

According to the findings, participants believed that iPads positively impacted on increasing the engagement of autistic pupils. Three educators reported that tablets stimulated the participation of children in learning, providing opportunities to overcome learning challenges.

E.g. Participant TB1: *"**They really enjoy it, and it is something that they are engaged in.** They like the iPads, and this is the main thing. **They need to be engaged and like what they are doing.** For example, we have a student that his writing is really poor, and he struggles. **However, with the iPads, it was another way for him to put in writing his ideas**. It was amazing, really good!"*

Another informant explained that iPads increased children's focus and collaboration in the classroom, highlighting pupils' engagement in learning tasks. For example:

Participant TB3: *"If we talk for example about Greek Gods…I might ask them, 'Let us build a Greek God-world'. So, I allocate roles to them, **and they interact and work together as they have to build things**."*

Participants also commented on the opportunities that iPads provided for combining individualised and team learning dynamics and their ability to increase pupils' independence, confidence and amount of work produced.

E.g. Participant TB2: *"Also, the children who struggle to write,* ***have been much more focused and enjoyed that level of independence with the iPads. I think iPads can build up their confidence by working on them.****"*

Regarding the challenges related to iPad use, participants referred to the devices' regulation and the school support. Three practitioners touched on the notion of distraction stating that the increase in the frequency or duration of use could influence the obsession of pupils with the devices.

E.g. Participant TB4: *"… we have one child, who if he does not get the iPad he will flip out and end up breaking stuff in the classroom because he is so used to having it...* ***There needs to be a fine line between letting the kids have the iPads and knowing that it is a privilege. It is important to help them understand that they can get it by being good or that it is available to help with a lesson and that they will not get it all the time."***

Three educators also referred to the challenging behaviour of pupils and its impact on breaking the devices. Practitioners mentioned that students' frustration was related to their obsession with iPads or software faults. For example:

E.g. Participant TB1: *"****It is quicker to frustrate and anger them if something goes wrong or they press the wrong thing…****So, when they are hitting the button many times, it gets backed up, and it crashes. So, they need to exit the app again****. It has its pros and cons in that sense.****"*

In all cases, the informants reported that devices' cost prevented them from using iPads frequently. This was related to the school's inadequate resources in protecting iPads (e.g. cases) and maintenance services. For example, the Lead ICT technician

(TB4) reported that most iPads in School B were old and hard to use, highlighting the lack of school support in updating the software.

E.g. Participant TB4: *"When iPads first came out, we just bought them and 'we jumped on the iPad wagon'. We have got iPad 2s and 3s [old generation].* ***You cannot update them to the latest iOS anymore…so they will slowly become out of date, and they will become useless, as technology always does.****"*

In another comment, TB4 referred to the skills of teachers in using technology, arguing that the lack of older educators' familiarity with technology and the frequent workforce reform in the school impacted their use.

Participant TB4*: "***The older generation of teachers will struggle with iPads,*** *unless the app is very simple…younger people are more inclined to being able to find their way around technology****… everybody's job roles always get moved around so it is very easy to train one teacher onto how to use the program but if that teacher then leaves****… it is kind of difficult unless you were to train everybody."*

Finally, reference was also made to the lack of collaboration between school leaders and practitioners in coordinating the integration of iPads into learning and encouraging staff in using tablets for educational purposes.

To sum up, the findings revealed that educators favoured the positive impact of iPads on increasing the collaboration and engagement of pupils in the learning process. Participants referred to flexibility, personalised learning and the development of students' independence and confidence as some of the advantages of iPads. Finally, educators stated that iPads' challenges were related to the regulation of their use combined with a lack of school support in maintaining the devices and training staff.

- **Views on why iPads attract autistic pupils**

Four educators mentioned enjoyment and attractiveness as possible reasons that iPads attracted autistic pupils. Reference was made to tablets' combination of audio-visual and interactive elements highlighting apps' multi-sensory stimulus and entertaining content.

E.g. Participant TB5: *"**Children do not see iPads as doing work**. We see poems that were done in a week to be all done in one lesson with iPads. Because **iPads are fun and different and children like using them."***

Two participants also reported that tablets repetitiveness and predictability allowed pupils to work in a structured environment, reducing reaction uncertainties and distress. For example:

Participant TB4: *"**An iPad is not going to get angry at you if you do something wrong**… in a game or an app. You just restart the task…**A child, knows exactly what it is going to get from an iPad and that is probably why they find it easy to use."***

Finally, two educators stated that iPads attracted autistic pupils due to their ability to personalise learning based on their interests and needs. This involved adjusting the settings of the devices or identifying apps relevant to the target skills that practitioners aimed to develop.

E.g. Participant TB3: *"We give pupils t**he prompts to adjust the devices based on their needs**. For example, **if one child is sound sensitive, then he is taught to adjust the volume at a lower level** to avoid frustration."*

Overall, the findings showed that educators seemed to believe that iPads' attractiveness, personalised learning, repetitiveness and predictability were some of the reasons that allured autistic pupils to the devices.

- **Role of teachers' confidence and training in using iPads in the classroom**

All practitioners in School B were positive about the role of training in improving the iPad practices implemented for autistic pupils' SC and ER. Participants reflected on the workshop session provided by the researcher, highlighting its positive impact on developing their confidence and technology-related practices. Reference was also made to the training structure, mentioning that the combination of practical strategies, the recommendations of specific apps and in-class support positively influenced teachers' understanding of delivery options.

E.g. Participant TB2: ***"I think it is the way that the training was conducted because it was very comprehensive**. **It also enabled me to pinpoint what would be most practical and functional in the classroom**, for example, children's needs or the ease of use… Before training, I was not very confident in using the iPads. I have not even got an iPad at home, so I am not all that technological.* ***However, it was really useful the training, and with the sessions of you coming in, it has been reassuring to have that support**. It has been **very motivating as well, being able to discuss ideas.** And for suggesting other ways that I had not thought of using the iPads. **So it has been really useful and doing this project has also built my confidence."***

Teachers in School B mentioned that they were interested in receiving regular training, considering continuous professional development as an essential element of their role. Interestingly, the findings revealed that practical training provided opportunities to educators to overcome iPad adoption hurdles regardless of their technical proficiency.

E.g. Participant TB1: *"**You (the researcher) coming here and just bringing all these new iPad ideas is just amazing** because I could see them last week, they were so engaged and they loved working on iPads…* ***if you could come more often and stay with us, to teach us how to use iPads with the kids that would be amazing."***

According to the findings, School B used to receive iPad training from external contractors. However, it was reported that since this collaboration ended, there was no replacement of the role of the trainer in the school. In line with this, the Lead ICT technician also justified that his role did not involve training but was confined to technical support.

E.g. Participant TB4: *"**If a teacher says I want to use iPad in a lesson, I will then support and help him. I am happy to help and make sure everything runs smoothly** because, as you can imagine with technology, things tend to go wrong. **So it is good for teachers to just to have a spare of hands, especially somebody that understands how they work and how to fix iPads.**"*

In sum, the findings highlighted that School B did not have a technology support network to oversee iPad use in practice and encourage knowledge sharing between practitioners. Despite that teachers favoured the positive impact of regular training on their confidence, highlighting a possible link between these two elements. Reference was also made to content of trainings highlighting their positive effect of in-class tutoring.

6.4.3 Contextual Influences (Mesosystem and Exosystem)

This theme provides information about elements in the school's environment that may have indirectly influenced the way iPads were implemented for autistic pupils' SC and ER (for more information, please see chapter 4). The sub-themes that emerged were related to i) collaboration, ii) school's technological resources, and based on their content were allocated to Mesosystem and Exosystem accordingly. More specifically, the sub-theme 'Collaboration' has been placed in the Mesosystem as it describes the interactions between practitioners-children and practitioners-parents. Besides, 'School's technological resources' has been allocated to Exosystem as it refers to the technological infrastructure of the school.

- **Collaboration (Mesosystem)**
  - **Collaboration between practitioners and children**

All educators highlighted the important role of teamwork in sharing ideas, practices and increasing their confidence in iPad use. However, it was revealed that no collaboration was facilitated in School B relating to technology use. For example, one teacher stated that the school did not provide any collaborative ICT integration plan, with most classes working with iPads independently.

E.g. Participant TB5: "***We have not had any guidance from school or collaboration with other classes.*** *Well, I know you (the researcher) have been doing this training with the other classes,* ***but we did not contact other teachers about this. They usually take it upon themselves to do all of this…"***
E.g. Participant TB1 ***"… it needs to be always teamwork, but there must be someone like you who knows how to do it and who teaches us how to do it.*** *It is true because how can we use the iPads if we do not know how to use them?"*

In line with this, reference was also made to the busy schedules of the teachers. For example:

E.g. Participant TB3: *"****People who have the knowledge might not share their ideas with colleagues because they have so many other things on their plate to deal with.*** *But if someone asked or requested help with iPads,* ***they would quickly show them."***

Moreover, the interview findings with the school Lead ICT technician also showed that despite his role in supporting teachers with technology, his experience with iPad software for autistic pupils was limited.

E.g. Participant TB4: "*I am a technician, but I do support lessons. So, if a teacher wants to do a lesson using an app and they would like the support, I can help. They can request me, and*

I am more than happy to go to the class and help. ***However, I have not done much work with iPads and kids with autism."***

Interestingly, School B participants valued the collaboration with children regarding iPads. More specifically, it was highlighted that educators with no technological background welcomed the knowledge exchange with pupils to develop their confidence and skills with technology.

E.g. Participant TB5: *"… it was a new program to me [Book Creator], and* ***I was learning as the children were learning … because I think it is important for children to see that I am learning too…*** *it is a case of when you say, 'I don't know how to do this' and then the child will come over to me and say, 'Actually you've got to do it like this or that'* ***so this is invaluable…they [the children] teach me.****"*

To conclude, the findings revealed that collaboration regarding iPads did not seem to be the highest priority of the school, indicating that technology-based learning approaches were not emphasised in the setting. Some teachers attributed the lack of knowledge sharing to their busy schedule or the lack of technology expertise between educators. Despite that, professionals favoured opportunities for knowledge sharing with children, which appeared to positively impact their confidence and iPad skills.

- **Home – school communication gap**

Another recurrent theme in the interviews was the lack of collaboration between practitioners and parents relating to iPad practices used for SC and ER. The findings revealed that three out of five practitioners reported using software to inform parents about the progress of the pupils without referring to specific iPad practices or applications.

E.g. Participant TB3: *"Specifically with the students from the resource base, we do not see their parents directly because they have to get taxis from the other side of the city to come here…****The only vague communication we do get is through communication books or the home-link application, which has become like a messaging service. But again, we do not always get messages back..."***

Although all practitioners acknowledged the vital role of home-school collaboration, the responses indicated a gap in communication between the two settings. Educators mentioned that this was attributed to parents' lack of control over the apps that children accessed at home and their busy schedule.

E.g. Participant TB4*: "****There is literally no communication between parents regarding what sort of apps we use…*** *I do not really know how much influence parents have in terms of using technology with the children at home."*

Only one participant who taught children of younger ages (Reception/Year 1) reported collecting information about the apps that children preferred to use at home. However, even in this case, the collaboration about iPad practices was not regular as it was taking place once a year.

E.g. Participant TB1: *"At the beginning of the academic year, parents are asked to fill in a form* ***about what children like doing at home. One of the things that we ask refers to iPads."***

To sum up, the findings identified a communication gap between home and school about iPad practices for SC and ER. Although practitioners highlighted the vital role of working together with parents, this process did not involve technology-related practices. Some practitioners believed that this was associated with the busy schedule of teachers. Interestingly, only one educator mentioned collecting information at the beginning of each academic year about the iPad preferences of children.

- **School's technological resources (Exosystem)**

The findings showed that School B was equipped with 36 iPads used both by practitioners and children. Thirty of the devices were allocated to the mainstream school, and six to the Resource Bases. Over half of the respondents reported difficulties sharing six iPads between three classrooms due to the limited resources.

E.g. Participant TB1*: "We have got six or seven iPads (in the resource base,) and we need to share*. ***We have six and, in my classroom, we are eight. We need to share them, and that is a nightmare, especially with children of younger ages…"***

Overall, the technological resources of the school did not seem to cover the needs of educators and pupils, revealing that one of the possible reasons for not integrating iPads into teaching related to practical difficulties. Interestingly, no reference was made to computers or other technological devices for learning purposes, with teachers not seeming willing to collaborate with colleagues to share the devices.

6.5 Examining the Views of Parents on iPad Practices for SC and ER

This section discusses the findings collected through semi-structured interviews with four parents of autistic pupils. The data have been organised into three broad categories: a) iPad: practices implemented (Microsystem), b) individual: parents' perspectives (Microsystem), and c) contextual Influences (Mesosystem).

6.5.1 iPad: Practices Implemented (Microsystem)

This theme provided information about the iPad practices that parents implemented at home for their children's SC and ER. The findings have been grouped under

Microsystem as the practices of parents appeared to directly impact the learning of children (for more information, please see chapter 4). The analysis revealed three sub-themes i) child-centred Use, ii) iPad regulation and frequency of use, iii) target skills, and iv) E-safety practices.

- **Child-centred use**

The findings showed that iPad use at home was child-centred, with all parents reporting that pupils selected the applications they wanted to access. Most of the informants mentioned that their children were confident users of technology and were allowed to download the software they wanted by themselves.

E.g. Participant PB1: *"I am not very good with technology.* ***My son can open his own Google account, go to the Play store and get whatever he needs*** *… he is always around me, so I know what he is doing.* ***He does the downloading most of the times****."*

All parents stated that the applications that children accessed were based on their interests and needs, while 'YouTube' was among the most frequently mentioned apps.

E.g. Participant PB2: *"I think he is interested in Science…****There is so much stuff for him to explore on the iPad.*** *He loves pirates,* ***so he watches a lot of pirate things on 'YouTube'. Alternatively, videos related to fish, as he loves the sea and the sea animals…"***

Although parents acknowledged that children used iPads for recreational purposes, they highlighted that many apps combined learning and amusement, focusing on the practice of more than one skill.

E.g. Participant PB3: *"There are certain apps on the tablets and phones – called 'Kids Mode' where you can create music or draw pictures.* ***They also have apps like 'CBeebies' where they can practice hand-eye co-ordination*** *…* ***they learn to trace; do jigsaws and puzzles.*** *Now they [her children] have a fascination for colouring…* ***My son usually prefers***

'YouTube', but he will also get that interaction with the songs and the numbers... He is still learning, even when he is watching 'YouTube'."

In summary, the results showed that the use of iPads at home was child-centred, and the selection of the apps was based on the interests of children. Parents were positive towards technology, mentioning that it combined educational and entertaining apps that allowed children to progress. Finally, the findings revealed that when children were confident users of technology, the roles of parents were confined to keeping children safe online.

- **iPad regulation and frequency of use**

This theme explored the frequency of iPad use at home and the practices that parents implemented to regulate their use.

The findings revealed that all parents provided children daily access to iPads for about two hours. A common point among all interviewees was the time that children accessed the devices, which was after school and before bedtime.

E.g. Participant PB3: *"**They [her children] have it for a couple of hours when they get back from school; they have the TV in the morning and the tablets and the phones in the evening –** they do not take them to bed, as they will stay awake all night."*

The participants also commented that iPads helped children find an outlet for relieving stress after school, emphasising that children followed a specific routine to avoid overuse.

E.g. Participant PB1: *"**He tends to have the iPad for about half or one hour when he gets back from school to wind down and** again half an hour at the end of the day **when he is sitting down and relaxing."***

Parents mentioned using structured routines adapted based on the needs of pupils to regulate the use of iPads. For example, three participants commented that they gave children clear guidelines about the amount of time they were allowed on iPads to minimise challenging behaviours and distress.

E.g. Participant PB1**:** *"**After a specific time, he knows he is not allowed to use it. During school days, he knows that this time is after 6:30pm.** At the weekend, he is not allowed to have it after 8pm, and he hands it over to me."*

Although most of the interviewees were confident in regulating iPad use at home, one participant (PB4) stated that she found the process challenging due to her child's reaction.

E.g. Participant PB4**:** *"For example, at the weekends, I tell her that it is enough, it is time to put it away, and **we have to turn off the Internet**. **When the Internet goes, she is always heartbroken, but it is hard for us to convince her that her time is up…** we need some time for her to understand. So, when she knows that it is not working, she turns it off and does something else."* (PB4, School B)

Overall, iPads seemed to be part of autistic children's everyday lives, with their use being based on a structured routine. Participants reported feeling confident in regulating their children's use, with only one parent being concerned about the process. The findings showed that all parents adapted their regulation practices based on the needs of children, identifying solutions that would not require the exclusion of technology from home.

- **Target skills**
    - **Social Communication (SC)**

Most of the interviewees reported using iPads to develop the communication skills of their children. For example, two parents whose children had severe communication difficulties stated that iPads helped them build their vocabulary and communication.

E.g. Participant PB4: *"**My daughter was not able to say anything. She was not able to communicate at all, but from the iPad, she has learnt so much...** She loves 'Peppa Pig',* *so she watches Peppa Pig stories. I let her watch for as long as she wants, that one because she picks up the stories and* ***sometimes that helps her to communicate better."***

Another parent mentioned that iPads were used at home and school to understand the needs or comprehension level of children who faced communication challenges. For example:

E.g. Participant PB4*: "**He could not speak very well. Before the iPad, his speech was very limited. He would not talk to you. The teachers were not very sure what he was comprehending** because he could not write very well or vocalise his thoughts. **But then they could see through the iPad what he was understanding."***

Another parent also referred to the positive impact of iPads on developing the social skills of his child.

E.g. Participant PB3: *"**It can help with social skills. For example, you have one go on an app, then someone else has another go, and then the iPad gives you feedback. The iPad does help them, and I have seen it with my little one**. He is a lot calmer than he used to be and will go and speak to other people now; he will not hide behind me. He is not afraid anymore. **I do think that overall they [the iPads] are brilliant things."***

The findings revealed that parents did not use specific apps to teach their children SC but followed pupils' interests to encourage communication and interaction.

To sum up, iPads were not used as teaching devices at home, as children independently accessed their preferred applications. All parents reported that pupils mainly accessed tablets for recreational purposes, highlighting technology's role to combine learning and entertainment.

- **Emotional Regulation (ER)**

The participants stated that iPad use at home had a positive impact on the ER of their children. The findings revealed that tablets were used at home as assistive tools to help pupils overcome meltdowns and reduce distress.

E.g. Participant PB3: *"If he is having a meltdown, I can turn around and say, 'You can have the tablet, but you can only have it for this long'.* ***With the tablet, everything changes, even his perspective.*** *For example, if he is arguing with his brother, I can turn around and say, 'No' and he turns around, and he says, 'Sorry'.* ***As I say, I think iPads are brilliant for controlling their tempers and controlling their emotions. If the children are calm, you can discuss with them, but when they have a meltdown, you cannot."***

Likewise, two participants stated that iPads were used to regulate the behaviour of children, increasing their engagement in activities and motivation to behave. For example:

Participant PB1: *"I think motivation can come from the iPad because by* ***watching what other kids are doing it helps him to realise what is appropriate and what is not for his age. In a more practical example, if he is not doing something, I usually tell him, 'You will not have the iPad until you have completed what you are doing, because you are not concentrating".***
Participant PB4: *"**Yes, the iPad motivates her to calm down**. For example, in the past when she was upset, she was crying, and not listening.* ***So I started giving her a specific app on the iPad. After a while, she would be much calmer."***

Finally, two parents reported implementing iPads to entertain their children. For example, one of the participants mentioned using the tablet as a childminding device due to her busy work schedule.

E.g. Participant PB2: ***"The main reason is that I am working.*** *We have a takeaway shop downstairs.* ***So I have to leave the child upstairs (at home) alone and use the tablet for his entertainment to keep him calm when I am away."***

To conclude, the findings revealed that parents used iPads at home as emotional regulators. This either involved reinforcing them to behave or keeping them calm. Overall, parents did not seem to believe that tablets isolated their children but acknowledged their potential in regulating their emotional state by entertaining, relaxing them and motivating them to behave.

- **E-safety practices**

Issues related to E-safety were not particularly prominent in the interview data. The findings showed that parents seemed confident with the practices that they implemented for the online safety of their children. However, it was revealed that their strategies were constrained to the activation of basic parental control settings.

E.g. Participant PB2: ***"I do modify some of the things on the iPad … For example, I set up the iPad for children only.*** *So, he is safe if he goes on 'YouTube'."*
E.g. Participant PB1: *"**I always get an email of every application he downloads, so I see it anyway."***

An observation that emerged from the data was that some interviewees were overly trusting of their children's abilities online.

E.g. Participant PB1*: "Nine times out of ten, he is around me.* ***His autism does not really keep him off track; it would only be if a suggested video came up. But again, he sticks to the same things."***
E.g. Participant PB3: *"**Even children with autism still understand that when mum or dad say 'no' it means 'no'.** So they understand that they cannot go on specific apps."*

Overall, parents seemed to be confident about keeping children safe online although in some cases, they were over-reliant on their children's ability to use technology.

6.5.2 Individual: Parents' Perspectives (Microsystem)

This theme provides an analysis of parents' personal views on iPads and training. It has been grouped under Microsystem as the perspectives of the participants directly influenced the iPad practices implemented at home (for more information, please see chapter 4).

- **Advantages-challenges of iPad use and views on training**

All parents seemed to favour the use of iPads for enhancing their children's skills and entertainment. Participants referred to the positive impact of tablets on academic progress, providing examples of use. Three interviewees stated that iPads developed the writing and fine motor skills of their children, while one participant referred to pronunciation and literacy.

E.g. Participant PB4: ***"Before the iPad, she was not interested in writing****…it was very difficult to give her a pen and paper. But iPads are more interactive so we thought of trying it …* ***I wanted her to learn somehow to write. It does not matter if it is with the iPad. And it has helped her so much actually."***
E.g. Participant PB3: *"****He does the 'funny things'…he has the 'Power Rangers' app on the iPad, and he practices letters and numbers on it. It has helped him because he started at an early age*** *with the 'Jolly Phonics' lessons on the app."*

Participants believed that some of the advantages of iPads related to their combination of learning and entertainment, immediate and clear guidance and explicit feedback regarding performance. Reference was also made to tablets positive influence on increasing children's independence and access to information. For example, one parent stated that the tablet allowed her child to find answers to school tasks or queries without relying on help from adults.

E.g. Participant PB1: ***"With the iPad, he does not always have to ask you for help to solve school tasks because he can go online and look for the answer.*** *Of course, if he gets stuck, he always says 'can you help me?'…****it does help him become more independent."***

Regarding challenges, only two participants reported being concerned about children's reliance on the devices, as their children preferred using iPads instead of pen and paper.

