Towards digital citizenship: a digital literacy curriculum to support teachers in the classroom

S M B MIDDLETON

PhD

2022

Towards digital citizenship: a digital literacy curriculum to support teachers in the classroom

SOPHIE MARGARET BRIGID MIDDLETON

A thesis submitted in partial fulfilment of the requirements of the University of Northumbria at Newcastle for the degree of Doctor of Philosophy

Research undertaken in the Faculty of Engineering and Environment

April 2022

Abstract

The purpose of this qualitative research is to generate theory that attempts to investigate, explore and "expand knowledge" (Bickman, 1981) in digital literacy skills and the needs of primary school teachers in educational training and Continuous Professional Development (CPD). Using its findings, an intervention framework was developed to empower teachers to support primary school children in an ever-changing digital landscape.

This study followed a Constructivist Grounded Theory (CGT) research method, focusing on generating a new theory through the exploration of pre-existing theoretical frameworks in relevant literature and the inductive analysis of the data gathered from Phases 2 (interviews) and 3 (interventions) of the research process.

Finding no agreed definition for 'digital literacy' in any given context during Phase 1 of the study, the researcher explored different models of digital literacy to create a definition of the phrase in a primary education setting:

Digital literacy in education involves using technology creatively and developing functional skills, through exploration and practice. It is the understanding of e-safety by critically questioning the use of technology and information and the risks involved. This involves critically conducting searches to find and select relevant information using digital tools. It involves the ability to communicate and collaborate effectively online and with this have knowledge and understanding of cultural, social, and ethical behaviours.

The researcher theorised that digital literacy in education consists of six components: functional skills, e-safety, finding and selecting relevant information, communication and collaboration, cultural, social, and ethical understanding, and creativity. The curriculum objectives of each component were determined after three-rounds of interviews with thirty-three practising teachers from North-East England, where questions were asked to gain an understanding of their digital literacy training needs which would be addressed in the training course. Findings showed the impact of COVID-19 saw these needs changing because of more frequent exposure and experience with teaching using technology, resulting in the development of digital literacy skills.

Without an agreed definition for digital literacy, the skillset which teachers require is often unknown. This study proposes that teachers are trained in a foundation of digital literacy

skills, specified to a primary educational context. Teachers will learn the required skills to ensure transferability as technology changes and digitalised societies advance.

The significance of this research is that it informs educators of an overview of the six components of digital literacy in an educational context and suggests that delivery of a framework which provides training for teachers in this area, which can be adapted to suit any audience. The researcher suggests it may be adapted for CPD training, a HE module or a topic for primary school children.

Contents

List of Tables

List of Figures

Abbreviations

BA	Bachelors'
CAQDAS	Computer Assisted Qualitative Data Analysis
CEL	Computer Engaged Learning
CK	Content Knowledge
CPD	Continuous Professional Development
DfE	Department for Education
DI	Digital Identity
DL	Digital Literacy
DOB	Date of Birth
EYFS	Early Years Foundation Stage
GDPR	General Data Protection Regulation
ICT	Information Communication Technology
ID	Identification
IL	Information Literacy
IT	Information Technology
ITT	Initial Teacher Training
KS	Key stage
ML	Media Literacy
NE	North-East
PCK	Pedagogical Content Knowledge
PD	Personal Development
PK	Pedagogical Knowledge
PLE	Personal Learning Environment
PS	Primary School
PST	Primary School Teacher
RQT	Recently Qualified Teacher
SLT	Senior Leadership Team
SMT	Senior Management Team
TA	Teaching Assistant
TCK	Technological Content Knowledge
TK	Technological Knowledge
TPACK	Technological Pedagogical and Content Knowledge
TPK	Technological Pedagogical Knowledge
TS	Teachers' Standards
TT	Teacher Training
UK	United Kingdom
USA	United States of America
VAK	Visual Audio Kinaesthetic
www	World Wide Web

Declaration

I declare that the work contained in this thesis have not been submitted for any other award and that it is all my own work. I also confirm that this work fully acknowledges opinions, ideas and contributions from the work of others as cited in this thesis.