E.g. Participant PB1: *"**I did not want him to be really reliant on writing on the iPad**. But he is a lot better at that now.* ***That was my only problem…"***
E.g. Participant PB3: *"**Putting pen to paper is another matter and I do try to get him to do writing in every chance**. For example, for birthday cards. I have to write it out first, and then he copies the message* ***but he still does not like to write with pen and paper to this day."***

The perspectives of parents regarding iPad training were mixed. Half of the participants stated that they were open to training opportunities, and half were unsure. For example, PB2 and PB4 noted that they were confident about how they used iPads at home, highlighting that their approaches were based on the needs and interests of their children.

E.g. Participant PB2: ***"Half and half because at the moment I would say what he is watching is what he likes…****I am the one who controls the content* ***but it is always relevant to his interests and needs."***
E.g. Participant PB4: *"Actually…**maybe, I do not know if I would like to receive training** because now on the Internet you get a lot of stuff and resources available… I use the right things to comfort her**. Usually I ask her 'What would you like to have today?' and she chooses."***

In sum, parents appeared to value the use of iPads for developing the entertainment and learning skills of children. Participants mentioned specific characteristics of iPads that positively influenced children's progress, focusing on the combination of learning, entertainment, immediate-clear guidance and explicit feedback. All parents referred to iPads' positive influence on their children's academic skills, with only two participants being concerned about pupils' reliance on the devices. Finally, half of the participants were open to receive training, with the rest of the sample feeling confident about their implementation of child-centred approaches.

6.5.3 Contextual Influences (Mesosystem)

This theme collected information about home-school collaboration to explore the contextual elements that may have influenced how iPads were used at home. Based on Bronfenbrenner's Ecological Systems theory (1979), this theme has been allocated to Mesosystem (for more information, please see chapter 4).

- **Collaboration**

A recurrent theme in the interviews was a sense amongst participants that there was no collaboration between parents and practitioners about iPad use. For example, one parent reported that she was not even aware if tablets were used in her son's classroom.

E.g. Participant PB1: ***"I am not too sure about whether they use the iPad at school or not.*** *I do not know what they do with him now. If they use iPads,* ***I am not even sure how much they use it with him in the classroom****."*

Although all parents agreed that collaboration between practitioners and parents could positively impact children's progress with technology, they mentioned that they did not communicate with educators about iPad practices. Interestingly, one parent explained that she only received information about the apps used at school was through her son. As she explained:

E.g. Participant PB3: *"…the children have the iPads at school,* ***and if they have seen something on that iPad at school, and they want to see it again at home then they come and tell me...that way they are still learning. What they have seen at school they can learn it at home on the same wavelength and show us what they have done.****"*

Finally, another sub-theme that emerged from the data was the lack of collaboration between parents. All participants reported feeling confident about the way they used iPads with their children, and none of them reported exchanging ideas with other parents.

Overall, the findings revealed a communication gap between home and school relating to iPad use. Only one parent referred to her child’s role as a ‘channel of communication’ between the two settings. Interestingly, participants appeared to be confident with iPads, showing no intention to communicate with other parents about technology.

6.6 Conclusion

This chapter presented and discussed the findings from School B, which were gathered through interviews with five practitioners, four parents of autistic pupils, and the school's E-safety policy analysis. The findings provided answers to three of the main questions as summarised below:

1) ***What are the iPad practices that educators and parents implement for the SC and ER of autistic pupils?***
   - ***Educators’ iPad practices (Microsystem)***

The findings revealed that iPads in School B were initially used for recreational purposes. Interestingly, after the training, participants reported feeling more confident in integrating tablets into teaching for SC and ER, using flexible apps across the curriculum to meet pupils’ needs. SC was reported to be among teachers’ highest priorities, focusing on autistic pupils’ communication, socialisation, and engagement. Interestingly, educators did not seem confident about the ER term, referring to practices that targeted reward and motivation. Despite that, the findings revealed that they used iPads as tools to calm pupils down and encourage positive behaviours. The evidence showed inconsistency in the frequency of tablets' use in School B, with educators attributing this to their low confidence in using the devices, children's unpredictable behaviour and the school's limited resources. Practitioners reported selecting apps based on their ease-of-use, cost, content, pupils' needs and age, implying that they followed child-centred pedagogies to meet students' needs.

- ***Parents' iPad practices (Microsystem)***

The iPad use at home was child-centred, with parents selecting apps based on pupils' interests. All participants were positive towards technology use, stating that it combined learning and entertainment. The interviewees reported feeling confident in regulating iPads by implementing structured routines and practices based on the needs of children. iPads were used daily at home, mainly for recreational purposes, with parents also focusing on SC and ER skills. Among the target skills relating to SC were communication, vocabulary development and socialisation, while reference was made to ER and the use of tablets as emotional regulators. Examples involved the use of iPads to calm pupils down, while one parent mentioned using the tablet as a childminding device. Finally, although parents reported feeling confident in safeguarding their children online, two of them seemed to be over-reliant on parental control settings and their children's abilities to surf the Internet safely.

2) What are educators' and parents' perspectives on iPad use for SC and ER?

- ***Educators (Microsystem)***

All educators believed that iPads increased the collaboration and engagement of pupils in the learning process. Participants referred to the potential of tablets to personalise learning due to their flexibility to be implemented across the curriculum as multi-modal learning tools. Educators mentioned that the advantages of iPads were related to their ability in developing children's independence and confidence in the classroom. Speaking of challenges, the participants referred to their difficulty regulating the tablets, the lack of training opportunities provided in their school, and the high maintenance cost of the devices. Educators also stated that the repetitiveness and predictability that iPads offered were some of the reasons that attracted autistic pupils, while reference was made to their ability to be personalised. Practitioners acknowledged the role of training in developing their confidence with technology, expressing their interest in receiving in-class tutoring and recommendations of useful apps and practices. Finally, it was revealed that educators were not supported by a technology support network in school B, working with iPads independently.

- ***Parents (Microsystem)***

Parents appeared to value the use of iPads for developing the entertainment and learning skills of their children. Among their advantages were reported to be their combination of learning, amusement, immediate-clear guidance and explicit feedback. All parents referred to children's iPad use for recreational purposes, mentioning examples of pupils' progress in academic skills and communication. Speaking of challenges, two participants reported being concerned about the reliance of their children on the devices for writing, providing examples of practices applied to motivate children to use pen and paper. Finally, two of the participants mentioned that they were open to receive training, with two interviewees stating that they already felt confident about the way they used tablets with their children.

3) What are the reported contextual influences (enablers and barriers) to iPad adoption at home and school for SC and ER?

The findings revealed that the contextual influences that seemed to negatively impacted iPad practices in School B were related to the lack of collaboration between practitioners, the communication gap between educators and parents and the limited technological infrastructure of the school.

Beginning with the lack of collaboration between educators, the findings revealed that School B did not emphasise the integration of technology-based approaches into learning, with staff roles following a vertical hierarchy with distinct responsibilities. Similarly, the policy of the school did not seem to encourage co-operation and knowledge sharing between staff members, providing insights about the school's culture towards technology. Considering that the school did not have a computing action plan at the time of the data collection but adopted the E-safety policy of the Trust to cover technology use, it mainly focused on the online safety of the children.

Another potential barrier to successful technology adoption was the lack of collaboration between practitioners and parents**.** Some practitioners mentioned that this was associated with parents' lack of control over the apps that children accessed at home or their busy schedule. The communication gap was also verified by reports from parents, who revealed that they did not exchange views with practitioners about iPads. Interestingly, it was only one case where a parent reported that her child was the only channel of technology knowledge-sharing between the two settings.

Finally, the findings showed that the technological resources of the school impacted the way iPads were implemented in School B. Tablets were not enough to be shared between pupils and educators, creating difficulties in integrating them into teaching.

Interestingly, no reference was made to computers or other technological devices, while teachers did not seem willing to collaborate with their colleagues to share the devices.

Having presented and discussed the analysis from School B, the next chapter moves on to discuss the findings from both schools to explore a) what we learn from the key messages from across both case studies, b) how the main findings move our understanding forward, and c) the research contribution of the thesis in terms of new knowledge and relationship to theory.

Chapter 7: DISCUSSION OF KEY MESSAGES FROM THE TWO CASE STUDIES

7.1 Introduction

This chapter brings together the findings of School A (chapter 5) and School B (chapter 6) to situate autism and iPads for SC and ER in context and illustrate key messages from both case studies.

The first sub-section discusses the similarities and differences in how iPads were used in the classroom of the two schools to develop autistic pupils' SC and ER. It then examines how the different educational contexts influenced the confidence and perspectives of educators regarding iPads. Next, using Abbott's concept of 'E-inclusion' (2007), one of the conceptual frameworks of the study, the chapter explores the interaction of iPads, key stakeholders and context. The sub-section looks at the interplay between digital technology, context and people to identify how this relationship impacts the ways the two schools used iPads for autistic pupils' SC and ER.

Furthermore, the chapter adopts Bronfenbrenner's Ecological Systems theory (1979) to illustrate the hierarchy of the interactions among iPads, individuals and contexts in the *micro-, meso-, exo- and macrosystem*. The sub-section puts the learner at the centre of the analysis and discusses the dynamic relationships and influences between the developing person (autistic child) and the environment and their effect on the performance of the child with iPads. Finally, the chapter summarises the key messages from the two case studies and presents the contributions of the findings to the field of iPads and autism.

7.2 Addressing the Research Questions

The research questions that are addressed in this chapter are the following:

- What are the similarities and differences in the way iPads are being used in the classroom for SC and ER of different educational contexts?
- How do the different educational contexts influence key stakeholders' confidence and perspectives regarding iPad use?
- What does the interaction of digital technology, context and individuals look like in relation to autism and iPads in the classroom?
- What are the different levels at which iPads, individuals and context interact?

The following sub-sections discuss key points from the two case studies making connections to the literature (chapter 2) and the online survey findings (chapter 3).

7.2.1 What are the similarities and differences in the way iPads are being used in the classroom for SC and ER of different educational contexts?

This study took the approach that iPad implementation should not be constrained on the effectiveness of specific apps for autistic pupils' SC and ER. Therefore, it addressed the practices that were applied in the particular contexts and the conditions in which learning took place.

According to the findings, variances were observed in the way iPads were implemented for SC and ER in the Special (School A) and Mainstream Autism Resource Base (School B) settings, showing links to the different pedagogies of the schools. These findings are further analysed in the sub-sections below.

7.2.1.1 Pedagogy and teaching methods

The pedagogies and teaching methods adopted by the two schools relating to how iPads were implemented in each context differed.

Educators in School A reported using iPads for SC and ER as additional learning tools, combining teacher- and child-led approaches to develop the skills of autistic pupils. They also mentioned focusing on the personalised needs of pupils by integrating iPads into teaching as enablers and enhancers of learning through collaborative, engaging activities that encouraged inclusion. The pedagogical approach focused on the process of learning, using technology to support pupils to problem-solve, communicate and access information. Hence, the role of teachers was reported to be confined to empower students to become independent learners, using the iPads to adjust their teaching to the needs of the pupils.

At the same time, technology acted both as an assistive tool to develop skills in an engaging and entertaining way and as an enabler of learning by reducing the hurdles of students (Abbott, 2007). These findings support previous research, which has shown that educators who implement student-centred practices approach technology as a tool to support learning (Tondeur et al., 2018). They also agree with Abbott's statement (2007) that technology can be e-inclusive when its use is rooted in appropriate pedagogy and collaborative learning.

The use of multi-modal teaching approaches was also another characteristic of School A. Teachers were diligent in ensuring that tablets were applied in the curriculum as multi-modal learning tools, combining free flow and structured tasks to create the required conditions for developing students' SC and ER. Respondents reported using iPads to enhance pupils' SC and ER across various subjects, affirming the research on the value of technology as a tool to support learning (Chambers et al., 2018). In addition, the use of several applications and autistic pupils' access to a wide range of materials (e.g. audio-visuals, interactive apps) increased children's motivation, engagement and improved their overall educational experience.

Contrary to that, educators in School B predominantly implemented tablets for recreational purposes to entertain and calm pupils down. Practitioners did not report using structured practices as pupils accessed the devices independently. However, this was not related to their beliefs on the positive impact of iPads' student-centred approaches but their intention to keep pupils busy or calm. It could also be linked to teachers' low confidence with iPads and lack of training. For example, after the one-day training provided to practitioners by the researcher, their pedagogies and teaching practices with tablets started changing. They gradually implemented a combination of child-centred and collaborative approaches to include pupils in learning and develop SC and ER. This evidence highlights the impact of educators' understanding of pedagogy on successful technology implementation. The shift in iPad practices and the understanding of the need to connect technology with pedagogy has also been emphasised by Scanlon et al. (2013). In their paper, they mention that the focus should not be solely on the technology but its application process to enhance learning.

Considering that pedagogy brings together teaching and learning (James and Pollard, 2011) and that technology was not initially designed as an education tool (Geer et al. 2017), the findings suggest that pedagogy should be approached as an essential element for creating the conditions for rich learning experiences with technology. In line with this, the study highlights that iPads cannot improve students' SC and ER on their own. Besides, it is how educators use them that can enable authentic learning experiences (Shuler, Levine and Ree, 2012). Therefore, the attention should be on the important role of pedagogy in empowering teachers to think differently about their practices and the potential of technology to enhance learning.

In line with this, the analysis showed that educators believed that the adoption of student-centred, collaborative approaches with iPads improved the specific developmental areas of autistic pupils, allowing them to be more in control of their learning. Practitioners from School A reported that the combination of iPad practices with pedagogies that were not solely didactic developed children's SC and ER holistically by personalising teaching to meet their learning styles. Moreover, the implementation of iPads across the curriculum and the use of interactive-optimised apps showed technology's potential to increase pupils' involvement in learning and inclusion. Finally, the findings revealed iPads' dual role as assistive tools for SC and ER and enablers of learning for autistic pupils.

7.2.1.2 Social Communication (SC): iPads as multi-modal learning tools

Another point that arose from the analysis related to the different target skills and practices that the educators focused upon when using iPads with autistic pupils.

Respondents from School A indicated using iPads for a range of educational purposes highlighting the devices' positive impact on developing students' SC. As previously mentioned, practitioners implemented a combination of different pedagogies, which were equally valuable depending on the target skills and children's abilities. For example, teachers used specific apps for instructional purposes to improve the communication of pupils and more flexible software to enable collaborative learning for students who faced difficulties with social interactions. These findings reveal tablets' potential to offer opportunities for combined teaching approaches for SC depending on the needs of children.

Among the skills that respondents focused on in both schools were communication, engagement and socialisation, affirming the research findings from chapter 2 on the value of technology for promoting SC interactions (Ebert, 2018; Redman, Jakab and Carlin, 2014). The findings also showed that contrary to the inclination of previous studies to approach iPads as intervention tools focusing on specific apps (Aspiranti, Larwin and Schade, 2020; Petrov et al., 2017; Hourcade et al., 2013), teachers showed their preference for integrating tablets across the curriculum, using specific and flexible software to develop SC.

Specifically, in School A, which was technology-oriented, iPads were embedded in academic subjects combining specific and spontaneous learning experiences to target various skills and motivate pupils to use tablets imaginatively. For example, communication was seen as a functional skill but was also addressed as an entity of literacy and poetry following child-centred approaches depending on the level and interests of students. Interestingly, it was revealed that despite teachers' reference to specific apps for SC, overall variation was observed in the practices implemented. This means that the learning tasks were adapted based on students' needs, interests, and abilities, prioritising learning through involvement.

7.2.1.3 Emotional Regulation (ER): Usage variation and term ambiguity

The structured use of iPads to develop autistic pupils' ER did not seem to be among educators' highest priority in both schools. The analysis showed that although participants used iPads for this developmental area, they did not realise it. This could be related to their uncertainty of the term, which encouraged the researcher to provide a detailed ER definition before and during the interviews. However, despite the reported discrepancy in the approaches adopted by educators, it was revealed that they all had a common aim which was to calm pupils down and control challenging behaviour.

These findings provide insights into the affective and emotional aspects of technology in reducing autistic pupils' anxiety levels. In line with chapter 2, which highlights the potential of technology to reduce stress (Nunes, Castro and Limpo, 2020), the findings show another dimension of technology as a calming tool for autistic individuals. For example, educators from the two settings mentioned using flexible apps in a free-flow way to reduce the stress level and tempers of autistic pupils. Hence, ER was not taught through structured activities and was not embedded in the curriculum.

In line with the literature findings, which show that anxiety is one of the top challenges that autistic individuals face and can affect their school life (James Lind Alliance, 2020), it was identified that educators used iPads as behaviour management tools to also enable 'E-inclusion' through ER. This approach which acts as an addition to Abbott's concept (2007), relates to technology's predictable and simplified environment (Bölte et al., 2010; Battocchi et al., 2008; Bosseler and Massaro, 2003), which allowed autistic pupils to stay calm, manage challenging behaviours (Alhalabi, Carryl and Pavlovic, 2014) and be motivated to engage in learning.

Another interesting point that emerged from the data was that educators from both schools referred to reward or motivation as elements of ER. Although a few studies in the literature have provided examples of technology use as a reward for regulating the emotions-behaviour of pupils (Constantin et al., 2017; Lee and McCord, 2012), ER usually occurs in research as a cascade of other researched target skills such as engagement or social performance. This is also confirmed with the outcomes from this study which showed that teachers mentioned reward and motivation to refer to practices that mainly targeted calmness, distress reduction or elimination of children's outbursts. Therefore, consistent with the online survey findings (chapter 3), educators incorporated ER into other areas of development that were offered to autistic pupils with iPads. However, the findings provided insights about iPads' influence to reduce autistic pupils' stress and tempers when used as rewards or motivators.

Teachers' uncertainty of ER definition and inconsistency of relevant iPad practices relates to the literature findings (chapter 2) which demonstrate that this field has received little attention (Bakola, Rizos and Drigas, 2019). They also confirm previous research on iPads and autism, which shows that most studies have concentrated on developing individuals' emotional recognition or delivering treatments for specific skills such as anxiety (Firth et al., 2017b; Torrado, Gomez and Montoro, 2017). This is also verified by this study which showed that four practitioners from School A reported using specific software to teach pupils emotional recognition without referring to practices for ER.

Overall, educators' self-directed, experiential learning with iPads supported successful tablet implementation for ER in both schools. However, greater guidance could encourage more effective practices and integration of this developmental area into planning. Thus, consistent with the online survey findings (chapter 3), it is suggested that teachers' training needs should focus on areas not broadly associated with iPad use, such as ER. This is due to the technology's potential to regulate autistic pupils' behaviour by reducing anxiety and providing opportunities for 'E-inclusion' and learning.

7.2.2 How do the different educational contexts influence key stakeholders' confidence and perspectives regarding iPad use?

According to the literature review (chapter 2), teacher beliefs play an essential role in the use of educational technology and can be one of the factors that hinder or enhance technology integration into teaching (Leem and Sung, 2019). Following the data analysis from both schools, and in accordance with the online survey findings (chapter 3), it was revealed that teachers' beliefs about iPads were overall positive. However, their practices with tablets seemed to be influenced by their level of knowledge of this technology. This was particularly evident in School B, where it was observed that the training contributed to giving educators a new understanding regarding their practice, allowing them to envisage the use of iPads as assistive tools and enablers of learning. However, although teachers reported being more positive towards iPad integration, it was identified that established iPad pedagogies and practices seemed to be lacking.

Another interesting point that emerged from the findings of School A was that teachers who embraced technology in the classroom managed to improve the learning process, when given the necessary support and space to be creative and take risks with iPads. For example, as reported in chapter 5, School A teachers experienced agency and empowerment to collaborate, form teacher communities and work as 'researchers' to identify apps or teaching methods that could meet the individual needs of autistic pupils. Practitioners also participated in technology-related research projects to advance their practices and understand how to use iPads to enable learning. Teachers' sharing of creative, context-specific iPad practices and students' positive response had an impact on the sustainable use of technology in the school.

Minimal differences were observed in the perspectives of key stakeholders in different educational contexts relating to why iPads attract autistic pupils and the advantages of using tablets in the classroom. Beginning with the reported reasons for autistic pupils' interest in tablets, participants from both schools referred to the predictability, entertainment and repetitiveness of iPads. A few educators from School A (*n*=4) also stated that the ease of use of the devices was another reason for attracting students with physical disabilities and autism. Moreover, two out of five participants from School B indicated that iPads offering personalised learning based on students' needs and preferences, positively influenced the interest of pupils in using the devices.

These findings accord with earlier observations that showed that computers predictability, consistency and interactive learning displays may encourage autistic pupils' inclination to technology (Boucenna et al., 2014). They also provide insights about the ability of iPads to support inclusion by stimulating students to engage in learning, increasing their motivation, independence and creativity. Considering that the way technology is implemented can facilitate learning (Clark and Luckin, 2013), the evidence illustrates that the iPads in both schools were adopted as assistive tools and enablers of learning to meet students' needs and attract their attention. Hence, the reasons reported regarding children's interest in iPads were comparable and did not seem to depend on context.

Regarding practitioners' perspectives for the advantages of using tablets in the classroom, there was no significant disparity in the findings. Respondents from both schools referred to the potential of iPads to increase the independence and personalised learning of autistic pupils. At the same time, a few educators in School B referred to skills such as engagement and confidence. These results reflect the findings from chapter 2, which showed that technology can promote the self-esteem, functioning (Abed, 2018; WHO, 2018) and independence (Redman, Jakab and Carlin, 2014) of users. Moreover, consistent with the literature (Clark et al., 2015) and the findings from the online survey (chapter 3), participants' perspectives about the advantages of iPads appeared to be positive and not dependent on their level of training or technical proficiency.

On the contrary, practitioners stated that the educational context in terms of policy and curriculum, the availability of technological resources, training and collaboration seemed to affect their level of confidence in using iPads in the classroom. According to the opinions of teachers from both schools, confidence impacted lessons' productivity with iPads. This also accords with the statement of Ertmer and Ottenbreit-Leftwich (2010), who mention that *"one of the explanations for the gap between what teachers know and what they do relates to their confidence, or self-efficacy, for performing the task successfully"* (p.269). These findings are further analysed in the sub-sections below.

7.2.2.1 Policy and curriculum

Variances in schools' specialisation in SEND and policy and curriculum requirements appeared to affect teachers. School A educators were reportedly more confident in using iPads in the classroom and, thus, more interested in searching for new apps and technology-oriented practices. This could be related to the specialisation of School A in SEND and its focus on supporting the use of iPads in teaching with a detailed policy. Consistent with the literature (chapter 2) about the role of policies and legislation in ensuring the inclusion of devices into teaching (ITPro, 2020; DfE, 2017a), it was revealed that the policy and curriculum of School A positively impacted the confidence of educators in using iPads as additional learning tools and enablers of learning.

Besides, three out of four teachers from School B mentioned using iPads mainly for recreational purposes, showing that technology integration into teaching was not the school's highest priority. This is also supported by the document analysis findings, which showed that School B did not have a computing action plan in place but adopted the general E-safety policy of the Trust to cover the use of technologies in the setting. The findings showed that the school's E-safety policy did not provide clear guidance to educators on ways of embedding tablets into teaching. Therefore, differences were identified in what the policy recommended and what was performed in practice as reported by the interviewees.

The lack of computing policy and curriculum adjustments in establishing a model of operating procedure and learning standards with iPads appeared to influence the confidence of educators to use iPads in School B. Thus, the findings suggest that carefully planned provisions and regulations for technology use in schools can positively impact technology integration. They also affirm the research findings in chapter 2 on the value of statutory guidance and educational technology strategies to support educators overcome barriers to effective technology use in practice (DfE, 2021a).

Overall, these observations provide insights about the important role of school authorities in developing forms of regulation and guidance regarding technology based on the needs of contexts (Lennon, 2012).

7.2.2.2 Availability of technological resources

Differences in technological infrastructure and technical support in the two schools seemed to impact the confidence of educators in embedding iPads into learning.

According to the findings, the well-equipped technological resources of School A provided educators with opportunities to familiarise themselves with the devices before using them in the classroom. Moreover, the variety of hardware and software allowed them to use the resources based on both their technological efficacy and pupils' needs. Participants also reported that the variety in resources was accompanied by training and relevant technical support to maintain and keep the devices updated.

Contrary to that, three out of five practitioners from School B stated that the limited technological infrastructure and technical support in their setting had implications on integrating iPads into teaching. This was attributed to difficulties in finding an adequate number of iPads to use with pupils. Educators also referred to the challenges that the school faced in updating tablets' software and purchasing apps. These findings suggest that the insufficient quantities of iPads and teachers' limited preparation time could be associated with educators low confidence in embedding iPads into the curriculum.

This finding is consistent with previous research, which has shown that the familiarity of educators with the devices before teaching can help them feel confident with the technology and realise the scope of support they can offer to students (Chambers et al., 2018). Besides, the school technical provision appears to be crucial too. According to the literature, training and technical support are necessary elements in any new programs within educational contexts (Shin, Han and Kim, 2014). In this way, the availability and high-quality resources seem to be contextual elements that can support or undermine teaching with technology and educators' confidence.

7.2.2.3 Training and the role of specialised personnel for iPads

All participants reportedly mentioned training to substantially affect their level of confidence in using iPads for educational purposes.

School A educators stated that regular training developed their confidence in using iPads to support the needs of autistic pupils. Practitioners acknowledged the impact of the school's systemic support on increasing their skills-knowledge of iPad instructional practices and keeping them updated about the latest state-of-the-art software. Reference was also made to the frequency of training that School A provided, implying that technology-related continuous professional development was among its top priorities. A strong relationship between regular training and confidence in using technology has also been reported in the literature by Ertmer et al. (2012). Their paper states that professional development can increase teachers' knowledge and skills and positively influence their beliefs, reducing concerns related to technology.

Participants of School A stated that the Educational Technology Coordinator (ETC), an expert in iPad training for educational purposes, was an essential element for integrating technology in learning. Hence, ongoing support from specialised personnel for iPads impacted training and successful technology use in the classroom, transforming educators' practices and their capacity for instructional iPad implementation for SC and ER.

On the contrary, the findings from School B showed that the Lead ICT technician had a technical support role but a limited impact on iPads' implementation in-situ. Interestingly, educators from School B reported that the training provided by the researcher modified their perceptions of iPads from entertainment tools to enablers of learning. It helped them approach iPads as agents of change in their teaching, acknowledging the potential of technology to enhance autistic pupils' learning experiences. All four teachers who participated in the workshop referred to the influence of the content of the training on their practice. For example, educators mentioned the structure of the training and the in-class support as essential elements for familiarising themselves with iPad delivery options. Moreover, the presentation of practical strategies and recommendations of apps were reported as a resource for far-reaching changes in their practice and perspectives.

Hence, it could be inferred that the impact of specialised technology training by well-informed personnel has been broadly supported by the work of other studies that have linked the role of mentors with successful technology integration (Baker et al., 2019; Admiraal et al., 2017). In line with this, the current study found differences in the impact that the ETC (School A) and the Lead ICT technician (School B) had on educators' confidence to use iPads. Therefore, it could be argued that adequate training on iPad use should not only involve computing skills but it should also focus on the enhancement of pedagogical ways through practice and real-life examples (Cubukcuoglou, 2013). Given the variances in educators' technological efficacy and schools' needs, it is recommended that future research on iPad training investigates the impact of specialised personnel and their training delivery methods.

7.2.2.4 Collaboration and its impact on educators' confidence

Variances in schools' collaboration between key stakeholders also appeared to influence the confidence of educators with iPads in the two contexts.

All participants from School A acknowledged the role of co-operation in developing their knowledge and confidence of successfully embedding iPads in learning. Hence, school leadership support and policy regulations appeared to impact the creation of technology-related partnerships between educators. This is because they provided opportunities for sharing and exploring ways of integrating iPads in teaching. The findings accord with previous research, highlighting that effective technology integration necessitates commitment, support and collaboration at different levels (Lim et al., 2013).

The study demonstrated that teachers in School A benefited from observing their colleagues using tablets in the classroom, mentioning that this process expanded their iPad practices and confidence. They also elaborated on the collaboration that was cultivated inside and outside the school context and the creation of partnerships with external agencies and researchers. Contrary to that, the absence of guidance and support in forming technology networks in School B was related to the lack of shared vision regarding iPads. This is because the school did not stimulate dialogue between professionals about technology use in the curriculum. Hence, the autonomous use of iPads was associated with contextual influences such as inadequate school support. Based on these points, it can be argued that dynamic processes of interactions can contribute to successful technology integration into teaching and influence educators' confidence.

The evident variation regarding the technology collaborative partnerships in the two schools accords with previous research, showing that interdisciplinary partnerships can encourage knowledge dissemination, influencing and informing professionals regarding effective practices (Parsons et al., 2015a; Apple, 2020). It also illustrates that collaboration and exchange of ideas between practitioners may be as essential as formal training in developing and maintaining educators' confidence and skills in using iPads. This finding also provides insights into the importance of learning communities in offering space around a shared goal to connect, exchange ideas and learn from each other (Harvard University, 2021).

Hence, this study reveals that learning communities can be valuable components for educators' learning and instructional improvement (Turner et al., 2017) with iPads, influencing their confidence and culture towards technology. Moreover, the involvement of broader school communities and professionals is likely to strengthen educators' support network of technologies and give direct access to schools to examples of good practices and resources.

7.2.3 What does the interaction of digital technology, context and individuals look like in relation to autism and iPads in the classroom?

This question has been discussed under Abbott's concept of 'E-inclusion' (2007), which has been one of the study's conceptual frameworks (chapter 4). To analyse the interaction between these elements, three broad categories have been defined following the data analysis, namely 1) *Organisational Influences-Context,* 2) *Personal Influences-Individuals* and 3*) Technological Influences-iPad and iPad-*

related Practices. In this discussion, the term 'context' encompasses the school setting and the conditions in which learning took place. The term 'individuals' involves the practitioners, parents and autistic pupils based on their beliefs and perspectives regarding iPads. Finally, 'iPad' refers to the devices and the related practices and applications implemented in the two settings for autistic pupils' SC and ER. These findings are further analysed in the sub-sections below.

7.2.3.1 Organisational influences: Context

This sub-section focuses on the role of organisational influences such as school type, culture towards technology and training, in influencing the iPad practices that educators implemented in-situ for SC, ER and 'E-inclusion'. Therefore, it discusses the connection between context, individuals, and iPad practices taking into account the contextual characteristics of each setting.

- **School profile**

The research revealed differences in iPad practices between the two schools, which could be related to the different profiles of the settings. Although the two schools shared the same legislation, the staff from the Special school seemed to have additional qualifications in special needs. Moreover, they were experienced with iPads, open to new practices and had greater support from the management team in terms of iPad use in the classroom (computing policy, training). Thus, the level of vision regarding technology's potential to enhance learning and how it was shared among the teacher community appeared to be different in the two contexts.

These differences seemed to influence how iPads were used in the two schools and consequently, had an impact on the individual learner. For example, knowledge practices concerning the integration of iPads into learning did not seem to be adequate in School B, as teachers reported needing both pedagogical and technical support in using iPads. Such findings highlight differences in the interaction between practitioners, technology and context due to the different established modes of supporting teachers and learners in the two school profiles. This also involves variances in schools' needs (such as pressure on time, larger classes), staff's expertise, or differentiated programmes due to the different context. Thus, as mentioned in chapter 2, legislative recommendations may be important for successful technology integration into the curriculum. Hence, it is suggested that educational provision should also focus on different school profiles as they influence the practices implemented and the learning of the individuals.

- **School culture towards technology**

School culture also appeared to influence both the educators' perspectives of iPads and the practices implemented in the settings for children's learning. In line with the literature review (chapter 2), school culture is associated with technology use in the classroom and so it influences the effective integration of the devices into teaching (Gürfidan and Koç, 2016). The strong development orientation and active internal and external networking regarding iPads in School A allowed educators to engage in various forms of learning (such as observations of other teachers), while School B did not foster collaboration between teachers regarding iPads, mainly relying on educators' initiative and volunteering.

In addition, the findings revealed that participants from School A that had significant support from the senior management team were more confident and willing to involve iPads in their practice for educational purposes. This accords with earlier studies which showed that motivating educators with initiatives to integrate technology into teaching could be facilitated by good support services (Cubukcuoglu, 2013; Fathi and Ebadi, 2020). It is worth mentioning that school leadership plays an essential role in providing a supportive culture of technology-enhanced learning (DfE, 2019c).

Interestingly, the study identified possible links between implementing a shared leadership, which included teachers who were iPad experts (such as the Educational Technology Coordinator), and the strengthening of the technology vision in the school. This was translated into creating a rich social context where teachers who were more specialised in iPads were encouraged to support staff and provide technical assistance. The shared leadership model also focused on the use of iPads by or with autistic pupils, facilitating collaborations and communities where learners could work together. Thus, child-centred, collaborative approaches were prioritised in School A, considering the experiences and expectations of teachers and learners and creating the conditions for ‘E-inclusion’.

To sum up, it could be inferred that the shared leadership model and the school culture may constitute contextual elements that interact with the iPad practices implemented in the classroom. They might also influence the role of teachers in the learning process from passive participants of the school’s computing guidelines to agents of their practice.

- **The influence of training on teachers' practices with iPads**

The findings showed that the delivery of training in the two schools led to discrepancies in teachers' understanding of iPads' potential to promote 'E-inclusion' and influenced autistic pupils' educational experience.

Abbott (2007) highlights the need to focus on the role of pedagogy and training for effective use of technology, mentioning that *"the need for the future is more training rather than more technology"* (p.23). In line with this, the literature states that training of 21st-century pedagogies and tools, such as iPads, within teacher education programs, are required to increase teachers' confidence and skills (Broda, Schmidt and Wereley, 2011; Ertmer and Ottenbreit-Leftwich, 2010). Consistent with the literature review findings, the study revealed that the differences in tablet practices may be linked with educators' opportunities for various appropriate and well-resourced iPad training opportunities and the connection of pedagogy and technology practices.

Considering that 'E-inclusion' should be rooted in pedagogy and communities of learners (Abbott, 2007), the study revealed that School A trained educators to use tablets focusing on child-centred and collaborative pedagogies. Teachers' growing awareness of the link between pedagogy and teaching practices during training guided them to use iPads as multi-modal learning tools. Hence, tablets were implemented as assistive tools to enable pupils to overcome challenges. They were also used as enablers for learning, providing inclusion opportunities across the curriculum. This use of iPad for individualised learning increased children's involvement in learning, showcasing technology's ability to encourage 'E-inclusion' when connected with appropriate pedagogies and teaching methods.

Overall, it can be inferred that technology-related training seemed to offer educators the opportunity to explore the relationship between technology and pedagogy in meaningful ways and apply practices that met pupils' needs. Moreover, the different approaches in training and teachers' support noticed in the two schools shows a possible link between the impact of context on interactions among iPads, teachers and autistic pupils.

7.2.3.2 Personal influences: Individuals

This sub-section focuses on the role of teachers, parents and autistic pupils in creating the conditions within which iPads are implemented to support e-*inclusive* practices. Therefore, it discusses the connection between individuals, context and iPad practices taking into account the experiences and expectations of key stakeholders.

- **Influences from teachers' confidence and iPad uptake**

The data showed that teachers' confidence in using iPads seemed to have an impact on the way tablets were implemented in the two schools and on pupils' educational experiences.

Variation was observed in teachers' confidence between the two schools and the frequency of iPad use in the classroom. Practitioners in School A reported using iPads daily, showing confidence in implementing specific strategies to regulate their use (e.g. timers, 'now and next' cards) based on pupils' characteristics. Contrary to that, inconsistency was identified in pupils' iPad use in School B, with participants referring to children's behaviour and devices' availability as criteria to determine their frequency of use.

The relationship between confidence and technology uptake in the classroom has been explored by earlier studies in the literature which showed that users' personal characteristics, such as confidence, may influence how often technology is used in teaching (Anderson and Putman, 2020; Cheng and Xieu, 2018; Saudelli and Ciampa, 2016). In line with the literature review, this study identified that educators' technology uptake was related to their confidence and seemed to have an impact on their practices and pupil's educational experiences with the devices. For example, in School B, teachers reported not feeling confident to use iPads in the classroom due to autistic students' unpredictable behaviour. Moreover, the lack of technological resources was another reason for feeling unprepared to embed iPads in learning as they did not have enough opportunities to practice and prepare before the lesson. This finding confirms Kaur's statement (2019) that teachers' confidence and limited access to hardware may deteriorate the successful integration of technology in the classroom.

Overall, it could be inferred that School A teachers who had better access to resources and contextual support than School B educators, seemed to be more confident to embed iPads in their teaching. Thus, they provided frequent opportunities for pupils to access tablets for educational purposes, increasing their motivation and engagement in the learning process. In this way, the findings show that the interaction between educators' confidence and contextual support has the potential to create the conditions required for 'e-inclusive' practices.

- **Influences from autistic pupils and their parents**

As noted in chapter 2, the voices of autistic individuals are often overlooked in research (Spiel et al., 2019), with many studies failing to capture their perspectives, needs and desires. Similarly, researchers refer to the importance of home-school collaboration and its impact on the progress of pupils (Mintz et al., 2012; O'Reilly and Wicks, 2013). However, few studies have explored the use of tablets in home settings (Neikrug and Roth, 2015; Dixon et al., 2015). Based on these points, this section discusses how autistic pupils and parents interacted with educators and iPads and what this interaction looked like in practice.

The reflections and feedback of autistic pupils showed that their experiences with iPads were context-dependent. Children accessed tablets for different purposes at home and school, mentioning that at home they used them for entertainment and relaxation, while at school for educational purposes. In addition, pupils reported that at school, educators implemented collaborative models of teaching with iPads, encouraging children to work with their peers to complete tasks. In line with the literature, this finding shows that the use of iPads at school provided opportunities for powerful learning through the implementation of collaborative pedagogies that facilitated authentic learning experiences (Abbott; 2007; Shuler, Levine and Ree, 2012).

Interestingly, children's use of iPads at home for recreational purposes also revealed another dimension of technology's role as an enabler of learning through entertainment. Abbott (2007) states that technology can support the needs of the learners and facilitate 'E-inclusion' by combining leisure, learning, and independence. According to the findings, the high-level digital competence of the autistic pupils allowed them to network, socialise and learn through applications that met their interests and needs. Hence, children's daily use of iPads at home for recreational purposes, provided opportunities for independent access to learning and 'E-inclusion'.

Parental beliefs can also impact technology use at home and influence autistic pupils' progress and learning (Clark et al., 2015). In line with this, Fletcher-Watson et al. (2019a) highlight that parents should not be excluded from research as they also interact with technology. Considering these points, this study revealed that parents' perspectives towards iPads were overall positive. Participants indicated the importance of using tablets with their children as calming tools, behaviour supports, communication devices and transition tools between activities and contexts. However, despite technology's daily use at home, parents reported that they did not collaborate with teachers about this matter.

The identified home-school communication gap provided insights into the lack of interactions between the two contexts and the influence that this had on the iPad practices implemented and children's progress. Considering that autistic pupils seem to prefer specific routines (Dodd, 2015) and that knowledge-sharing can positively influence the development of autistic pupils (Guldberg, 2017), home-school partnerships should be a priority for both parents and educators. For example, parents' use of iPads as assistive tools for ER could provide valuable insights to teachers who were not confident in using technology for this developmental area. The recreational use of iPads at home could also broaden educators' perspectives of how learning could be achieved in a more free-flow and entertaining way and inform them of ways that learning can be facilitated outside educational contexts. Similarly, teachers' practices to develop academic skills could also be applied at home by parents. Based on these points, it could be inferred that the meaningful interaction between educators and parents can reveal powerful learning experiences of tablets use as assistive tools for SC and ER and enablers of 'E-inclusion'.

Although collaboration between home and school can be challenging due to parents' and educators' busy schedules, this study showed that pupils can play an important role in this process. According to the findings, one participant reported that her child worked as a 'channel' of communication between home and school, informing the parent about the apps that educators used at school. Although this finding is preliminary and it also depends on personal characteristics (such as pupils' skills and abilities), it may have important implications for situating children's role in fostering communication bridges between parents and educators.

Overall, the analysis revealed that the interaction between individuals (parents-children-educators), home-school and iPads was strong, as context seemed to be woven together with teachers', autistic pupils' and parents' iPad practices and preferences. Hence, these elements developed reciprocally and changed as a complex system. Based on these points, the findings help us understand that there is a necessity to bridge the gap between different contexts (e.g. home and school or between different schools) to allow knowledge sharing and achieve consistent use of technology and learning continuity across settings.

7.2.3.3 Technological influences: iPad and iPad-related practices

This sub-section focuses on the role of technological influences such as resources and iPad-related practices, in influencing the learning of the autistic individual in the classroom. Therefore, it discusses the connection between iPad and iPad-related practices with context and practitioners, taking into account how iPads were approached in the two schools.

- **Focus on application, not on technology**

According to the findings, technology use varied between the two schools, with School A emphasising practice more than the type of technology implemented. Contrary to this, the attention of teachers from School B was placed on the notion that purchasing better/more devices or upgrading the old software would improve technology integration into learning. Hence, educators' different views of iPads' role in teaching seemed to influence both their practices and the learning experiences of autistic pupils with the devices based on their own accounts of practice.

Abbott (2007) states that when technology is used to assist learning, it works as a supplement to the process rather than as an agent in which learning occurs. Hence, it should not have a central role in the teaching process but be used as a way to facilitate learning by helping individuals overcome specific challenges. The findings revealed that this was not the case in School B, where iPads were not embedded in learning, as teachers believed that the school's old software and devices were not adequate to meet autistic pupils' needs. Interestingly, after the training, practitioners approached iPads as assistive tools and extensions of learning, confirming previous research on the role of pedagogy and contextual support in transforming how technology is used by educators (Abbott, 2007; Scanlon et al., 2013).

The shift in the way iPads were implemented in School B after the training and the change in teachers' perceptions of technology's role in learning provided insights about the interaction between iPad-related practices, context and educators. More specifically, the findings revealed that iPads' efficacy in autistic pupils' learning appeared to be influenced by educators' perspectives of technology and could be in-turn related to the educational context. Therefore, it may be implied that technology needs to be studied in conjunction with the individuals' actions and the environment.

- **iPad-related practices**

Educators in School A reported using iPad-related practices that fostered rich and empowering learning opportunities for autistic pupils. Technology was implemented as a tool to scaffold learning in various ways and increase children's engagement, using teachers' knowledge of pedagogical content to personalise learning. Educators reported using collaborative, child-centred approaches, which in line with Abbott's concept of 'E-inclusion' (2007), enabled a supportive, holistic and inclusive use of technology. The findings showed that the iPad approaches in the Special school were based on socially constructed learning, which was applied across the curriculum linking formal and informal learning to achieve 'E-inclusion'. Hence, the process had positive results in developing autistic pupils' SC and ER skills, fostering the conditions for learning through collaboration.

The implementation of iPad practices in the two schools was motivated by children's learning outcomes and their enjoyment and engagement when using technology.

Children's responsiveness to iPads and their effective integration into the curriculum by educators offered opportunities for 'E-inclusion' through structured and free-flow practices. IPads were also implemented in-situ to reduce the stress levels of autistic pupils and regulate challenging behaviours. Following Abbott's statement (2007) that technology can offer new pedagogical models when combined with reflective spaces and practices, these findings add another dimension to how Abbott has defined the different uses of technology. More specifically, they highlight technology's multidimensional role as an assistive tool for SC and ER, an enabler of learning and as a mean for regulating emotions.

Overall, the evidence generated regarding the role of iPads in teaching and their impact on practices and autistic children's learning provides insights about any type of technology use and application to teaching and learning. The literature review findings revealed that previous research in autism studies focused on specific technologies and their effectiveness in certain areas of difficulty (Valencia et al., 2019; Den Brok and Sterkenburg, 2015). However, the implications of this research could be broader. While the discussion of this study centred around iPads for autism, many of the points covered above could be relevant to other types of technologies, schools, forms of educational support and skills.

The findings of this study confirmed that technology practices interact with organisational, personal and technological elements and are influenced by them. Contrary to the approaches of previous studies which used specific technologies as support tools for autistic pupils (Kaur and Pany, 2016; Singhal and Garg, 2019; Grynszpan et al., 2013), this discussion recognises technology's role as an enabler of learning. More specifically, it emphasises the impact of technology on developing

SC and ER and thus facilitating ‘E-inclusion’. It also encompasses the role of contextual influences and individuals’ attitudes in integrating technology into learning, identifying the conditions required to enhance SC and ER in school environments. Therefore, it provides a more in-depth exploration of what happens in-situ, revealing insights about technology enhanced learning teaching and e-inclusive practices that could be considered in other forms of technology research.