The ethical clearance for the research presented in this thesis have been approved. Approval has been sought and granted by the Faculty of Engineering and Environment Ethics Committee.

I declare that the word count of this thesis is: **80, 604**

Name: **SOPHIE MARGARET BRIGID MIDDLETON**

Signature:

Date: 30th April 2022

Acknowledgements

Throughout the course of this PhD, I have received a huge amount of support, kindness, and advice for which I am truly grateful.

First and foremost, I would like to give my sincere thanks to my supervisor, Dr Alison Jane Pickard, who has shown enduring patience, invaluable mentorship, and encouragement throughout this research journey. She has provided priceless guidance that has helped me to grow into an independent researcher. I thank Professor Rebecca Strachan, my second supervisor, whose wisdom, support, and encouragement also contributed to the development and progress of this research.

Many thanks to Northumbria University and the Faculty of Engineering and Environment for providing Research Studentship Funding and an enabling environment to focus on this study. I thank my colleagues Alan, Cherie, David, Graham and Steven for their advice, support and laughter when working in our office and on virtual platforms during the pandemic. I am also thankful to have had the opportunity to seek advice and constructive feedback from Dr Opeyemi Dele-Ajayi and Dr Itoro Emembolu, both of whom have become good friends.

Next, I would like to express my gratitude to my family, who have expressed their support and interest throughout this journey. Words are not enough to express my appreciation for the love, laughter and support you have shown. At the heart of this, I thank my mother, Paula Henry, for her work ethic and inspiring practice as a Foundation Stage Leader which inspired me to become a teacher myself. It is my passion for education and information research that has led me to this project.

Huge thanks goes to all of those who took the time to participate in this study, without whom it would not have been possible. As a former teacher myself, I greatly appreciate the time and effort made by the practising teachers during the three rounds of interviews. In a time of intense pressure, you all provided invaluable information that greatly aided this

study and helped to determine the requirements of the framework. Thank you to the Primary Education (BA) students from Northumbria University, who were the first to participate voluntarily in the six interventions and gave interesting and valuable feedback. I also thank those four practising teachers who went even further to watch the recordings of the six sessions and offered their expert advice and encouragement during their reviews.

Finally, I express my heartfelt gratitude to my husband, Mark Middleton, to who this PhD is dedicated. You are a constant pillar of love, support, advice, and encouragement and have been there for me during all stages of this research. I appreciate your love and willingness to share your time with my work. You are my backbone, and an enthusiast who has helped me to focus when I have struggled. I am eternally grateful to be blessed with you by my side.

1. Chapter One: Introduction

1.1 Background context of the study

It has been noted that we are living in a society which is becoming increasingly reliant on technology and the internet; the world has become digital (Deady, 2017). “Digitalisation is advancing at an ever-increasing pace and affecting life on various levels: It is challenging the ways we communicate, entertain, learn, socialize, and work” (Lucas, et.al., 2021). As the ‘digital world’ evolves, teachers now “require a complex range of skills, knowledge and understanding” (Facer, 2009) of technology to be considered ‘digitally literate.’ Information Communication Technology (ICT) has had to become more present as an educational tool and teachers are expected to be able to create successful learning environments using technology, and this is becoming more recognised as education had moved to online teaching due to the impact of COVID-19 (Tzifopoulos, 2020).

Teachers lacking these skills risk not utilising these resources to their full potential: “an introduction of such technologies in schools for producing change and innovation is not enough, it requires digitally competent teachers to facilitate the use of ICT in education” (Hassan & Mirza, 2021). Digital literacy skills are extremely important for teachers to support alternative teaching strategies, which became apparent during COVID-19: “Concerns about the digital skills gap have been particularly acute during the COVID-19 pandemic as people have been more reliant on digital skills for accessing education” (UK Parliament Post, 2021). The outbreak of COVID-19 (2020) in England forced schools throughout the nation to close, with only two days’ notice, with an expectation of delivering home-based learning to all students. “School’s out, but class is on” (Zhou et al, 2020) and so teachers were required to fulfil their job expectations; forced to deliver teaching remotely, find methods to monitor progress and discovering ways to communicate with their colleagues, students, and parents alike, when neither party has been trained to do so.