7.2.4 What are the different levels at which iPads, individuals and context interact?

To get an insight about the different levels at which iPads, individuals, and context interact, Bronfenbrenner’s Ecological Systems theory (1979) has been implemented. Thus, this section discusses the dynamic relationships and influences between the developing person (autistic child) and the environment, focusing on the hierarchy of their interaction and its impact on how iPad use influences children’s performance. The discussion is based on the adapted visual representation of Ecological Systems theory designed according to the study’s scope (see chapter 4, Figure 4-2). These findings are further analysed in the sub-sections below.

7.2.4.1 Microsystem Level (Home-School-Peers)

- **Educators**

The role of teachers is widely acknowledged in the literature as facilitating access to the curriculum, focusing on the needs of learners (DfE, 2013c). The analysis of the findings revealed that the delivery of teaching with iPads by practitioners appeared to be affected by their confidence in using technology. Educators from School A seemed to perceive the integration of iPads into teaching as significant due to their positive impact on the progress of autistic pupils. However, teachers' beliefs of technology were not enough to ensure successful iPad incorporation into learning. Consistent with the findings, it was discovered that the educational context (Exosystem) was an essential element to consider in this interaction. This was emphasised by the findings from School B, where teachers reported that contextual elements such as lack of resources or school support created challenges in embedding iPads into teaching despite the devices' positive impact on pupils' progress.

Although technology has been widely used in teaching and learning (Voogt et al., 2018), identifying ways to support teachers to integrate it effectively into learning remains an issue. The literature (chapter 2) highlights that school factors such as structure can impact how students access technology. In line with this, the findings of this study revealed that although educators in the Microsystem were the connecting link between autistic pupils and their access to iPads, organisational challenges (Exosystem) such as school support, training, resources indirectly influenced the sustainability and effectiveness of iPad practices.

Based on these points, it could be inferred that although educators' practices and beliefs can directly impact children's learning with iPads (Microsystem) and are the more influential elements in the system, they are not always enough to change the school's culture towards technology (Exosystem). Hence, elements of the Exosystem can have significant implications on teachers' practice (Microsystem) and, in turn, on the child's educational progress with iPads.

- **Parents and peers**

Parents had a direct impact on children’s access to iPads at home, as they were the binding agents between the two. The analysis revealed that the iPad practices that parents implemented were not influenced by the context, as the children appeared to be the main agents of iPad use at home. For example, parents reported that the selection of apps and the way tablets were used depended on children’s preferences and interests. Thus, a connection was identified between children’s access to tablets, their progress and their interests. This means that although parents directly impacted children’s learning at home by giving them access to iPads, they did not serve as facilitators of learning with technology. Besides, their role was mainly confined to stimulating children’s interests and motivation to develop skills independently through informal learning.

Regarding the interaction between autistic pupils and their peers, the findings showed that this relationship directly influenced the way autistic pupils used the devices at home. The analysis implied that children fostered interactions with their friends as they used online communication tools to socialise and connect. Interestingly peers did not seem to influence the iPad use at school or autistic pupils’ interaction with the devices. This may be associated with teachers’ central role in regulating technology practices in the classroom and giving access to specific software. Thus, the direct influence of peers on autistic pupils’ learning with iPads was linked with the home use of the devices.

Overall, although practitioners, parents and peers seemed to directly impact on the development of autistic pupils’ skill with iPads in the Microsystem, their level and type of influence varied depending on the context where they operated (home or school).

7.2.4.2 Mesosystem Level

- **Collaboration with other professionals**

The findings of the study provided insights into how educators developed collaborations within and between professionals who worked around autistic pupils, as collaboration is an essential component of effective technology integration into teaching and has been widely acknowledged by researchers in the field (Parsons et al., 2020; Guldberg, 2017; Porayska-Pomsta et al., 2012). The analysis suggested that practitioners in School A had established communications with their colleagues and external agencies compared to teachers in School B (Mesosystem). This could be associated with differences in the schools' contexts, technology culture and expertise (Exosystem). For example, teachers' difficulty to navigate the complex system of School B (Exosystem) due to its structured vertical hierarchy of roles, provided limited opportunities for developing interconnections between colleagues.

The variances in partnerships and levels of collaborations in the two schools could also be associated with the different perceptions in schools of the value of technology (Exosystem) in meeting autistic pupils' needs and fostering e-inclusive practices. This was evident in the different support levels provided in Schools A and B regarding knowledge sharing and training. For example, the iPad support in School B was confined to the role of the Lead ICT technician, whose responsibilities were to provide technical support to the staff, maintain the devices and purchase software. On the contrary, the Educational Technology Coordinator in School A was the connecting link between collaborations within the school and the community. Moreover, his role focused on providing teachers educational support in view of iPad integration into the curriculum.

Taking everything into consideration, the findings showed that collaboration occurred at different levels in the two contexts (Mesosystem) and directly impacted the iPad practices implemented in the classroom (Microsystem) and autistic pupils' learning. As it was revealed, the stronger the collaborations between professionals and support networks in schools (Mesosystem), the more complex and robust connections were established within and between major settings (e.g. school and external agencies), involving more specialist personnel around the learner. Moreover, it was evident that when the partnerships in the Mesosystem were solid, the influences of outer systems (such as Exosystem or Macrosystem) in the Microsystem were more straightforward as the partnership networks worked as connecting links between the different systems.

- **Collaboration with parents**

The literature reveals (chapter 2) that parents also interact with technology and being the advocates of their children, they should not be excluded from research (Fletcher-Watson et al., 2019a). However, although previous studies have mentioned the importance of home-school collaboration for autistic individuals' progress (O'Reilly and Wicks, 2013), few studies have explored the use of tablets at home (Neikrug and Roth, 2015; Dixon et al., 2015).

Following these statements, the analysis provided insights into the relationship between parents and practitioners regarding iPad use for autistic pupils. The findings revealed a communication gap between the two, with most parents conceptualising educators' role as academic knowledge disseminators with limited time to discuss technology-related issues outside school. Even in the Special school, which was technology-oriented, teachers viewed their roles as providing information and advice to families regarding E-safety and did not focus on informing parents about specific apps or practices. Parents believed that their and teachers' responsibilities with iPads were different, as were also their values towards technology. Therefore, although they acknowledged the importance of collaboration between home and school, they did not form partnerships related to iPad use.

The findings show that rich Mesosystem links between elements of children's Microsystems should not be assumed. Besides, attention should be placed on exploring the different values that might characterise elements of the Microsystems and their influence in forming interactions. For example, according to the analysis, parents' and teachers' varied values on technology use and practices, influenced the communication between home and school. Teachers' misinterpretation of the iPad practices implemented at home and vice versa refrained all parties from working towards a shared iPad goal. These findings imply that establishing common values between elements of the Microsystem could be the supportive link for developing autistic pupils' performance with technology.

The indirect links within and between home and school settings were weak as communication did not seem to be effective or bi-directional. However, increasing parental involvement and children's dynamic role of their 'multi-setting participation' could foster iPad learning continuity between home and school. Following the data analysis, it could be stated that children could have a dynamic role in this process as communication bridges between educators and parents. However, this depends on children's ability level and the openness of contexts to create strong relationships.

To sum up, it could be inferred that the home-school communication gap (Mesosystem) seemed to affect how iPads were accessed by children in the two contexts (Microsystem), highlighting that the weak collaborations in the Mesosystem created challenges to effective iPad integration and learning continuity. Therefore, the study suggests that knowledge-sharing opportunities should be encouraged between contexts combining teachers', parents' and children's practical experiences without prioritising one type of knowledge over the other (Parsons, 2020).

7.2.4.3 Exosystem Level (Leadership Structure-School Culture)

The participants referred to the school leadership revealing that it had an impact on the successful integration of technology in the two school environments. More specifically, school support, structure, technological infrastructure, technology-related culture and collaboration were some of the reported elements that influenced this process. This also accords with previous research which has highlighted the role of leadership in promoting commitment to change (Rabah, 2015; Gürfidan and Koç, 2016), verifying the notion that school leaders (such as headteachers) play a central role in this process. The data showed that the leadership of School A (Exosystem) promoted the use of iPads in the classroom and provided continuous support to practitioners to integrate tablets into teaching (Microsystem). Moreover, the leadership structure of School A provided the conditions for collaboration between professionals within and around the school community (Mesosystem), showcasing the school's openness to knowledge sharing. In line with this, the headteacher's initiative to engage educators in developing iPad guidelines created a feeling of belonging, indirectly influencing the attitudes and behaviours of staff towards iPads (Microsystem).

The leadership (Exosystem) also seemed to affect the type of support that educators received regarding training and influenced their practices with iPads (Microsystem). For example, School A, which placed professional development at the centre of the computing policy and was well-equipped with facilities, maximised educators' motivators for integrating technology into learning. Moreover, teachers' internal and external influences with other professionals within and around the learner's immediate environment raised awareness in the school about the positive impact of technology in learning. Consequently, the relationship between the school's leadership team (Exosystem) and teachers' beliefs and practices towards technology (Microsystem) appeared to be bi-directional and indirectly influenced each other.

The study also revealed that the culture of School A and B towards technology (Exosystem) indirectly shaped educators' perspectives of iPads and their practices (Microsystem). For example, School A, which was technology-oriented, followed specific technology integration guidelines based on collaboration, common decisions, and a shared vision. Hence, educators were enthusiastic and eager to use iPads as elements of their teaching (Microsystem). Contrary to that, School B did not provide support to teachers about how to integrate iPads in teaching (Exosystem), and educators did not prioritise their use in learning. In line with these points, the literature shows that school culture can serve both as a guide for technology integration and a mediator of teachers' identity (Yang and Chun, 2018). Hence, a positive school climate and adequate support has the potential to increase the use of technology in learning (Gürfidan and Koç, 2016).

The structure of schools also indirectly influenced educators' practices with iPads. According to the findings, the computing policy of School A impacted on the practices that educators implemented (Microsystem), as it provided clear goals and guidance of how iPads should be embedded in teaching. Contrary to this, the lack of computing policy in School B impacted teachers’ confidence to use iPads and their ability to commit to specific practices. Considering that the policies were shaped based on the schools' cultures, School A seemed to prioritise more educational technology integration than School B. In line with these points, it could be argued that computing policies with clear goals can be essential incentives for fostering technology integration in schools and should not be under-estimated.

Overall, the study showed that elements of the Exosystem such as school structure (such as policy, resources), leadership and culture may impact educators’ practices with iPads (Microsystem). Hence it is suggested that these elements of the outer school system (Exosystem) which shape technology decisions in schools and indirectly influence autistic pupils’ learning with technology should not be studied in isolation.

7.2.4.4 Macrosystem Level (Education system, national curriculum, SEND legislation)

As mentioned in chapter 2, educational technology has created expectations in both mainstream and special needs settings and has become an essential component of the national curriculum in English schools (DfE, 2013b; DfE, 2020b). In line with this, various technologies have been used in schools to meet the needs of pupils, including tablets, laptops and interactive whiteboards (Barna, 2020). However, teachers' support to integrate technology effectively in the classroom remains an issue, possibly due to the fast-paced evolution of technological innovation (Bloomberg, 2015). With the potential of technology to support the needs of pupils with SEND, several provisions and regulations have been developed in the UK over the past years.

The findings of this study showed that although the overarching patterns of the education system and national curriculum were entrenched in both schools, the SEND legislation regarding technology integration in teaching was more influential in the Special school. This also accords with earlier observations which demonstrated that successful technology integration in schools could be affected by factors such as appropriate policies and provision of the facilities (Voogt et al., 2018). Therefore, it is likely that the specialisation of School A in SEND and iPads, the school's adapted curriculum based on pupils' special needs and the sufficient level of teachers' autonomy and involvement in technology-planning had an impact on the way iPads were implemented.

According to the data, the Macrosystem incorporated key drivers for change in the two educational contexts, which were deeply embedded in the remaining systems. However, the findings showed that although curriculum, legislation, educational values or practices shaped the Macrosystem, they were not enough to completely influence teachers' practices and ideologies towards technology (Microsystem). For example, as observed in School B, technology-related guidelines and strategies were underused due to contextual influences such as lack of training, poor technological infrastructure (Exosystem) and teachers' low confidence in using iPads (Microsystem). Hence, the Macrosystem's pathway to reach the learner was the most remote and did not have a great impact on autistic pupils' learning with iPads as it was influenced by elements of the Exosystem and Microsystem.

The findings also provided insights about the opposite process, which involves children's influence on the Macrosystem. According to the analysis, it was highlighted that autistic children's power to alter decisions about any issue affecting their learning (such as technology use) was not feasible, as the broader societal values (Macrosystem) defined curriculum and legislation. This point raises questions about students' right to contribute to school decisions affecting their learning. Although student voice is deep-rooted in the concept of children's rights (UN, 2009), the findings showed that their views and opinions regarding iPads were not considered. Hence, this study suggests that opportunities to expand research in context at the distal Macro- and Exo-levels should also be encouraged, involving autistic children as actors and advisors of meaningful iPad-related practices.

Overall, the findings showed that Macrosystem can indirectly influence teachers' practices and autistic pupils' learning with iPads, as legislation and curriculum shape the learning goals of schools and the practices adopted. However, schools' specialisation and contextual characteristics (Exosystem) seem to also affect the decision-making process regarding technology's role in learning. Based on this, it is important to align the elements of the Macrosystem with elements of the Exosystem and understand how they can effectively support technology integration in-situ. Finally, it is recommended that attention is given to autistic pupils' role in this process and their power to influence/inform decisions related to their learning.

7.3 Conclusion

This chapter addressed four research questions of the study by combining and discussing the findings that emerged from School A (chapter 5) and School B (chapter 6).

In relation to the first research question, the chapter explored the variances in the way iPads were implemented in the classroom of the two educational contexts for the SC and ER of autistic pupils. The analysis illustrated discrepancies in schools' teaching methods and approaches which seemed to be related to different pedagogies. Regarding SC, educators from School A reported using iPads as multi-modal learning tools across the curriculum, implementing child-centred collaborative pedagogies to enable learning. Contrary to that School B, mainly used iPads for ER to calm pupils down and reduce challenging behaviours, revealing technology's positive impact on regulating autistic pupils' emotions. In general, iPads were applied in both schools as assistive tools for SC and ER and enablers of learning, depending on teachers' technological efficacy.

The chapter also addressed the second research question by discussing how the different educational contexts impacted key stakeholders' perspectives and confidence regarding iPads. The findings indicated minimal differences in teachers' perspectives related to why iPads attract autistic pupils and the advantages of using tablets in the classroom. Moreover, educators' beliefs towards iPads were overall positive and did not seem to be influenced by their technology skills. However, it was revealed that the educational context in terms of policy and curriculum, availability of technological resources, training from specialised personnel and collaboration had an effect on teachers' level of confidence in using iPads in-situ.

The third research question analysed how the interplay of iPads, context and individuals looked like in practice, using Abbott's concept of 'E-inclusion' (2007). The findings showed that in both schools, a) organisational, b) personal, and c) technological components interacted and influenced how educators used iPads in the classroom. The discussion focused on the connection between context (school profile, culture, training), individuals (practitioners'-children's-parents' perspectives and preferences), and iPads (practices), revealing an additional dimension to Abbott's concept of 'E-inclusion', which refers to technology role as an enabler of learning through ER.

Last but not least, the fourth question provided insights into the different levels at which iPads, individuals, and context interacted (*micro-, meso-, exo-,* and *macrosystem)* by discussing the dynamic relationships and influences between the developing person (autistic child) and the environment. The analysis focused on the hierarchy of different environments showing that educators, parents and peers (Microsystem) directly affected the child's learning with iPads. Moreover, the study identified a collaboration gap in Mesosystem between home and school, highlighting the need for shared common values across contexts to establish learning continuity. Finally, the discussion illuminated the indirect influences from the Exosystem and Macrosystem which shape school decisions regarding iPad use.

Overall, the analysis of the findings from the two case studies offers several contributions to the research field of iPads and autism. Firstly, the study informs the literature about the differences in pedagogy and teaching methods adopted in the two different educational contexts and their impact on the role of iPads as enablers of learning and assistive tools for SC and ER. Also, it reveals the contextual conditions that can influence key stakeholders' perspectives and confidence regarding iPads.

Moreover, the implementation of Abbott's concept of 'E-inclusion' (2007*)* situates technology and autism in context and offers valuable outcomes about the complex interaction between educational environments, key stakeholders and iPads. Also, the study adds another dimension to the way Abbott (2007) has defined the different uses of technology revealing the iPad's role as a tool for ER. Finally, the thesis adopts an approach based on Bronfenbrenner's Ecological Systems theory (1979) to put the learner at the centre of the analysis and illustrate the hierarchy of the interactions among context-key stakeholders-iPads and their different level of influences on the learning of the autistic pupil.

The next chapter moves on to discuss further contributions and concluding points based on the findings of this and previous chapters.

Chapter 8: CONCLUSIONS

8.1 Overview of the Chapter

The final chapter of the thesis provides a summary of the study by reflecting on the steps followed to answer the overarching research question. It then presents the contributions of the thesis to theory, methodology, knowledge and practice discussing broader implications. Next, the chapter expands on the strengths and limitations of the study, providing suggestions for future research. Finally, it ends with major concluding points about the value of this research for the field and key messages for future work.

8.2 Summary of the Study

The main goal of the current study was to explore the perspectives of key stakeholders about practices relating to using iPads for autistic pupils' SC and ER. To position the thesis in context, an extensive review of the literature was performed to identify gaps that needed to be addressed, followed by an online survey, which presented a snapshot of iPad practices and support offered in different school settings for SC and ER. Having provided an overview of how iPads and autism were contextualised in theory (chapter 2) and practice (chapter 3), two case studies were conducted in two schools (Special and Mainstream Autism Resource Base settings) to explore in-depth practice in-situ. The findings of each case study were evaluated and analysed using Bronfenbrenner's Ecological Systems theory (1979) and Abbot's concept of 'E-inclusion' (2007) as conceptual frameworks. Finally, the findings were brought together and discussed leading to the final concluding and contributing points of the thesis.

More specifically, the detailed literature review of educational technology in the field of autism shaped the study's focus, emphasising previous research on iPads for SC and ER. Together the findings identified research gaps and provided insights about the importance of situating autism and technology in context as an enabler of learning, including the perspectives of key stakeholders. Next, an online survey was designed and distributed in primary schools across England to collect an overview of iPad practices implemented in schools for autistic pupils' SC and ER. Also, the aim was to explore the impact of context on practices and collect professionals' perspectives.

To drill down into the detail and take a closer look at practice in-situ from the stakeholders' perspectives, two case studies were conducted in a Special school and a Mainstream Autism Resource Base setting. The methodology that provided the basis for analysing the schools' findings was informed by the study's research questions, philosophical underpinnings and theoretical concepts. To investigate the topic from different angles, the two case studies included interviews with key stakeholders (educators, autistic pupils, parents) and document analysis of the schools' computing and E-safety policies.

The data from the case studies were analysed following Braun and Clarke's six phases of thematic analysis (2006). Moreover, to inform the lines of enquiry and data interpretation Bronfenbrenner's Ecological Systems theory (1979) and Abbott's concept of 'E-inclusion' (2007) were implemented. The aim was to explore what the interaction between iPads, key stakeholders and contextual elements looked like in practice, illuminating the different levels at which they interacted. The findings provided answers about a) the iPad practices for SC and ER implemented in Schools A and B, b) educators', parents' and autistic pupils' perspectives on iPad use for SC and ER and c) the relevant contextual influences (enablers and barriers) to iPad adoption at home and school.

To situate autism and iPads (for SC and ER) in context and illustrate the key messages from both case studies, the findings of the two schools were brought together and discussed. Broader implications about the variances in the way iPads were adopted in the two settings were produced, focusing on the interplay of digital technology, context, and people. Finally, putting the learner (autistic child) at the centre of the analysis, the hierarchy of the interactions among iPads, individuals and contexts and their effect on the child's performance with technology was illustrated.

8.3 Thesis Contributions and Broader Implications

This thesis explores how iPads are implemented in-situ for the SC and ER of autistic pupils by situating technology and autism in context. It does this by a) analysing practitioners', parents' and autistic pupils' perspectives about the practices relating to using iPads for SC and ER at school and home, b) evaluating the impact of context on iPads' implementation process, and c) investigating the interaction between participants, iPads and context and their influence on the adopted practices in the classroom. Thus, the study makes the following contributions and recommendations in theory and practice to the topic of iPads and autism for SC and ER:

- ***Performs a thorough review of the literature on the subject of autism and technology and conducts a critical assessment of the work done in previous studies on iPad use for SC and ER.***

A comprehensive literature review was conducted regarding autism and technology use in the classroom, focusing on iPads' use for SC and ER. The research progress to-date and prospects in the field were extensively collected and discussed. Information was gathered from several sources (books, evidence-based articles, peer-reviewed journals, technological-educational conference proceedings/papers, dissertations, theses, and credible online sources), concentrating on the decade 2010-2020 when iPads were first launched and the concept of mobile technology integration into learning evolved. The specific gaps identified in the literature combined with the online survey findings provided a comprehensive view of how iPads for SC-ER and autism are situated in-situ both in theory and practice, informing the study's research questions and providing motivation for further investigation.

- ***Explores key stakeholders' perspectives about practices relating to using iPads for SC and ER at school and home, by implementing a comprehensive research design.***

The study provides a detailed research design approach to capture and analyse key stakeholders' perspectives about practices relating to using iPads for autistic pupils' SC and ER in context. This is achieved by applying a mixed-methods approach (online survey, interviews, document analysis) to investigate iPad use for SC and ER in-situ. Moreover, it adopts the required ethical considerations to include in research vulnerable populations and collects the perspectives of autistic pupils, parents and educators (teachers, teaching assistants, educational technology coordinators, speech and language therapists, Lead ICT technicians), focusing on two different contexts (a Special and a Mainstream Autism Resource Base school). Finally, the study adapts Abbott's (2007) and Bronfenbrenner's (1979) conceptual frameworks accordingly, to develop a dedicated methodology with consistent language and structure for data interpretation and analysis.

- ***Provides an extensive analysis for iPads' use for SC and ER and evaluates the impact of context on the practices implemented in the classroom.***

The study provides insights into the way iPads are being used in the classroom of a Special and Mainstream (Autism Resource Base) school. It also explores the extent to which educators are able to apply iPads for SC and ER, the challenges they experience and the degree to which training impacts on their practice.

This information could be used for the development of teacher and parent training programmes or advise the delivery techniques of such programmes in the field of mobile technology and autism relating to practical applications for SC and ER. This way, it could also assist towards developing new or evaluating any existing related guidelines.

Moreover, the study situates iPads and autism in context by evaluating aspects that might enhance or hinder the use of iPads in the classroom and addressing the impact of different educational settings on key stakeholders' perspectives regarding iPad use. In addition, it examines the interplay between them and iPads in each of the two schools (the Special and the Mainstream Autism Resource Base setting), aligning the interactions with the respective context.

Finally, the thesis contributes to the underexplored research area of iPads' use for ER, providing recommendations to future educational research on the use of mobile technologies for this developmental area. It also sheds light on children's and key stakeholders' preferences and experiences in using tablets for ER, helping future studies and software designers target needs that will be meaningful for the end-users.

- ***Investigates the various levels at which key stakeholders, technology (iPads) and context interact and the way they influence the practices adopted in the classroom, by applying a combination of two conceptual frameworks.***

The study Illustrates the way in which an appropriately adapted approach of Bronfenbrenner's (1979) and Abbot's (2007) conceptual frameworks can benefit the investigation of the complex interaction between context, individuals and technology. As mentioned in the literature although there were many other research works that analysed their findings through Bronfenbrenner's Ecological Systems theory (Hewett, Douglas and McLinden, 2021; McLinden et al. 2020; Odom, 2018), there has not been identified any related work to apply these two conceptual frameworks explicitly to explore iPad use in-situ for autistic pupils' SC and ER. Thus, this study contributes to previous research, which highlighted the need for future studies to focus on the role of context in educational technology research (Rosenberg and Koehler, 2015; Tondeur et al., 2017).

More specifically, this work presents the application of a combination of conceptual frameworks to situate iPads and autism in the classroom and provide a better understanding of how aspects of the environment support or undermine learning with technology. Abbott's concept of 'E-inclusion' (2007) has been applied to analyse the interaction between digital technology, context and individuals focusing specifically on autistic individuals, related key stakeholders and iPad use in-situ.

Moreover, Bronfenbrenner's Ecological Systems theory (1979) has been implemented to provide an approach to understanding the hierarchy of interactions and their effect on the child's performance with iPads. The contextualisation of the user's experience and how he/she interacts with iPads and other key stakeholders has encompassed the broader environmental elements that influence the way tablets are implemented in the classroom. It has also provided insights about technology's role beyond one user, one device or one application.

- ***Informs the literature by providing educators', parents' and autistic pupils' perspectives regarding the in-situ (home and school) use of iPads for SC and ER.***

The findings from this thesis contribute to previous research, which emphasised the need to involve in technology studies the perspectives, experiences and interpretations of key stakeholders with a focus on autistic individuals (Fletcher et al., 2019b; King, Brady and Voreis, 2017; Sulaimani, 2017).

Specifically, King, Brandy and Voreis (2017), in their paper that collected the perspectives of education professionals on tablet use with children with autism, suggested that future research should involve parents' viewpoints. Following their recommendations, this study contributes to their paper by moving a step further to include educators', parents' and autistic pupils' perspectives. The participants' experiences have been approached as the central features of this thesis, capturing how iPads are used for SC and ER at home and school.

Thus, the findings provide insights about home/school iPad practices and priorities for SC and ER, generating meaning and recommendations from the unique lived experiences of the participants to inform future research. Consistent with previous research, this study's approach produces results that are relevant to individuals' lives and are likely to positively affect them (Fletcher-Watson et al., 2019b; Parsons et al., 2020).

- ***Suggests pointers to practice illustrating iPad's role as an enabler of learning through ER and adds another dimension to Abbott's concept of 'E-inclusion' (2007).***

As identified in the literature (chapter 2), there is little information in the field about how technology can help autistic pupils manage emotions (particularly anxiety). Though, based on the findings of this thesis, it was identified that the iPad was used as a tool for emotional regulation and behaviour management, particularly in the way it was implemented at home. In the school contexts, the iPad was approached both as an assistive tool for SC and ER and an enabler of learning to facilitate inclusion. These findings add another dimension to the way Abbott has defined the different uses of technology for 'E-inclusion' (2007), illustrating technology's role as an enabler of learning through regulating emotions.

Hence, the thesis suggests pointers to practice as iPads have the potential to support ER by reducing autistic pupils' stress levels and challenging behaviour especially considering that rates of anxiety are much higher in the autistic population (James

Lind Alliance, 2020). The study reveals that this could be achieved through free-flow activities that focus on children's interests. In other words, the thesis shows that when technology is used for relaxation, it can reduce autistic pupils' challenging behaviour. Therefore, it can offer opportunities for successful 'E-inclusion' and meaningful participation in learning without using structured activities to target ER.

- ***Provides guidance about the contextual factors that create the conditions to enable iPads enhance autistic pupils' SC and ER in school environments and highlights issues around pedagogy and teaching methods.***

Considering that the role of the environment has been often left out from research in technology (Rosenberg and Koehler, 2015; Kelly, 2010), this study provides insights into the contextual factors that can influence the successful iPad implementation in-situ for autistic pupils' SC and ER. Hence, this thesis reveals that conditions such as systemic support (school culture, leadership team, policy, structure), the collaboration between practitioners-parents-children and training from specialised personnel are requirements for informing teachers decisions and empowering them to develop technology-related skills and understanding of pedagogy.

The thesis presents implications for practice by illustrating issues around pedagogy and teaching methods important to facilitate authentic learning with iPads. Hence, it suggests that the combination of child-centred and collaborative pedagogies and the use of iPads as multi-modal learning tools across the curriculum can facilitate opportunities for enhancing autistic pupils' SC and ER. Finally, it signifies the importance of using iPads to develop communication, peer collaboration, relaxation, and transition, presenting tablets' multidimensional role in learning as assistive tools for SC and ER and enablers for learning and 'E-inclusion'.

8.4 Limitations of the Research and Reflections

The study involved various groups of participants (practitioners, parents, autistic pupils) from two schools (Special and Mainstream Autism Resource Base settings) to provide a holistic insight of key stakeholders' perspectives regarding iPads use for SC and ER. However, it should be acknowledged that the number of participants from School A did not match those from School B due to the difficulty of gaining access to the settings, the data collection specific time frame and the interviewees' busy schedule. Though, it could be argued that the sample of participants was considered sufficient for the purposes of this study due to the detailed research design implemented.

Since the aim was not to compare the two settings but to provide rich findings of iPad practices for SC and ER based on key stakeholders' perspectives, the involvement of teachers, teaching assistants, Educational Technology Coordinator, Lead ICT technician, Speech and Language therapist, parents and autistic pupils contributed to a detailed exploration of the topic. Although the findings cannot be generalised, they provide useful information for the researched phenomenon, considering that few studies have contextualised autism and technology in the classroom (Ifinedo and Kankaanranta, 2021; Mangafa, 2017; Parsons et al., 2015b). Thus, understanding fewer participants and home-school environments in more depth has been valuable in this early-stage investigation of iPad practices for SC and ER in-situ.

Another methodological limitation of this study could be that practice was not formally observed in-situ but was studied through the perspectives of key stakeholders. This approach could be criticised to place inevitable boundaries on what the researcher was able to know about iPad integration in learning. However, it should be noted that informal observations were performed during the data collection process. More specifically, the researcher spent extra time in schools before and after the data collection to discuss with teachers what practice was like for them, the applications they used and the implemented practices. Moreover, examples of pupils' work were presented to the researcher by the teachers to better understand of iPads' integration into learning for autistic pupils' SC and ER. Although this material has not been included in this thesis due to space constraints and data analysis time limitations, these approaches have provided a closer look to practice.

The points mentioned above provide insights about other possible methods that could be used from future studies to get closer to iPad practice for SC and ER in-situ. For example, case studies may be conducted that will include other methods for data collection, such as direct observations. Ciesielska, Boström and Öhlander (2018) state that observation is one of the most valuable research methods to explore social interaction. This is because it allows the involvement of the researcher in a specific culture either as a peripheral member (participant observation) or as an outsider who avoids 'taken-for-granted' evaluations (non-participant observation). Hence, observations could provide a more in-depth exploration of the school contexts, the iPad practices implemented for SC and ER, and participants' behaviour in the settings. Moreover, action research is another method of systematic enquire that could be undertaken by teachers who are also researchers to investigate ways of improving practice with iPads and make a positive change to tablet use in-situ.

Another limitation of the study relates to the impact that the training of the researcher to School B teachers had on the curation of the data. As previously mentioned in chapter 4, the headteacher's prerequisite for granting access to the school involved the researcher conducting a workshop for the study participants on iPad applications targeting SC and ER. Although this process could influence the findings, the researcher was careful to acknowledge the training's impact on participants' views when reporting the data. More specifically, the findings from School B (chapter 6) were presented concerning the participants' perspectives and practices with iPads before and after receiving the training.

Interestingly, despite the possible limitations of the adjustment of data collection methods in School B, the workshop offered valuable insights into the role of training in educators' practice with iPads. Considering the study's aim to situate iPads and autism in context by exploring the interaction of technology-individuals-context, it could be argued that the findings from School B provided extensive evidence of how environmental elements (such as training) may influence educators' perspectives and practices.

The researcher's involvement in practice also reveals the tension and the benefits of wearing both teacher and researcher hats during the data collection process. Hence, it provides insights into the researcher's role and position within research. Although a more positivist perspective could consider the 'intervention' with the training session as a process that might influence the data gathered from School B, it was a powerful example of the lived and complex reality of doing research in schools. More specifically, the researcher's intention to work with the educators came from a more ethical approach which supports that researchers do not simply extract data based on their interests. In contrast, they focus on issues and recommendations that can be useful and, in some cases, are needed for the targeted population. For this thesis, the researcher's expertise in teaching and research provided a more reciprocal engagement with School B, showcasing that although fieldwork might be planned, it is sometimes acceptable to cover interesting aspects that have not been initially considered. However, it should be noted that this approach can be acceptable as far as the researcher's role and position within research are justified.

The thesis also acknowledges that although the autistic pupils' involvement in the study has been valuable in understanding their perspectives regarding iPad use for SC and ER, their small sample led to certain assumptions. Hence, it has been hypothesised that children's interest, positive reactions and reported practices with iPads would appear across a broader group of autistic children or different technologies. Besides, considering the heterogeneity of autism and the fact that the autistic children interviewed in this study had a specific range of difficulties (social interaction challenges, severe-mild communication and language difficulties, challenging behaviour, foetal alcohol syndrome), additional diverse cases may need to be added to the current body of evidence, including more autistic participants for a broader representation of the autistic spectrum.

Finally, it should be highlighted that although the study has aimed to capture key stakeholders' perspectives, the inclusion of the autistic voice provided insights into the interrelation between the learner and his environment. However, it should be noted that the approach followed to collect data from the autistic pupils was more structured. Hence, it could be criticised as more restricted in collecting the meaning that pupils ascribed to their experiences. This point raises another issue about the researcher's need to meet the ethical requirements of the higher education institutions while also steering through more complex or unanticipated scenarios in practice (Sherwood and Parsons, 2021). In this study, although the researcher applied semi-structured interviews to collect the data, various other methods were employed to explore in more depth pupils' experiences of using iPads. This involved the use of follow-up questions, the adjustment of the interview vocabulary based on pupils' needs, pictures to visualise the questions and the verification of children's responses with the teacher present during the interviews. Despite the difficulties of collecting the views of vulnerable populations in research, this study offers data that could inform future studies as it provides insights about the need to develop creative methods of facilitating quality dialogue between autistic individuals and researchers. This may involve the use of gestures, communication devices, or the implementation of additional research methods such as observations to get a deep insight into the targeted population's lived experiences.

Although these limitations showcase some of the constraining aspects that have influenced this study, they reflect a bit more openly on some of the tensions of conducting research in context. Based on these points, the following section provides more detailed proposals for future research.

8.5 Proposals for Future Research

The findings of this study have led to a number of areas that could be further explored. Based on broad implications and limitations, future research could entail the following proposals concerning:

- ***Research that focuses on the perspectives of autistic individuals***

This thesis situated technology and autism in-situ, considering the interaction between individuals, iPads and context. More specifically, it explored the perspectives of key stakeholders regarding practices relating to using iPads for SC and ER. In line with the literature review (chapter 2) about the need to involve autistic voice in research (Milton, 2014), it is recommended that future research may replicate this study, focusing on autistic individuals. Collecting autistic children's viewpoints and their experiences when using tablets for SC and ER may be used as an addition to the conclusions drawn from this study to provide a more holistic view of the researched phenomenon.

- ***A focus on ways of fostering two-way communication between school and home regarding iPad use.***

This study has identified a gap between school and home regarding iPad use for SC and ER. The findings revealed a need for greater two-way communication between educators and parents to facilitate learning continuity. As Mintz et al. (2012) argue, school-home collaboration could enable sharing of ideas, practices and applications that could promote joint planning of activities using the digital tablet. Based on the points mentioned above, future studies may focus on ways of fostering collaborative partnerships, exploring the hidden enablers and barriers to this gap and bringing together school and home iPad practices.

- ***Conducting further research on iPad use for ER in autism specialist schools to include their specific characteristics and practices.***

This research was conducted in two schools, a Special and a Mainstream Autism Resource Base setting. The findings provided insights about the contextual elements and iPad practices implemented by educators in the two schools focusing on the interaction between technology, individuals and context. Future research may collect data regarding iPad use from autism specialist schools focusing on the under-explored area of ER. Considering the different facilities and specialist training for staff provided in these settings, rich information could be gathered about the iPad use for ER, educators' perspectives regarding tablets and the contextual characteristics. Thus, recommendations about iPad practices for autistic pupils' ER could be collected to inform research and the computing-educational guidelines for these schools' needs.

- ***Development of broad technology training programmes based on lessons learned from iPads' implementation in context of technology-oriented special schools and the outcomes of this study***.

In line with the literature review (chapter 2), the findings of this study reveal the impact of training on the successful implementation of iPads in the classroom. More specifically, the study implied a close alignment between training, pedagogical beliefs and school support. It also highlighted the role of the Educational Technology Coordinator in sharing good iPad practices for SC and ER, increasing teachers' confidence with technology, and providing knowledge-sharing opportunities within and outside the school context.

Considering these findings, future studies may focus on developing broad technology training programmes that could be applicable in various educational settings. For this to be achieved, it is recommended that consultation may be sought by collecting the perspectives and in-situ experiences of Educational Technology Coordinators and special needs teachers. Their opinions and viewpoints may be used to design, develop and evaluate schools' technology training programmes combining research with real-world practices.

- ***Extending the approach of this study to other models of technology use in practice.***

This study was based on the perspectives of key stakeholders to explore the activity of iPads' use in the classroom. It also emphasised the interaction between digital tools, contexts and individuals. Implementing the conceptual frameworks of Abbott (2007) and Bronfenbrenner (1979), the study showed that context is woven together with technology use in the classroom, highlighting that individuals and context develop reciprocally and change as a complex system. Moreover, this thesis provided a more in-depth exploration of what happens in-situ, revealing insights about technology-enhanced learning and 'E-inclusion' practices for autism.

In line with these points, future research may extend the approach of this study to other models of technology use in practice. More specifically, the methodology and theoretical concepts of this thesis may be applied to explore the use of smart objects, robots, virtual reality, tangible interfaces, or wearable technology in the classroom for autistic pupils. Engaging educators' perspectives and integrating research within real-world practices may provide valuable research about how technology and autism are situated in context.

- ***Research that focuses on ways of increasing the impact of the national curriculum towards forming schools' computing policies.***

This study provided insights into the impact that the computing policies have on how technology is integrated into teaching. For example, the online survey findings revealed that policies had a more substantial effect than the national curriculum for selecting the iPad applications in the classroom. According to the literature, school policies and procedures meet the requirements of each school or Trust and, in some cases, cover several requirements collectively (DfE, 2020a). The DfE guidance on *"Statutory policies for schools and academy trusts"* (ibid.) shows that computing policy is not recommended as mandatory in schools. However, computing is a key curriculum subject and an essential part of learning delivery.

Based on the points mentioned above and the findings of this study, it is recommended that future research may focus on ways of increasing the impact of the national curriculum towards forming schools' computing policies. The studies may contribute to the DfE national strategy (2010), namely 'ICT across the Curriculum-Management Guide', by including practical ideas of technology use in practice. In other words, future research may investigate ways of bringing together the national curriculum and computing strategies, providing recommendations that schools will easier adapt based on their needs.

8.6 Major Concluding Points

This research has studied the practices relating to using iPads for autistic pupils' SC and ER in-situ by collecting the views of key stakeholders. Contrary to previous studies, the topic has been considered from several viewpoints, contexts and methodologies, edging the importance of situating autism and iPads in context. Hence, various aspects and practices have been explored to obtain a complete understanding of this complex process. Summarising, some of the most significant concluding points and findings to emerge from this study are discussed below:

- ***Practitioners used tablets as multi-modal learning tools across the curriculum, focusing on child-centred, collaborative pedagogies and targeting more than one skill.***

  The online survey results and the two case studies revealed that iPads were used for autistic pupils in a constructive way across educators, contexts, and grade levels in primary schools. However, several disparities were identified in the conditions under which tablets were utilised in the classrooms of different school settings (Special and Mainstream Autism Resource Base schools).

  For example, the study indicated that iPads in School A were implemented throughout the curriculum as additional learning tools focusing on more than one skill, depending on the autistic pupils' needs. According to the experiences of the teachers, iPads were applied in various aspects of the classroom life, employing primarily child-centred, collaborative approaches to support the learning process. Contrary to this, it was revealed that in School B, before the training provided to teachers, the tablets were used mainly for entertainment purposes or to reward pupils, record their progress and calm them down. Interestingly, after the one-day workshop, educators reported using tablets in different subjects for several learning purposes depending on the interests and needs of the autistic pupils.

  The findings from this study suggest a potential disconnect between previous research focus on specific iPad applications/interventions and practice in-situ. The identified variability of iPad approaches, target skills and the implementation of child-centred practices provides the basis for thinking differently about educational technology research. It suggests that by identifying positive examples of iPad use in the classroom considering the perspectives of key stakeholders, future research may determine elements of successful implementation that can be applicable in different technologies, skills and educational contexts.

- ***The development of autistic pupils' SC with iPads was prioritised more by educators than ER, as they did not really know what ER involved.***

  The online survey and the findings from the case studies showed that educators prioritised more autistic pupils' SC than ER with iPads. According to the case studies, similarities were identified in the practices implemented for SC in the Special and Mainstream Autism Resource Base schools. At the same time, considerable overall variation was reported in the way iPads were applied for ER. Interestingly, the prioritisation of SC over ER could be related to participants' lack of awareness of what this (ER) developmental area involved.

  For example, educators from both schools referred to using iPads for pupils' communication, engagement and socialisation, affirming previous research base on the value of technology on supporting social communication skills (Ebert, 2018; Alhajeri, Anderson and Alant, 2017; Waddington et al., 2014). On the contrary, ER practices focused mainly on children's independent use of iPads for relaxation and regulation of challenging behaviour with participants showing ambiguity in what this developmental area involved. In line with this, examples of iPad use were provided, with participants referring to reward or motivation as elements of ER. The findings illustrated that teachers were not aware of what could be achieved in this developmental area using iPads.

As previously mentioned by Torrado, Gomez and Montoro (2017), the study suggests possible links between the limited research base on mobile technology use for autistic pupils' ER. It also highlights issues related to teachers' low skill levels in this area. Hence, the data retrieved from the thesis emphasise the need for future research to focus on practices that centre on areas not commonly indicated for iPad use. Moreover, relevant school training programmes may be created to help educators specialise their skills in ER, including the use of iPads for this fundamental area of autistic pupils' development.

- ***The importance of the Educational Technology Coordinator on successful iPad adoption in school contexts.***

The results of this study reveal the impact of the Educational Technology Coordinator (ETC) in developing teachers' confidence with iPads by providing frequent training and sharing good practices. The ETC appeared to be central in creating a strong 'technology support network' within and outside the school context, encouraging co-operation and knowledge sharing between practitioners, researchers and other technology experts.

For example, School A educators revealed that the role of the ETC was essential for using iPads as pedagogical tools. This is because the educational technology specialist increased the school's systemic support by reinforcing the development of training programmes and providing the required in-class support. School B practitioners also valued the impact of the educational technology specialist after receiving the one-day iPad training provided by the researcher. More specifically, elements of the workshop's content, such as the in-class tutoring and the recommendations of useful apps and practices were reported as essential components in developing their confidence with iPads.

The findings inform research about the role of ETC/specialists in the successful integration of iPads in the classroom as additional learning tools and enablers of learning. Considering that ETCs have a solid foundation in the curriculum and are well informed about instructional technologies, the study highlights their role in impacting teachers' training and influencing technology adoption in school settings. The findings also provide insights into the distinction between the ETC and Lead ICT roles in iPad integration into learning. In line with this, this research classifies ETCs as technology specialist teachers-mentors and Lead ICTs as technical support providers. Thus, the thesis highlights the need to shift the attention to the effect that ETCs may have on the successful iPad integration in the classroom and suggests their involvement in teachers' training programmes as developers, planners or deliverers of technology training in schools.

- ***A communication gap was identified between school and home regarding iPad use for autistic pupils' SC and ER.***

  The findings imply that a communication gap between educators and parents exists regarding iPad use for autistic pupils' SC and ER. Although all participants recognised the importance of partnership between the two settings, it was revealed that learning continuity was not achieved concerning tablet practices. This was associated with both educators and parents busy schedule, the different uses of technology at home and school and participants' different perceptions/values of iPad use.

For example, the interviews showed that educators believed that iPads were not used at home as instructional tools. Therefore, teachers did not consider it necessary to share their knowledge and ideas with parents. As observed, the interaction regarding technology use between educators and parents was mainly concerned with E-safety issues. Interestingly, it was revealed that in some cases, the role of the autistic pupil provided opportunities for knowledge sharing as a communicator between home and school.

The findings provide new directions about the need to shift the attention in iPad research from the 'research-practice' gap to the 'school-home' gap, determining that the relationship between educators and parents should not be taken for granted. Further research is called to focus on opportunities for knowledge exchange between educators and parents, placing the autistic child at the centre of this relationship. Thus, future studies may focus on strategies that provide opportunities for informative and reflexive collaboration activities between school and home, serving as catalysts for learning continuity between the settings.

- ***iPad use at home was mainly concentrated on recreation. It was also implemented as a tool for ER, focusing on child-centred pedagogies and following specific routines.***

The study reveals differences in how iPads were implemented at home and school for autistic pupils SC and ER. According to the findings, children's use of iPads at home mainly focused on recreational uses with the preferred activities including watching 'YouTube' videos, playing games and communicating online with friends and family. The results showed that children accessed the devices was daily, with parents following a structured routine to regulate their use. Similar to the findings from the schools, the approaches implemented at home were child-centred, as the software was selected based on children's interests and needs.

Parents reported prioritising the development of autistic pupils ER with iPads, approaching the devices as calming tools to reduce their anxiety levels and challenging behaviour. Still, SC was also among the preferred target skills, with parents' highlighting tablets' positive impact on developing pupils' communication skills. The findings revealed that the iPad implementation at home positively influenced the balance of families and children's skills, providing new insights about the hidden benefits of technology's recreational uses for students with autism. It was also observed that the leisure and educational uses of tablets at home were often interrelated, highlighting the need to shift the attention on technology-enhanced informal learning experiences.

Based on the points mentioned above, future studies may focus on how parents use iPads for autistic pupils' ER to provide insights into effective practices of using tablets for this under-explored developmental area. Moreover, research should also consider the advantages of the recreational uses of iPads for the development of autistic pupils' SC and ER.

- ***The school's computing policy for implementing iPads into the curriculum significantly shaped the learning practices adopted by educators.***

According to the literature (chapter 2), changes in the UK provisions and regulations regarding technology's potential in learning have provided insights into how teaching should be transformed (ITPro, 2020; DfE, 2017a). However, the findings of this thesis revealed that national guidelines might not guarantee successful iPad integration into learning, implying that generic technology recommendations may be less supportive than anticipated.

For example, the online survey and the findings from the two case studies showed that the computing policies had a considerable impact on the way iPads were integrated into learning. As it was observed in School A, the policy offered clear guidelines to teachers about technology's role in teaching, providing a structured approach to ensure appropriate and responsible use throughout the curriculum. Contrary to that, School B did not have an allocated computing policy but used the Trust's E-safety plan to cover technology use in the setting. Hence, although the E-safety policy seemed to encourage the use of technology in the school, there was no clear direction on how this could be achieved, influencing the iPad practices of the educators.

In line with the points mentioned above, the study provided insights into the impact that school policies may have on shaping educators' use of technology across the curriculum. Therefore, the findings highlight the need for future studies to focus on developing technology policies that will be informative and easily adaptable based on schools' needs. Hence, it is recommended that the views of teachers and Educational Technology Coordinators are included in the process to provide insights into technology-related didactic and pedagogical approaches.

- ***The combination of organisational, personal, and technological components influenced how educators used iPads in the classroom for autistic pupils' SC and ER.***

  This research recognises iPads' role as enablers of learning, encompassing the impact of contextual influences and individuals' attitudes on integrating technology into teaching. Contrary to previous studies which have examined specific technologies' effectiveness as support tools (Kaur and Pany, 2016; Singhal and Garg, 2019; Grynszpan et al., 2013), this thesis provided an in-depth exploration of iPad practices for SC and ER, focusing on the complexity and uniqueness of the two educational contexts. The study findings confirmed that iPad practices implemented in-situ were influenced by the interaction of organisational, personal and technological elements.

  In line with Abbott's concept of 'E-inclusion' (2007), the study highlighted several issues relating to the successful integration of iPads in the classroom, associated with the schools' profiles, cultures, training, teachers' beliefs and key stakeholders' influences. More specifically, it was revealed that educators' practices were shaped by their confidence and the school's context. The identified complex relationship of iPads, individuals and context showed that technology should not be seen separately from practice, providing insights into the various practices and purposes observed in different contexts.

  The study confirms Abbott's statement (2007) that technology should be examined in conjunction with reflective spaces and pedagogical models-practices to inform teaching and learning. Hence, the findings provide insights to future studies into the need to consider the role of organisational, personal, and technological components when exploring technology use in the classroom.

- ***Distal systems and contextual elements were identified to indirectly impact autistic pupils' learning with iPads and - influence the practices implemented in the classroom.***

  Using Bronfenbrenner's Ecological Systems theory (1979) and putting the learner at the centre of the analysis, the study illustrated the hierarchy of interaction between the developing person, iPads and the environment. The findings provided insights about the indirect influence of distal contextual elements (such as schools' computing policies and cultures) on the successful integration of iPads into teaching.

  For example, it was identified that the disparities in iPad use for autistic pupils' SC and ER between the Special and Mainstream Autism Resource Base settings were associated with differences in their specialisation, computing policies and cultures towards technology. These contextual components involved key drivers for change in the two schools that indirectly impacted autistic pupils' learning with iPads.

  The discussion of findings based on Bronfenbrenner's Ecological Systems theory (1979) provided an in-depth exploration of the different environmental levels at which iPads, individuals, and context interacted in the two schools. Moreover, they enabled the development of an understanding of how different layers of the social structures affect school practices with iPads and impact the development of the autistic pupil. The identification of the remote systems' influences on the development of the learner provided insights about the importance of expanding educational technology research at the Exo- and Macro-levels. Hence, based on the points mentioned above, future studies should consider exploring several direct and indirect contextual issues associated with iPads' use in practice to provide findings that could be relevant and applicable in-situ.

Further to these concluding points, it could be inferred that this thesis provides valuable insights into what drives teachers to make decisions regarding technology use in the classroom. It particularly emphasises the importance of supporting educators to develop skills in technology, highlighting the essential role of understanding pedagogy as a driver for successful technology integration into learning. By adopting a methodology and theoretical framework that situate technology in-situ, the study explores the complex interaction between iPads, key stakeholders and context. At the same time, it suggests pointers to practice about the contextual factors that create the conditions for successful iPad use for SC, ER and 'E-inclusion'. The thesis also presents useful recommendations for practice highlighting technology's potential to support autistic pupils' communication, collaboration, relaxation and transition through collaborative pedagogies and multi-modal teaching methods. Finally, it illustrates a combined view of technology's role as an assistive tool and enabler of learning for autistic individuals, highlighting an additional dimension to its use as a regulator of ER and challenging behaviour.

8.7 Dissemination

Aspects of this research have been presented at the following conferences:

- **Oral Presentations[2]:**
    - The 7th National Autism Conference (2019), Athens, Greece.
    - School of Education Annual Conference (2018), University of Birmingham, UK.
    - Oral presentation at the 16th Annual School of Education Doctoral Research Conference (2017), University of Birmingham, UK.
- **Poster Presentations:**
    - Poster presentation at the 50th Scottish Autism Conference (2018), Glasgow, Scotland.
    - Poster presentation at the 17th Annual School of Education Doctoral Research Conference (2018), University of Birmingham, UK.
    - Poster presentation at the 15th Annual School of Education Doctoral Research Conference (2016), University of Birmingham, UK (won the first prize).

[2] The research findings were also presented to visiting PhD students and academics from the College of Education University of Illinois (Chicago) as part of the welcome workshop held at the School of Education, University of Birmingham, UK (2018).

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APPENDICES

Appendix 1: Ethical Approvals

Appendix 1a: Ethical Approval for the Online Survey

S[redacted] C[redacted]

Mon 12/09/2016, 14:49
Karen Guldberg;
Despina Papoudi (School of Education);
Alexia Achtypi <AXA1102@student.bham.ac.uk>
ethics-online survey sent emails

Dear Dr Guldberg and Dr Papoudi

Re: Application for Ethical Review ERN_16-0551

Thank you for your application for ethical review for the above project, which was reviewed by the Humanities and Social Sciences Ethical Review Committee.

On behalf of the Committee, I confirm that this study now has full ethical approval.

I would like to remind you that any substantive changes to the nature of the study as described in the Application for Ethical Review, and/or any adverse events occurring during the study should be promptly bought to the Committee's attention by the Principal Investigator and may necessitate further ethical review.

Please also ensure that the relevant requirements within the University's Code of Practice for Research and the information and guidance provided on the University's ethics webpages (available at https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Links-and-Resources.aspx) are adhered to and referred to in any future applications for ethical review. It is now a requirement on the revised application form (https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Ethical-Review-Forms.aspx) to confirm that this guidance has been consulted and is understood, and that it has been taken into account when completing your application for ethical review.

Please be aware that whilst Health and Safety (H&S) issues may be considered during the ethical review process, you are still required to follow the University's guidance on H&S and to ensure that H&S risk assessments have been carried out as appropriate. For further information about this, please contact your School H&S representative or the University's H&S Unit at healthandsafety@contacts.bham.ac.uk.

Kind regards

S[redacted] C[redacted]
Research Ethics Officer
Research Support Group
C Block Dome
Aston Webb Building
University of Birmingham
Edgbaston B15 2TT

Appendix 1b: Ethical Approval for Practitioners'/Parents Interviews

S[redacted]C[redacted]

Thu 09/03/2017, 09:16

Karen Guldberg;

Despina Papoudi (School of Education);

Alexia Achtypi <AXA1102@student.bham.ac.uk>

Dear Dr Guldberg and Dr Papoudi

Re: Application for Ethical Review ERN_16-0551A

Thank you for the above application for amendment, which was reviewed by the Humanities and Social Sciences Ethical Review Committee.

On behalf of the Committee, I can confirm that this amendment now has full ethical approval.

I would like to remind you that any substantive changes to the nature of the study as now amended, and/or any adverse events occurring during the study should be promptly bought to the Committee's attention by the Principal Investigator and may necessitate further ethical review. A revised amendment application form is now available at https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Ethical-Review-Forms.aspx . Please ensure this form is submitted for any further amendments.

Please also ensure that the relevant requirements within the University's Code of Practice for Research and the information and guidance provided on the University's ethics webpages (available at https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Links-and-Resources.aspx) are adhered to and referred to in any future applications for ethical review. It is now a requirement on the revised application form (https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Ethical-Review-Forms.aspx) to confirm that this guidance has been consulted and is understood, and that it has been taken into account when completing your application for ethical review.

Please be aware that whilst Health and Safety (H&S) issues may be considered during the ethical review process, you are still required to follow the University's guidance on H&S and to ensure that H&S risk assessments have been carried out as appropriate. For further information about this, please contact your School H&S representative or the University's H&S Unit at healthandsafety@contacts.bham.ac.uk.

If you require a hard copy of this correspondence, please let me know.

Kind regards

Su[redacted]n C[redacted]n
Research Ethics Officer
Research Support Group

C Block Dome, Aston Webb Building

University of Birmingham

Edgbaston B15 2TT

Appendix 1c: Ethical Approval for Children's Interviews

Application for Ethical Review ERN_16-0551B
[redacted]
Sent:20 March 2018 13:11
To: Karen Guldberg; Alexia Achtypi (PhD Education - FT); Despina Papoudi (School of Education)

Dear Dr Karen Guldberg & Dr. Despina Papoudi

Re: Application for Ethical Review ERN_16-0551B

Thank you for the above application for amendment, which was reviewed by the Humanities and Social Sciences Ethical Review Committee.
On behalf of the Committee, I can confirm that this amendment now has full ethical approval. I would like to remind you that any substantive changes to the nature of the study as now amended, and/or any adverse events occurring during the study should be promptly bought to the Committee's attention by the Principal Investigator and may necessitate further ethical review. A revised amendment appliction form is now available at: https://intranet.birmingham.ac.uk/finance/accoun_ng/Research-Support-Group/Research-Ethics/Ethical-Review-Forms.aspx . Please ensure this form is submitted for any further amendments.
Please also ensure that the relevant requirements within the University's Code of Practice for Research and the informtion and guidance provided on the University's ethics webpages (available at https://intranet.birmingham.ac.uk/finance/accoun_ng/Research-Support-Group/Research-Ethics/Links-and- Resources.aspx) are adhered to and referred to in any future applications for ethical review. It is now a requirement on the revised application form (h_ps://intranet.birmingham.ac.uk/finance/accoun_ng/Research-Support-Group/Research-Ethics/Ethical-Review-Forms.aspx) to confirm that this guidance has been consulted and is understood, and that it has been taken into account when completing your application for ethical review.
Please be aware that whilst Health and Safety (H&S) issues may be considered during the ethical review process, you are still required to follow the University's guidance on H&S and to ensure that H&S risk assessments have been carried out as appropriate. For further information about this, please contact your School H&S representative or the University's H&S Unit at healthandsafety@contacts.bham.ac.uk.

If you require a hard copy of this correspondence, please let me know.

Kind regards,

Ms [redacted]
Deputy Research Ethics Officer
Research Support Group
C Block Dome (room 132)
Aston Webb Building
University of Birmingham
Edgbaston B15 2TT

Appendix 2: Participation Information Sheets and Consent forms

Appendix 2a: Participation Information Sheet for the Online Survey

Research Participant Information Statement

Research Study Title:	"PERSPECTIVES OF KEY STAKEHOLDERS ABOUT PRACTICES RELATING TO USING iPADS FOR AUTISTIC PUPILS' SOCIAL COMMUNICATION AND EMOTIONAL REGULATION"
UoB HREC Approval Number	ERN-160551
Researcher's Name	Alexia Achtypi
Researcher's Relationship to UoB	Postgraduate student-PhD

Description of the Research: If you are between 18 and 65 years old, you are invited to participate in a research study that focuses on how iPad applications can be effectively used to support the social communication and emotional regulation of primary school-age children with autism. You are asked to complete a survey about the types of technologies that you currently use in the classroom for children with autism, the practices that you implement and the learning outcomes that you focus upon.

Benefits and Risks:

Benefits: This study aims to make recommendations for improving autism practice around the use of iPads for social communication and emotional regulation in school settings. It is hoped that the findings of this study will be applicable in various contexts and will have an impact on policy and legislation within the general field of Education. More specifically, that they will provide decision makers with information and evidence to help develop practices that will benefit students with autism improve their school experience.

Risks: There are no anticipated risks to you of participating in this study.

Time Involvement: This survey will take approximately 30 minutes.

Participant Rights: Participation in this study is voluntary-you are not under any obligation to consent and- if you do consent- you can withdraw at any stage. However, once you have submitted your questionnaire anonymously, your responses cannot be withdrawn.

Confidentiality and Disclosure of Information: Any information that is obtained in connection with this study able to be identified as in connection with you will remain confidential and will be disclosed only with your permission. In addition, anonymity will be preserved in the release of the findings both for the participants and the location of the research.

The data collected from this online survey will be used for the completion of the PhD thesis and for academic conferences and research journal papers. However, any published information will be provided in such way that you cannot be identified.

Data storage: The electronic data will be stored using University of Birmingham "Research Data Store (RDS)" and the "Research Data Archive (RDA)" service. These services provide an integrated, secure and resilient service for the long term storage of data. The data will not be e-mailed to anybody and their access will be restricted. The files will also be encrypted for further protection and only the researcher will have access to them. The data will be kept safe for at least 10 years, following the University of Birmingham code of conduct for research and after this period of time they will be deleted from the electronic system.

The Researcher: The research is being conducted by the PhD student Alexia Achtypi under the supervision of Dr Karen Guldberg (e-mail: xxx@bham.ac.uk) and Dr Despina Papoudi (e-mail: xxx@bham.ac.uk). Dr Karen Guldberg is Director of the Autism Centre for Education and Research (ACER) at the School of Education, University of Birmingham and Senior Lecturer in Autism Studies in the department of Disability, Inclusion and Special Needs /DISN. Dr Despina Papoudi is Lecturer in Autism in the Department of Disability, Inclusion and Special Needs /DISN at the school of Education, University of Birmingham.

This research contributes to Alexia Achtypi's studies for the award of the Doctor of Philosophy degree in Education being undertaken at the School of Education, University of Birmingham.

Feedback: Should you be interested in receiving the results of the study or have any questions, please contact me at axa1102@bham.ac.uk. After the data analysis an e-mail will be sent to the head teacher of your school, providing extra feedback about the results of the survey. In addition, information about the research will also be available on the Autism Centre of Education and Research (ACER) website of the school of Education, University of Birmingham (http://www.birmingham.ac.uk/research/activity/education/acer/research/index.aspx).

If you agree to participate, please fill-in the consent form accompanying this sheet.

Thank you for your consideration,

Alexia Achtypi (PhD researcher)

School of Education

University of Birmingham

Edgbaston, Birmingham, B15 2TT, UK

Appendix 2b: Participation Consent Form for the Online Survey

Research Participant Consent Form

UNIVERSITY OF BIRMINGHAM

Research Study Title:	"PERSPECTIVES OF KEY STAKEHOLDERS ABOUT PRACTICES RELATING TO USING iPADS FOR AUTISTIC PUPILS' SOCIAL COMMUNICATION AND EMOTIONAL REGULATION"
UoB HREC Approval Number	ERN-160551
Researcher's Name	Alexia Achtypi
Researcher's Relationship to UoB	Postgraduate student-PhD

Participant Consent

I agree to participate in this research. I have read the Research Participant Information Statement and the researcher has answered any questions I had about the research.

I understand that my participation in this study is voluntary and that I have the right to withdraw at any time. However, once I have submitted my questionnaire anonymously, my responses cannot be withdrawn.

Please complete, placing a ✓ in applicable boxes

Are you between 18 and 65 years of age?

☐ Yes

☐ No – Unfortunately, you cannot complete this questionnaire

______________________________ ________________

Research Participant Signature   Date

Appendix 2c: Participation Information Sheet and Consent Form for Practitioners' Interviews

UNIVERSITY OF BIRMINGHAM

Research Participant Information Statement

UoB Ethics Approval Number	ERN_16-0551A
Researcher's Name	Alexia Achtypi

Aim of the study: This research project focuses on key stakeholders' perspectives about practices relating to using iPad for autistic pupils Social Communication (SC) and Emotional Regulation (ER). The aim of the study is to expand current knowledge of the use of iPads in natural contexts for these two developmental areas and explore the impact of context on this process.

Description of study: I would like to invite you to take part in this study, on a VOLUNTARY basis, by answering some questions about the way you use iPads in the classroom for autistic children's SC and ER. The research will be conducted in a form of a face-to-face audio-recorded interview, taking in average 30 minutes each.

Participant Rights: Participation in this study is voluntary-you are not under any obligation to consent. You have the right to withdraw while taking part in the one to one interviews. You will not be able to withdraw after two weeks have passed after having completed the one to one interviews, as all participants will be anonymised after this date and it will be difficult to locate part of the interview transcript that relates to the specific participant. You also have two days to think about your participation in the study after you return this form.

Confidentiality and Disclosure of Information: All data will be anonymised and whenever a name, a location, or anything that could trace it back to the participant, it will be 'blurred out' on audio/video recordings and coded or modified on transcripts. In addition, the data will be restricted to the first hand use of the research team and they will not be placed on the internet.

Data storage: The electronic data will be stored using University of Birmingham "Research Data Store (RDS)" and the "Research Data Archive (RDA)" service. These services provide be encrypted for further protection and only the researcher will have access to them. The data will be kept safe for at least 10 years, following the University of Birmingham code of conduct for research and after this period of time they will be deleted from the electronic system.

Results of the study: I intend to give feedback of the research through practitioner or academic conferences and meetings and potentially preparing training sessions and/or workshops to present some findings that could benefit other professionals.

The Researcher: The research is being conducted by the PhD student Alexia Achtypi under the supervision of Dr Karen Guldberg (e-mail: xxx@bham.ac.uk) and Dr Despina Papoudi (e-mail: xxx@bham.ac.uk). Dr Karen Guldberg is Director of the Autism Centre for Education and Research (ACER) at the School of Education, University of Birmingham and Senior Lecturer in Autism Studies in the department of Disability, Inclusion and Special Needs /DISN. Dr Despina Papoudi is Lecturer in Autism in the Department of Disability, Inclusion and Special Needs /DISN at the school of Education, University of Birmingham. This research contributes to Alexia Achtypi's studies for the award of the Doctor of Philosophy degree in Education being undertaken at the School of Education, University of Birmingham.

Feedback: Should you be interested in receiving the results of the study or have any questions, please contact me at axa1102@bham.ac.uk. After the data analysis an e-mail will be sent to you, providing extra feedback about the results of the study. In addition, a small video will be created and presented to you including snapshots of the whole observation/interview process.

If you agree to participate, please fill-in the consent form accompanying this sheet.

Thank you for your consideration.

Consent Form

Title of the proposed study: "Perspectives of key stakeholders about practices relating to using iPads for autistic pupils' SC and ER"

☐ I confirm that I have read and understand the participant information sheet for this study. I have had the opportunity to ask questions if necessary and have had these answered satisfactorily.

☐ I understand that my participation is voluntary and that I am under no obligation to consent.

☐ I understand that no real names will be used and there will be no breach of confidentiality.

☐ Based upon the above, I agree to take part in this study.

Name of participant...

Date...

Signature...

Name of researcher..

Date...

Signature...

Appendix 2d: Participation Information Sheet and Consent Form for Parents' Interviews

UNIVERSITY OF BIRMINGHAM

Research Participant Information Statement

UoB Ethics Approval Number	ERN_16-0551A
Researcher's Name	Alexia Achtypi

Aim of the study: This research project focuses on key stakeholders' perspectives about practices relating to using iPad for autistic pupils Social Communication (SC) and Emotional Regulation (ER). The aim of the study is to expand current knowledge of the use of iPads in natural contexts for these two developmental areas and explore the impact of context on this process.

Description of study: I would like to invite you to take part in this study, on a **VOLUNTARY** basis, by answering some questions about how you use the iPad for your child's SC and ER. The research will be conducted in a form of a face-to-face audio-recorded interview and will take place in the school setting. The duration of the interview will be approximately 30 minutes and the meeting will be organised at your convenience.

Participant Rights: Participation in this study is voluntary-you are not under any obligation to consent. You have the right to withdraw while taking part in the one to one interviews. You will not be able to withdraw after two weeks have passed after having completed the one to one interviews, as all participants will be anonymised after this date and it will be difficult to locate part of the interview transcript that relates to the specific participant. You also have two days to think about your participation in the study after you return this form.

Confidentiality and Disclosure of Information: All data will be anonymised and whenever a name, a location, face or anything that could trace it back to the participant, it will be 'blurred out' on audio recordings and coded or modified on transcripts. In addition, the data will be restricted to the first hand use of the research team and they will not be placed on the internet.

Data storage: The electronic data will be stored using University of Birmingham "Research Data Store (RDS)" and the "Research Data Archive (RDA)" service. These services provide be encrypted for further protection and only the researcher will have access to them. The data will be kept safe for at least 10 years, following the University of Birmingham code of conduct for research and after this period of time they will be deleted from the electronic system.

Results of the study: I intend to give feedback of the research through practitioner or academic conferences and meetings and potentially preparing training sessions and/or workshops to present some findings that could benefit other professionals.

The Researcher: The research is being conducted by the PhD student Alexia Achtypi under the supervision of Dr Karen Guldberg (e-mail: xxx@bham.ac.uk) and Dr Despina Papoudi (e-mail: xxx@bham.ac.uk). Dr Karen Guldberg is Director of the Autism Centre for Education and Research (ACER) at the School of Education, University of Birmingham and Senior Lecturer in Autism Studies in the department of Disability, Inclusion and Special Needs /DISN. Dr Despina Papoudi is Lecturer in Autism in the Department of Disability, Inclusion and Special Needs /DISN at the school of Education, University of Birmingham. This research contributes to Alexia Achtypi's studies for the award of the Doctor of Philosophy degree in Education being undertaken at the School of Education, University of Birmingham.

Feedback: Should you be interested in receiving the results of the study or have any questions, please contact me at axa1102@bham.ac.uk. After the data analysis an e-mail will be sent to you, providing extra feedback about the results of the study.

If you agree to participate, please fill-in the consent form accompanying this sheet.

Thank you for your consideration.

Consent Form

Title of the proposed study: "Perspectives of key stakeholders about practices relating to using iPads for autistic pupils' SC and ER."

☐ I confirm that I have read and understand the participant information sheet for this study. I have had the opportunity to ask questions if necessary and have had these answered satisfactorily.

☐ I understand that my participation is voluntary and that I am under no obligation to consent.

☐ I understand that no real names will be used and there will be no breach of confidentiality.

☐ Based upon the above, I agree to take part in this study.

Name of participant..

Date...

Signature..

Name of researcher..

Date...

Signature..

Appendix 2e: Participation Information Sheet, Consent-Assent Form for Children's Interviews

UNIVERSITY OF BIRMINGHAM

Research Participant Information Statement

University of Birmingham Ethics Approval Number	ERN_16-0551B
Researcher's Name	Alexia Achtypi

Aim of the study: This research project focuses on key stakeholders' perspectives about practices relating to using iPad for autistic pupils Social Communication (SC) and Emotional Regulation (ER). The aim of the study is to expand current knowledge of the use of iPads in natural contexts for these two developmental areas and explore the impact of context on this process.

Description of study: I would like to invite you and your child to participate in a study that will be conducted in a form of interviews. The interview will take place during the school day and will aim to collect data about your child's views on the iPads. The participation is completely voluntary and the child will be accompanied by a teacher or teaching assistant.

Participant Rights: Participation in this study is voluntary-you are not under any obligation to consent for your child. However, participants (and the parents/caregivers) of the participants have the right to withdraw while taking part in the interview. This is because, after this period of time the data will be anonymised and it will be difficult to locate which recording/homework relates to the specific participant. In the event that your child shows signs of distress or discomfort during the interview, they should be asked if they want to stop. The researcher will be sensitive to the fact that children may be intimidated by the situation and reluctant to say spontaneously they want to stop. The recordings will also be removed from the study and you will be informed about the incident. In case the child is not able to say that he/she wants to withdraw and feels distressed during the study, he /she will be removed from the situation and the parent will be contacted.

Confidentiality and Disclosure of Information: All data will be anonymised and whenever a name, a location or anything that could trace it back to the participant, it will be coded or modified on transcripts. In addition, the data will be restricted to the first hand use of the research team and they will not be placed on the internet. You also have two days to think about your participation in the study after you return this form.

Data storage: The electronic data will be stored using University of Birmingham "Research Data Store (RDS)" and the "Research Data Archive (RDA)" service. These services provide be encrypted for further protection and only the researcher will have access to them. The data will be kept safe for at least 10 years, following the University of Birmingham code of conduct for research and after this period of time they will be deleted from the electronic system.

Results of the study: I intend to give feedback of the research through practitioner or academic conferences and meetings and potentially preparing training sessions and/or workshops to present some findings that could benefit other professionals.

The Researcher: The research is being conducted by the PhD student Alexia Achtypi under the supervision of Dr Karen Guldberg (e-mail: xxx@bham.ac.uk and Dr Despina Papoudi (e-mail: xxx@bham.ac.uk). Dr Karen Guldberg is Director of the Autism Centre for Education and Research (ACER) at the School of Education, University of Birmingham and Senior Lecturer in Autism Studies in the Department of Disability, Inclusion and Special Needs /DISN. Dr Despina Papoudi is Lecturer in Autism in the Department of Disability, Inclusion and Special Needs /DISN at the school of Education, University of Birmingham. This research contributes to Alexia Achtypi's studies for the award of the Doctor of Philosophy degree in Education being undertaken at the School of Education, University of Birmingham.

Feedback: Should you be interested in receiving the results of the study or have any questions, please contact me at axa1102@bham.ac.uk. After the data analysis an e-mail will be sent to you, providing extra feedback about the results of the study. In addition, a small video will be created and presented to you including snapshots of the whole observation process.

If you agree to participate, please fill-in the consent form accompanying this sheet. Thank you for your consideration.

Consent Form

☐ I confirm that I have read and understand the participant information sheet for this study. I have had the opportunity to ask questions if necessary and have had these answered satisfactorily.

☐ I understand that my child's participation is voluntary and that I am under no obligation to consent.

☐ I understand that no real names will be used and there will be no breach of confidentiality.

☐ Based upon the above, I agree to allow my child to take part in the interview.

Name of participant's parent /gatekeeper..

Name of the child..

Date...

Signature...

Name of researcher...

Date...

Signature..

Research Assent Form (Children)

What is a research study?

Research studies help us learn new things. We can test new ideas. First, we ask a question. Then we try to find the answer.

This paper talks about our research and the choice that you have to take part in it. We want you to ask us any questions that you have. You can ask questions any time.

Important things to know…

- You get to decide if you want to take part.
- You can say ‘No’ or you can say ‘Yes’.
- No one will be upset if you say ‘No’.
- We would still take good care of you no matter what you decide.

Why are we doing this research?

We are doing this research to find out more about how you learn using iPads.

What would happen if I join this research?

I will interview you and I will ask questions about how you use the iPads at school and at home.

Could bad things happen as a result of this research?

No bad things will happen to you if you join this research.

Could the research help me?

We think being in this research may help us understand more about how IPads can be used in school.

What else should I know about this research?

-If you don't want to be in the study, you don't have to be. If you have changed your mind and you do not want to participate anymore you can let me know during the interviews or two weeks after the interviews have taken place.

-You can ask me questions any time.

-Take the time you need to make your choice.

Is there anything else?

If you want to be in the research after we talk, please write your name below. You have two days to think about it. After you return the form, I will then write my name too. This shows we talked about the research and that you want to take part.

Please tick the box based on your preference:

- **Do you want to be interviewed by me?**

  - ☐ **YES**
  - ☐ **NO**

Name of Participant:

Printed Name of Researcher:

Signature of Researcher:

Date:

Time:

Copies of this form will be given to the parents/guardians of the child

Appendix 2f: Recruitment Letter for Parents' Participation in the Interview

Birmingham, ___/___/_____

Dear Sir/Madam,

My name is Alexia Achtypi and I am a PhD student at the School of Education, University of Birmingham. I am conducting research under the supervision of Dr Guldberg (xxxx@bham.ac.uk) and Dr Papoudi (xxx@bham.ac.uk) and my aim is to understand key stakeholders' perspectives about practices relating to using iPads for the social communication (SC) and emotional regulation (ER) of primary school-age children with autism.

I am inviting you to participate in this study by sharing with the iPad practices that you implement at home for your child's SC and ER and your views on tablets. Participation in this research is voluntary and you have no obligation to consent. For the study, the researcher aims to conduct an interview with you which will be audio-recorded. The duration of the interview will be approximately 40 minutes, it will take place at the school and will be anonymous. If you would like to participate, the interview will be scheduled at your convenience.

If you have any questions or would like to discuss any details of the research, you can contact me via email at: axa1102@bham.ac.uk.

Kind Regards,

Alexia Achtypi

Doctoral Researcher

School of Education / The Autism Centre for Education and Research (ACER), University of Birmingham, UK

Appendix 2g: Recruitment Letter to Parents for Children's Participation in the Interview

Birmingham, ___/___/_____

Dear Sir/Madam,

My name is Alexia Achtypi and I am a PhD student at the School of Education, University of Birmingham. I am conducting research under the supervision of Dr Guldberg (xxx@bham.ac.uk) and Dr Papoudi (xxx@bham.ac.uk) and my aim is to collect key stakeholders' perspectives about practices relating to using iPads for autistic pupils' social communication (SC) and emotional regulation (ER).

I would like to invite your child to participate in a study that will be conducted through interviews. The interviews will be anonymous and will take place during key times of the school day with the presence of a teacher. The aim is to collect data about children's preferences and views on iPads.

Participation in this research is voluntary and you have no obligation to consent for your child. The duration of the interview will be approximately 10 minutes and it will take place at the school.

For more information, please see the attached information sheet and interview questions.

If you have any questions or would like to discuss any details of the research, you can contact me via email at: axa1102@bham.ac.uk.

Kind Regards,

Alexia Achtypi

Doctoral Researcher
School of Education / The Autism Centre for Education and Research (ACER)
University of Birmingham, UK

Appendix 3: Data Collection Tools

Appendix 3a: Online Survey

Section A: Some facts about you

Please tick the option which best describes yourself.

1. Do you currently work with a child/children with autism (including children with or without autism assessment)?

☐ Yes
☐ No

2. Do you currently use iPad applications in the classroom for the students with

autism?

☐ Yes
☐ No

If you answered **'Yes'** to both questions 1 and 2 then please continue!

3. What is your gender?

☐ Male
☐ Female
☐ Other
☐ Prefer not to say

4. What is your age?

☐ 18-24 years old
☐ 25-34 years old
☐ 35-49 years old
☐ 50-65 years old

5. What is your current professional role?

☐ Teacher
☐ Special Education Needs (SEN) Teacher
☐ Teaching Assistant
☐ Special Education Needs (SEN) Teaching Assistant
☐ Special Educational Needs Coordinator (SENCO)

- ☐ Specialist advisory teacher
- ☐ Supply teacher
- ☐ Supply teaching assistant
- ☐ Other

If **other** please specify ____

6. What is the highest level of formal education that you have completed?

- ☐ General Certificate of Secondary Education (GCSE)
- ☐ High School Graduate /A levels/ BTEC National Diploma
- ☐ National Vocational Qualifications (NVQs)
- ☐ Bachelor’s Degree
- ☐ Master’s Degree
- ☐ Doctorate Degree
- ☐ Other

If **other** please specify ____

7. What kind of school do you teach in?

- ☐ Mainstream School
- ☐ Mainstream School with an Autism Unit
- ☐ Special School for Moderate Learning Difficulties (MLD)
- ☐ Special school for Severe Learning Difficulties (SLD)
- ☐ Autism Specialist School

8. How would you characterise the type of the school that you teach in?

- ☐ State school (e.g. community schools, foundation schools, grammar schools, special schools etc.)
- ☐ Faith school (schools that are associated with a particular religion)
- ☐ Free school (schools that are funded by the government but are not run by the local council. They have more control over how they do things e.g. University technical colleges, studio schools etc.)
- ☐ Academy (they are publicly funded independent schools)
- ☐ City technology college (they are independent schools in urban areas, owned and funded by companies)
- ☐ State boarding school (provide free education but charge fees for boarding)
- ☐ Private/Independent school (They charge fees to attend instead of being funded by the government)

9. How long have you been working as a teacher so far?

Where possible exclude extended periods of absence (e.g. career breaks).

Less than a year

- ☐ 1-2 years
- ☐ 3-5 years
- ☐ 6-10 years
- ☐ 11-15 years
- ☐ 16-20 years
- ☐ More than 20 years

10. How long have you been working with pupils with autism so far?

- ☐ Less than a year
- ☐ 1-5 years
- ☐ 6-10 years
- ☐ 11-15 years
- ☐ 16-20 years
- ☐ More than 20 years

11. Which age group of students do you currently work with?

- ☐ 5-7 years old
- ☐ 7-9 years old
- ☐ 9-11 years old

12. How many students with autism do you support daily?

- ☐ 1-2
- ☐ 3-5
- ☐ 6-8
- ☐ more than 8

Thank you for completing ‘Section A’ of the questionnaire. Please continue with ‘Section B’.

Section B: Autism and iPad applications

<u>**Note:**</u> This study aims to identify how iPads are used in the classroom to support the **social communication** and **emotional regulation** of students with autism. Consequently, all the questions in this survey are focusing on identifying iPad practices that support these two abilities.

<u>**Definitions:**</u>

****Social communication***: Development of spontaneous communication, emotional expression and secure and trusting relationships with children and adults (e.g. smiling, sharing, turn taking, making eye contact, understanding language, providing information etc.).

*****Emotional Regulation:*** Is the process through which an individual filters their emotions in order to control how they feel and, consequently, communicate these feelings. It involves the development of the ability to maintain a well-regulated emotional state to cope with everyday stress, and to be most available for learning and interacting.

<u>Please mark boxes with an 'X'</u>

13. Do you currently use iPads to support the <u>social communication*</u> of students with autism?

- ☐ Yes
- ☐ No

If you answered **yes,** please specify below **which** applications you use.

If you answered **no**, please specify below **how** you use the iPads in the classroom (e.g. for motivation, entertainment etc).

____

14. Do you currently use iPads to support the <u>emotional regulation</u> of students with autism?**

- ☐ Yes
- ☐ No

If you answered **yes,** please specify below **which** applications you use.

If you answered **no**, please specify below **how** you use the iPads in the classroom (e.g. for motivation, entertainment etc)__________________________________

15. How do you choose which iPad applications to use in the classroom to support the <u>social communication</u>* of students with autism?

On a scale of 1-4 with 4 being the strongest influence, please rate the following factors

	No effect >	Minimal effect >	Moderate effect >	Strong effect
-Applications that fit with with the National Curriculum	1☐	2☐	3☐	4☐
-Child's individual needs	1☐	2☐	3☐	4☐
-Parent-Teacher collaboration	1☐	2☐	3☐	4☐
-Collaboration with the associated stakeholders	1☐	2☐	3☐	4☐

(e.g. administrators, community members, school board members, city councillors etc.)

-School's Policy	1☐	2☐	3☐	4☐
-Other	1☐	2☐	3☐	4☐

If **other,** please specify:____

16. How do you choose which iPad applications to use in the classroom to support the <u>emotional regulation</u> of students with autism?**

On a scale of 1-4 with 4 being the strongest influence, please rate the following factors

	No effect >	Minimal effect >	Moderate effect >	Strong effect
-Applications that fit with with the National Curriculum	1☐	2☐	3☐	4☐

-Child's individual Needs 1⏭ 2⏭ 3⏭ 4⏭

-Parent-teacher Collaboration 1⏭ 2⏭ 3⏭ 4⏭

-Collaboration with the associated stakeholders 1⏭ 2⏭ 3⏭ 4⏭

(e.g. administrators, community members, school board members, city councillors etc..)

-School's policy 1⏭ 2⏭ 3⏭ 4⏭

-Other 1⏭ 2⏭ 3⏭ 4⏭

If other, please specify:____

17. Which skills do you aim to develop while using the iPads in the classroom with students with autism?

On a scale of 1-4 with 4 being the high priority, please rate the following factors.

Not a priority< Low priority < Medium priority < High priority

-Communication skills 1⏭ 2⏭ 3⏭ 4⏭

(e.g. eye-contact, facial expressions etc.)

-Social skills 1⏭ 2⏭ 3⏭ 4⏭

(e.g. knowing how to act in a certain social situation etc.)

-Emotional skills 1⏭ 2⏭ 3⏭ 4⏭

(e.g. show empathy, share emotions etc.)

-Other 1 ⏭ 2 ⏭ 3 ⏭ 4 ⏭

If **other,** please specify:______________________________

18. Which iPad application do you think is the best for the development of the social communication* of students with autism and why?

____

19. Which iPad application do you think is the best for the development of the emotional regulation of students with autism and why?**

____

20. Do you embed the use of iPad applications in the school's curriculum?

- ☐ Yes
- ☐ No

If **yes**, please specify **why** and **how** you embed them: ______________________________

21. Do you measure students' performance while using iPads?

- ☐ Yes
- ☐ No

If **yes**, please specify **why** and **how** you measure the performance:______________

22. How often do you use iPads with students with autism?

- ☐ On a daily basis
- ☐ On a weekly basis
- ☐ Once a month
- ☐ Rarely

23. Do you feel that iPad applications can have a positive impact on the <u>social communication</u>* of children with autism?

- ☐ Yes
- ☐ No
- ☐ Not sure

24. Do you feel that iPad applications can have a positive impact on the <u>emotional regulation</u> of children with autism?**

- ☐ Yes
- ☐ No
- ☐ Not sure

25. On a daily basis, how much time do students with autism spend with the iPads?

- ☐ 0-30 minutes
- ☐ 31-60 minutes
- ☐ 61-120 minutes
- ☐ more than 120 minutes

26. Do you think that students with autism spend more time on the iPads than other students?

- ☐ Yes
- ☐ No

27. Have you received training for using the iPads in the classroom for students with autism?

- ☐ Yes
- ☐ No

If **yes,** please specify the type of training received: ___________________________

28. Would you be interested in receiving training for learning how to use iPads in the classroom for students with autism?

- ☐ Yes
- ☐ No

If you are interested in taking part in the next phase of this study, please leave your e-mail address when prompted at the end of the survey.

Thank you very much for your time!

Appendix 3b: Semi-structured Interview Questions for Practitioners

- **Introduction**

Dear X, I would like to start this interview by thanking you for being involved in my study. With this interview I would like to invite you to share your experiences about the way you use iPads in the classroom for autistic children's SC and ER.

- **Questions**

PART 1: Demographic background

1) Could you please give me a general view of your current professional role?

(Probing questions: -How long have you been working as a teacher so far?

-How long have you been working with children with autism?

-How many students with autism do you support daily?)

PART 2: iPad use in practice for SC and ER

2) What has been your experience in using iPads in the classroom for children with autism?

(Probing questions: -Do you use them to support the social communication of students with autism?

- If yes, which applications do you use?
- How do you choose them?
- If no, how do you use the iPads in the classroom?

-Do you use them to support the emotional regulation of students with autism?

- If yes, which applications do you use?
- How do you choose them?)

3) Can you think of the factors that influence the way you choose which applications to use in the classroom?

4) Can you give me some examples of the student's skills that you aim to develop while using the iPads in the classroom? (e.g. communication skills etc.)

5) Could you think of some applications that have been effective for students with autism?

(Probing questions: -In what way have they been effective?

-Why do you think they have been effective?

-Do you use specific applications for specific skills?)

6) Can you think of some examples that you embed the iPads in the school curriculum?

7) Could you give me an example of the frequency that your students use the iPads during the day?

8) Can you provide suggestions about effective ways of using iPads in the classroom for the development of the social communication of children with autism?

9) Is there anything else that you would like to discuss about the topic?

PART 3: Practitioners' perceptions

---

10) How do you think iPads can be used to support the development of the social communication of children with autism?

11) How do you think iPads can be used to support the development of the emotional regulation of children with autism?

12) Do you agree with the statement that teachers' confidence on using technology can affect the use of iPads in the classroom?

(Probing question: -Can you give me an example?)

13) Have you seen any differences in children's social communication while using the iPads?

(Probing questions: -If yes, why do you think this is happening?)

14) Have you seen any differences in children's emotional regulation while using the iPads?

(Probing questions: -If yes, why do you think this is happening?)

15) Can you think of any reasons that iPads attract the attention of children with autism?

(Probing questions: Any specific characteristics of the applications?)

PART 4: Interdisciplinary collaboration

---

16) Do you think that the collaboration between practitioners and other professionals can positively affect the way iPads are being used in the classroom?

(Probing questions: -Does it play an important role?

- If yes, in what way?
- If no, why?
- Can you give me an example of that?
- Can this affect the way iPads are being used in the classroom?)

17) Do you believe that the collaborative relationship between parents and teachers can affect the educational success of students with autism?

Probing questions: -Does it play an important role?

- If yes, in what way?
- If no, why?
- Can you give me an example of that?
- Can this affect the way iPads are being used in the classroom?)

➢ **<u>Closing the interview:</u>** At this point I would like to inform you that this is the end of this interview. Once again, thank you very much for your time and participation.

Appendix 3c: Semi-structured Interview Questions for Parents

- **Introduction**

Dear X, I would like to start this interview by thanking you for being involved in my study. With this interview I would like to invite you to share your experiences with me about the way you use iPads with your child for SC and ER.

- **Questions**

PART 1: Demographic background

1) Could you please give me a general view about yourself?

PART 2: iPad use and purposes

2) What has been your experience in using iPads with your child?

(Probing questions: -Why do you use them at home?)

- If yes, which applications do you use?
- How do you choose them?

3) Can you think of the factors that influence the way you choose which applications to use for your child?

4) Can you give me some examples of your child's skills that you aim to develop while using the iPads? (e.g. communication skills etc.)

5) Could you think of some applications that your child is particularly interested in?

6) Could you give me an example of the frequency that your child uses the iPads at home?

PART 3: Parent's perceptions

7) How do you think iPads can be used to support the development of the social communication of children with autism?

8) How do you think iPads can be used to support the development of the emotional regulation of children with autism?

9) Have you seen any differences in your child's social communication while using the iPads?

(Probing questions: -Why do you think this is happening?)

10) Have you seen any differences in your child's emotional regulation while using the iPads?

(Probing questions: -Why do you think this is happening?)

PART 4: Parent-teacher collaboration

11) Do you believe that the collaboration between parents and teachers in using the iPads can positively affect the educational success of your child?

Probing questions: -Does it play an important role?

- If yes, in what way?
- If no, why?
- Can you give me an example of that?
- Can this affect the way iPads are being used in the classroom?)

Suggestions

12) Is there anything else that you would like to discuss about the topic?

- **Closing the interview**

At this point I would like to inform you that this is the end of this interview. Once again, thank you very much for your time and participation.

- Introduction

Dear X, thank you very much for speaking to me. During our talk I will ask you a couple of questions about the iPads and I will record your answers using this voice recorder. If you do not know the answer to a question, or if you want to stop our talk please let me or your teacher know and we will stop immediately.

***Note:** The questions will be adapted based on children's needs. Below is an example of the photos that I will use with the children that are struggling to reply.

- Questions

PART 1: Demographic background

1) Can you tell me your name?
2) How old are you?
3) What year are you in school?
4) Do you have a sister?

5) Do you have a brother?

PART 2: iPad school use-feelings

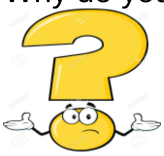
6) Do you use the iPad at school?

Yes   No

6a) If yes, do you like using the iPads? 

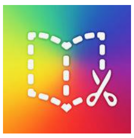
Yes   No

7) Why do you/do not like them?



8) What application you enjoy most on the iPad?

If no answer provided I will provide the following options as those are used in the schools that I have already been:

a) Book Creator 

b) Yakit Kids 

9) How do you feel when you use the iPad?





Happy Sad Neutral Scared Confused

(No specific feeling)

10) Do you prefer using the iPad or the Computer?


iPad Computer

10a) Why do you think you like using the X more?

11) Do you like sharing your iPad?

11a) Yes No and why


12) Would you like to use the iPad more at school?

Yes

No and why

13)What do you like most….?

a) Playing with friends 

b) Playing on the iPad 

14) How did you learn to use the iPad? Did anyone teach you that or you learn it by yourself?

15) How do you feel when it is time to shut down the iPad?

Happy

Sad

Neutral (No feelings)

Anxious

Confused

16) How do you know it is time to shut down the iPad?

PART 3: Home use

17) Do you have an iPad at  home?

17a) If yes, can you have it all the time?

17b) Do you ask your parents/carer before you take it?

17c) Which applications do you go on at home?

17d) You go on the iPad when you are ……

Happy Sad Neutral (No specific feelings) Anxious Confused

17e) How do you feel when you use the iPad at home?

Happy Sad Neutral (No specific feelings) Anxious Confused

17g) Do you have your own iPad at home?

17h) Do you parents/carers know how to use the iPad?

17i) How do you feel when it is time to shut down the iPad?


Happy


Sad


Neutral

(No specific feelings)


Scared


Confused

17j) How do you know it is time to shut down the iPad?

18) Would you like to have an iPad at home?

Yes

No and why

General comments

-Would you like to say anything else about the iPads?

-Do you have any suggestions about how to use the iPads in the classroom?

- **Closing the interview**

Appendix 4: Example of Data Analysis

Participant's code: TA8 (School A)

Code name of interviewer: R

Transcription sample			
Theoretical Framework	**Transcription**	**Initial Themes**	**Sub-themes**
	R: Dear ADE, I would like to start this interview by thanking you for being involved in my study. Could you please give me an overview of your current professional role?		
Ecological Systems Theory: Microsystem	**TA8:** I am a part-time teacher, full-time coordinator of educational technology within the school. I am also manager and coordinator of our technology training centre.	Background information	
	R: How long have you been working as a teacher so far?		
	TA8: Eleven years this summer.	Background information	
	R: How long have you been working with children with autism?		
	TA8: Ten years in a special needs' context.	Background information	
	R: How many students with autism do you support daily?		
	TA8: In the class probably three or four, I would say.	Background information	
	R: What has been your experience in using iPads in the classroom for children with autism?		

Theoretical Framework	Transcription	Initial Themes	Sub-themes
Ecological Systems Theory: Microsystem (educator's perspectives) **Abbott's Concept:** Individual	**TA8:** Very productive, they have a lovely engagement with the iPads, and they learn very quickly. It is also exciting that they can cross apply the skills that they have learnt in one app to a variety of others. For a child with autism to cross-apply things is pretty unbelievable.	Advantages of iPad use	Engagement Cross-application of skills
	R: Do you use the iPads to support the Social Communication (SC) of children with autism?		
Ecological Systems Theory: Microsystem (educator's practices) **Abbott's Concept:** iPad-Practices implemented	**TA8:** To a degree, yes, because they use the iPads collaboratively. So, they have to communicate with others when they use the devices. Recently, we also started looking at Lego therapy. During Lego therapy, we use iPads to record and facilitate part of the activity, so it helps with their SC.	Target skills and examples of use Collaborative Pedagogies	SC Suggestions
	R: Do you use specific applications for the SC?		
Ecological Systems Theory: Microsystem (educator's practices) **Abbott's Concept:** iPad-Practices implemented	**TA8:** Not really, but we facilitate the lesson to make it have a SC angle. The wider/more flexible the lesson is the more it supports the use of the apps I suppose.	Examples of use Flexible apps	SC iPads as multi-modal learning tools

Theoretical Framework	Transcription	Initial Themes	Sub-themes
	R: Do you use the iPads to support the Emotional Regulation (ER) of students with autism?		
Ecological Systems Theory: Microsystem (educator's practices) **Abbott's Concept:** iPad-Practices implemented	**TA8:** Not yet unfortunately because I am not aware of apps that can help with this. There needs to be more research on this area.	Target skills and examples of practices	ER-suggestions
	R: Can you think of the factors that influence the way you choose which applications to use in the classroom?		
Ecological Systems Theory: Microsystem (educator's practices) **Abbott's Concept:** iPad-Practices implemented	**TA8:** Price, ease of use, not being subject-specific. Because the generalisation of skills is a priority for me. Keeping it as simple as possible and limiting the number of available apps tends to have a more significant impact. Because then students can cross apply the skills that they have learnt to a variety of subjects.	Apps' selection criteria	Cost-children's age-ease of use
	R: Can you give me some examples of the students' skills that you aim to develop with the iPads?		

Theoretical Framework	Transcription	Initial Themes	Sub-themes
Ecological Systems Theory: Microsystem (educator's practices) **Abbott's Concept:** iPad-Practices implemented	**TA8:** Social and communication skills, being more confident in communicating and becoming clear communicators. Also using the iPads independently to enhance/express their learning, the way they want. We give them the tools to know how to use a variety of apps that they would then be able to use on their own. So, they might come in the classroom and say: "Can I use this to show you what I found on the iPad?", which is brilliant!	Target skills and examples of practices iPads as multi-modal learning tools	SC Independence
	R: Could you think of some applications that have been effective for students with autism?		
Ecological Systems Theory: Microsystem (educator's practices) **Abbott's Concept:** iPad-Practices implemented	**TA8:** Book Creator, iMovie… any movie making software basically has been incredible because they can develop different skills and cross-apply their learning in various subjects. Also, any software with animation that they can put their own slants on it. For example, they can take something like the story: "Jack and the Beanstalk" and make it into a film. Add their own characters and make it their own movie. It is still the same story, but their own version of it and they engage more that way. So, film making is definitely a very successful software with the autistic group.	Target skills and examples of practices Independent learning	SC-suggestions
	R: Can you think of some examples that you embed the iPads in the school's curriculum?		

Theoretical Framework	Transcription	Initial Themes	Sub-themes
Ecological Systems Theory: Microsystem (educator's practices) **Abbott's Concept:** iPad-Practices implemented	**TA8:** So, mostly we spend the time in computing subject lessons to give them the skills that are required for specific apps. This is when we introduce new apps to the pupils. The 'Seesaw' app is the perfect example as they record themselves, and they can use the app in a variety of subjects. In another example, they might take a picture and put it into Book creator to make a book of the work that they have been doing. So, they use the iPads mostly as a tool like a ruler or a pencil inside the classroom. In some other cases, they choose their own roots to record with the iPad (for example free flow activities) which again opens up a new way!	iPads as additional Learning Tools Multi-modal teaching methods Target skills and examples of practices Child-centred pedagogies	Child-centred use SC
	R: Could you give me an example of the frequency that your students use the iPads during the school day?		
Ecological Systems Theory: Microsystem (educator's practices) **Abbott's Concept:** iPad-Practices implemented	**TA8:** At least once a day, probably more than once a day. It depends…	iPad Regulation and Frequency of Use	Frequency
	R: And for how long?		
Ecological Systems Theory: Microsystem (educator's practices) **Abbott's Concept:** iPad-practices	**TA8:** I think probably between 1 and 2 hours a day I would say in my class.	iPad Regulation and Frequency of Use	Duration

Theoretical Framework	Transcription	Initial Themes	Sub-themes
	R: How do you think iPads can be used to support the development of the SC of autistic children?		
Ecological Systems Theory: Microsystem (educator's practices) **Abbott's Concept:** iPad-Practices implemented	**TA8:** So again, collaboration. It is crucial …children working together in collaborative projects by doing things together. Specific software like animation can enable them to communicate with each other based on their roles and responsibilities.	Target skills and examples of practices Collaborative Pedagogies E-Inclusion	SC
	R: Do children share the iPads in your classroom, or do they have their own individualised devices?		
Ecological Systems Theory: Exosystem (school's structure) **Abbott's Concept:** Context **Ecological Systems Theory:** Microsystem (educator's practices) **Abbott's Concept:** iPad-Practices implemented	**TA8:** Sometimes they have their own devices and sometimes they have to share them. Even when they have got the individual ones, sometimes I set the tasks in a way that they have to work together. For example, when they have to make a film in groups of two. So, by setting this task accordingly, I can facilitate communication to happen rather than doing things independently. With a lot of the activities that we do with the iPads, they communicate a lot more than they would do with the traditional teaching methods. This is because they do not realise that they are learning at the same time. iPads enable them to complete learning tasks in a fun way.	School structure Target skills and examples of use Collaboration Communication Assistive tools & Enablers of learning	School's well-equipped technological resources SC
	R: How could iPads be used to support the ER of children with autism?		

Theoretical Framework	Transcription	Initial Themes	Sub-themes
Ecological Systems Theory: Microsystem (educator's practices) **Abbott's Concept:** iPad-Practices	**TA8:** A possible idea could be to use wearable technology linked to iPads to give children an idea when their heart rate is going up. To provide them with an earlier reminder when they become stressed to move from the situation and start to understand self-regulation a little bit more. There are other bits and pieces on certain apps, but it needs the cognitive ability of the children, and that is the problem. So, the older the child is the more cognitive able they are. Therefore, some bits and pieces might come in, but at a primary level, it is hard.	Target skills and examples of use Anxiety-ER regulation	ER-Suggestions
	R: Do you agree with the statement that teachers' confidence on using technology can affect the use of iPads in the classroom?		
Ecological Systems Theory: Microsystem **Abbott's concept:** Individual-Perspectives	**TA8:** Yes, I agree. This is why my main role in the last 4 or 3 years is to get people on board and enable them to integrate the iPads effectively in the lesson.	Role of Confidence on iPad Practices Implemented in Practice	Confidence
	R: Have you seen any differences in children's SC while using the iPads?		
Ecological Systems Theory: Microsystem **Abbott's concept:** Individual-Perspectives	**TA8:** Yes, there are a few cases that I have seen where the SC has improved vastly, and children have become happy to communicate with others. I am more confident, and I think it goes much across the board that children that are effectively using iPads can become more confident in their ability to communicate.	Advantages of iPads SC iPads as assistive tools	SC
	R: Can you think of any reasons why the iPads attract children's attention?		

Theoretical Framework	Transcription	Initial Themes	Sub-themes
Ecological Systems Theory: Microsystem **Abbott's concept:** Individual-Perspectives	**TA8:** Because they use them at home for social aspects and I think they cross apply what they have learnt here at school. The other thing is that it is easy for them to use iPads in areas where they struggle. For example, if they have difficulties with their handwriting or if they struggle with expressing themselves using the traditional methods, it is easier for them to use the iPads.	Views on why iPads attract autistic pupils	Independence, control, ease of use
	R: Do you think that the collaboration between practitioners and other professionals can positively affect the way iPads are used in the classroom?		
Ecological Systems Theory: Mesosystem **Abbott's concept:** Context	**TA8:** Yes, without any doubts, yes. By sharing skills, ideas and good practice we learn from each other, and we become more confident users. One app can do a hundred things if you think about it. And I think that is the beauty of sharing ideas is that everyone's practice improves.	Collaboration	Collaboration between practitioners
	R: Do you think that the collaboration between parents and teachers can affect the way iPads are being used in the classroom?		
Ecological Systems Theory: Mesosystem **Abbott's concept:** Context	**TA8:** Potentially, as long as the parents realise that the iPad is not a toy, and it is not just a reward. But it is a tool that we use for educational purposes and not a childminding device. This is something hard to understand because they see it as a home device to entertain children. They cannot necessarily understand what we do in our context.	Collaboration Different values-perceptions	Home-school communication gap
	R: Do you organise workshops at school to inform parents how to use the iPads?		

Theoretical Framework	Transcription	Initial Themes	Sub-themes
Ecological Systems Theory: Mesosystem **Abbott's concept:** Context	**TA8:** Yes, we run our online safety workshops. They open parents' eyes to the risks that might exist online. During the workshops, we go through the settings on iPads, and we show them how to restrict things. But I think that if we spend a lot of time explaining to parents, the practises that we use at school, they will try and replicate them at home. Then the unique aspect of using the iPads in the lesson would go, as children would have similar experiences at home. Therefore, it would not have the same impact on children and parents would probably not understand why we are doing the activities in that way. Because it looks a bit gamey or maybe a bit unnecessary for them to use the iPads for education purposes at home. Parents do not understand the educational aspect of the devices and our practices at school because they are not teachers. We know why we are doing the lesson in this specific way. For a parent, it would be 'Why on the earth are they doing this at school?'. There is a fine line really between home and school, although the collaboration is necessary. Collaboration regarding the iPads needs to be considered thoroughly as we should not expect from parents to act as teachers at home.	Collaboration for E-safety Different values-perceptions Distinct roles of parents-educators	Home-school communication gap (one-way communication)
	R: Could you please provide some suggestions about effective ways of using the iPads in the classroom for the SC of autistic children?		

Theoretical Framework	Transcription	Initial Themes	Sub-themes
Ecological Systems Theory: Microsystem **Abbott's Concept:** iPad-Suggested Practices	**TA8:** Collaboration, collaborative working between children, between adults, between children and adults between everyone. I think that we can make some fantastic steps with communication and social skills with the iPads. Because we learn to do things together and in a different way that allows everyone to have roles to do. Making a film is the prime example. One can be the cameraman, one can be the director, one can be doing the actor, one can be choosing the theme, so it is the perfect way to do this. The same with animation is having those roles and the fact that we can build various roles within it. But again, it is all about creativity and careful planning. These two things are hand in hand, really.	Target skills and examples of practices Collaborative pedagogies iPads as multi-modal learning tools E-inclusion	SC
	R: Did you ever have any problems with children's behaviour regarding the iPad regulation?		
Ecological Systems Theory: Microsystem (educator's practices) **Abbott's Concept:** iPad-Practices implemented	**TA8:** Yes, but I think that is down to classroom behaviour management. So, it is crucial to explain to them that the iPad is a tool to do their work. If we have to take the device off from them, they need to understand that they have to go back to working on paper and pencil to do the activity. But there are tools available now, so they make it a lot easier for the practitioners to lock the iPads in specific apps. That way, children stay on track, and they do not access irrelevant apps. But it is all about the practitioner's behaviour management skills of the classroom. So, to be fair, it is not down to the device, but it is down to the teacher's confidence in using it effectively.	iPad Regulation and frequency of use E-safety Teachers' confidence	Regulation
	R: Thank you very much! At this point I would like to inform you that this is the end of the interview. Thank you for your time and your participation!		
	TA8: Thank you!		

Appendix 5: Educators' List of Suggested Apps for SC and ER

Apps' suggestions from the online survey	
For SC	**For ER**
Baby look faces	Breathe, Think, Do
Big Bang	Choiceworks
Book Creator	Colourful Semantics
Clicker	Emotions full app
Communicate easy	Expressions
Cospatial	FaceApp
Dragon Dictate	Games
FindMe	Karisma Kidz
Gigglebug's Face Race	Koi Pond
Games	LightBox
LAMP	MyUSO
Makaton app	Proloquo2Go
PECS	Recording
Proloquo2Go	Songs / music
Sand timer app	Story making apps
Social Detective	Talktablet
Story Making apps	The Zones of regulation
Stories2Learn	5-point scale
Talktablet	
Tellagami	
Voice recorder	
Whats app	
Widgit Go	
Wordwall	
YouTube	

Apps’ suggestions from the case studies			
SC	**ER**	**Maths**	**Reading/Writing**
Articulation station	Book Creator	Book Creator	BBC app
ChatterPix	ChatterPix	Osmo Tangram	Hairy Letters
Dash and Dot	Seesaw	PiCollage	Notes
GarageBand		QR & Barcode scanner	Osmo Tangram
Jack and the Beanstalk Interactive Story book		Shadow Puppet Edu	PiCollage
Osmo Tangram		Squeebles Maths	Twinkl Phonics
PicCollage		Writing Wizard	Writing Wizard
Puppet Pals			
Shadow Puppet Edu			

Appendix 6: Thesis Brief Presentation/Overview

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Perspectives of Key Stakeholders about Practices Relating to Using iPads for Autistic Pupils' Social Communication (SC) and Emotional Regulation (ER)

PHD THESIS VIVA PRESENTATION

Alexia Achtypi, axa1102@bham.ac.uk

Supervisors: Professor Karen Guldberg , Dr Despina Papoudi

School of Education
Department of Disability Inclusion and Special Needs (DISN)
University of Birmingham, UK
August 2021

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Research Incentive

- Mobile devices integration into the classroom as additional learning tools
- In the UK, tablets are familiar elements of educators' practices and students' learning: EdTech strategy (1)
- Since 2010, special schools have increased the use of tablets (2)
- Autistic individuals show affinity to technology (3)

However:

- Understanding how technology can best meet the needs of pupils remains a challenge
- Studies have explored mobile technologies to meet specific needs or address curriculum subjects (4)
- Limited research has focused on what really happens in the classroom(5)

Hence, this Thesis shifts the attention to investigating the perspectives of key stakeholders regarding practices relating to using iPads *in-situ* for SC and ER.

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Autism and Technology in Context (A)

To contextualise autism and technology the study is split into two sections:

A) A narrative literature review

B) An online survey

A) **<u>Literature Review:</u>** Previous research in iPads and autism

- Lacks methodological rigour (small sample sizes, controlled environments)
- Has focused on iPads as intervention tools and applications that target SC
- Has not extensively explored ER
- Should involve input from key stakeholders

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Autism and Technology in Context (B)

B) **<u>Online survey:</u>** *n*=55 educators in Special and Mainstream (Autism Resource Base) schools

Findings:

- Similarities and variations were identified in the way iPads are implemented for SC and ER, based on:
    - The effect of specific criteria for the selection of apps
    - The prioritisation of autistic pupils' skills
    - The measurement of students' performance during iPad use
    - The frequency and daily duration of iPad implementation
    - The iPad training provided to educators
- iPads as multi-modal learning tools
- Contextual factors influenced iPad implementation in different settings
- Participants' perspectives were positive and not dependent on training

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Research Objectives

- Collect and analyse practitioners', parents' and autistic pupils' perspectives about the practices relating to using iPads for autistic pupils' SC and ER at school and home.

- Understand and evaluate the impact of context on how iPads are implemented in real world environments.

- Investigate and assess the various levels at which participants, iPads and context interact and the way they influence the practices adopted.

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Research Design

- **Two case studies:**

  a) Special school (School A)

  b) Mainstream Autism Resource Base school (School B)

- **Data collection methods:**

  a) Interviews: School A (*n*=10 educators, *n*=3 parents, *n*=4 autistic children)

  School B (*n*=5 educators, *n*=4 parents)

  b) Document Analysis : Computing/E-safety policies

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Conceptual Framework

Abbott's concept of "E-inclusion" (2007):

- To illustrate the interaction between iPads, key stakeholders and contexts

Bronfenbrenner's Ecological Systems theory (1979):

- To illuminate the different levels at which iPads, key stakeholders and contexts interacted
- To provide an overview of the broader environmental components and their impact on the individual's learning with tablets

→ Both theoretical concepts encouraged *consistent language* and *structure* for the data analysis

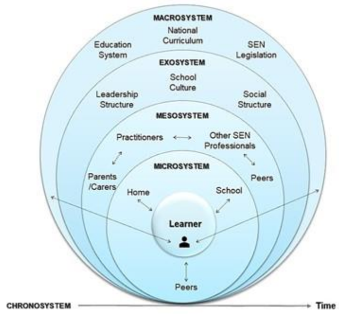

Figure 1: Adapted Visual Representation of Ecological Systems Theory (Bronfenbrenner, 1979)

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Key Messages from both Case Studies

- Discrepancies in schools' teaching methods, approaches, pedagogies
- Prioritisation of pupils' development of SC with iPads at school than ER
- Minimal differences in teachers' perspectives
- Educators' positive beliefs towards iPads
- Context's impact on teachers' level of confidence in using iPads
- Organisational, personal, and technological components' influence on how educators used iPads
- Educators, parents and peers (Microsystem) direct impact on the child's learning with iPads
- Indirect influences from the Exo- and Macrosystem shaped schools' decisions regarding iPad use
- Children's iPad use at home mainly for communication/social networking and relaxation
- Collaboration gap regarding iPad use between home and school

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Thesis Contributions

- Conducts a critical assessment of the work done in previous studies
- Implements a comprehensive research design to explore key stakeholders' perspectives
- Provides an extensive analysis for iPads' use for SC and ER evaluating the impact of context
- Combines two conceptual frameworks to investigate the levels at which key stakeholders, technology and context interact
- Informs the literature by providing the perspectives of educators, parents and autistic pupils regarding the in-situ use of iPads for SC and ER
- Illustrates iPads as assistive tools and enablers of learning through ER and adds another dimension to Abbott's "E-inclusion"
- Offers guidance about the contextual factors that can enable iPads enhance autistic pupils' SC and ER

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Broad Implications for Practice

The Thesis:

- Provides insights into what drives teachers to make decisions regarding technology use
- Emphasises the importance of supporting educators to develop skills in technology
- Situates technology in-situ and explores the complex interaction between iPads, key stakeholders and context
- Provides recommendations about the successful iPad use for SC, ER and "E-inclusion"
- Highlights technology's potential to support communication, collaboration, relaxation and transition
- Illustrates technology's multidimensional role as assistive tool, enabler of learning and regulator of challenging behaviour
- Provides insights about technology's role beyond one user, one device or one application

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Limitations

- The number of participants from School A did not match those from School B

    → *but sample sufficient for the purposes of the Thesis*

- Adjusted data collection methods in School B

    → *but the training's impact on participants' views was acknowledged when reporting the data*

- Limited representation of the autistic spectrum

    → *but provided insights into the interrelation between the learner and his environment*

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Proposals for Future Research

- Focus on the perspectives of autistic individuals
- Explore ways of fostering two-way communication between school and home
- Further research on iPad use for ER in autism specialist schools
- Develop broad technology training programmes based on expert personnel
- Extend the approach of this study to other models of technology use in practice
- Impact of the national curriculum towards forming schools' computing policies

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Major Concluding Points

- Tablets as multi-modal learning tools across the curriculum
- SC with iPads was prioritised more than ER at school
- Positive impact of Educational Technology Coordinator on the successful iPad adoption
- Communication gap between school and home
- iPad use at home was mainly concentrated on recreation and ER
- The school's computing policy shaped the iPad learning practices
- Organisational, personal, and technological components influenced how iPads were used in-situ
- Distal systems and contextual elements indirectly impacted autistic pupils' learning

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Thank you!

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