The issue with the expectation that teachers should now be digitally literate is that there is currently no agreed definition for the phrase 'digital literacy.' Without an agreed definition, it can be interpreted in different ways and has a different meaning in different contexts. Research in this study has shown that teachers are uncertain about the meaning of the phrase, which is to be expected. As a result, teachers prior to the pandemic did not know what it is to incorporate Information Communication Technologies (ICT) into the classroom or what it is to be digitally literate (Prendes & Gutiérrez, 2013; Suárez, Almerich, Gargallo & Aliaga, 2013). The outbreak of COVID-19 has emphasised the lack of understanding and how teachers were unprepared for remote learning in an international crisis. The needs of digital literacy skills have changed from an option to incorporating them into a physical classroom, to becoming a requirement in a virtual classroom. This situation has brought more of a focus on e-learning opportunities and has forced teachers to adapt to using more digital learning strategies and developing their digital skills. The need to use and develop these skill sets altered teachers' perceptions of this concept as their knowledge and understanding became more accurate.

"The interpretation of the concept of digital competencies and digital literacy has undergone long-term development and its contemporary appearance is characterised by complexity and by focuses not only on technology skills but also cognitive and attitudinal components of personality."

(Rambousek, Štípek, and Vaňková, 2016).

This suggests that as technology and digital skills evolve, the meaning of the concept 'digital literacy' also develops to encompass and embrace these changes. To be competent or literate one must have the potential to perform effectively in each context; using integrated, portable, and multifunctional set of knowledge, cognitive and practical skills, attitudes, and values (Rambousek, Štípek, and Vaňková, 2016) to adapt and develop as technology evolves. COVID-19 has emphasised that digital literacy skills will evolve from an understanding of how to use these tools to then become digitally fluent and with the ability to create something with these tools as the educational environment changes.

Research suggests the idea of digital literacies having multiple 'components' (Savage, 2015) or 'elements' (Belshaw, 2012). Hague and Payton (2010) suggest that to be digitally literate, teachers must be trained in the eight components of digital literacy: functional skills, e-safety,

creativity, critical thinking and evaluation, cultural and social understanding, collaboration, the ability to find and select information and effective communication, suggesting that to be digitally literate teachers must be competent in a range of skills. In answer to the challenge of defining digital literacy, a wide variety of educational institutions, professional organisations, and others have created digital literacy models or frameworks (Freerar, 2019). Although these frameworks try to identify the necessary skills and areas of digital literacy, none of these are identified in the Teachers' Standards (DfE, 2011). Before the impact of COVID-19, some teachers questioned whether these skills are necessary or if it is extra work on top of an already heavy workload. In the current climate, it seems obvious that these skills are most definitely a requirement. However, digital literacy is not compulsory, it is not identified in the Teachers' Standards (DfE, 2011) and it is not fully understood. It is plausible that practising teachers have difficulty defining this phrase and therefore interesting to discover their experiences with and perceptions of digital literacy, prior to and during the COVID-19 outbreak.

In early 2020, COVID-19 brought about an unprecedented experience forcing the world to adapt to these new circumstances (Tzifopoulos, 2020). As the UK was placed into lockdown, schools had to change their teaching practices and strategies to those that would support distance learning. 'The COVID-19 pandemic has impacted education at all levels in various ways. Institutions and teachers have had to quickly respond to an unexpected and "forced" transition from face-to-face to remote teaching' (Carillo, 2020). This situation has questioned pervious thoughts that digital literacy skills were not necessary and there may not be a place for them in the current Teachers' Standards. "Teachers have been thrown into the battle of 'survival" (Tzifopoulos, 2020) highlighting the complexities and significance of digital literacy.

"For informed and productive online teaching and learning it is important to learn about its potential and use."

(Carrilo, 2020).

To support distance learning, training for teachers in basic functional skills are necessary to provide an overall goal for teachers to adapt and explore these skills. This will lead to better communication with students and help deliver their learning needs to meet the Standards of

the National Curriculum: “out of social affordances of online tools, collaboration was seen as a key feature” (Theelen, et al., 2020).

This study began looking at the initial perceptions of primary school teachers (PST) in North-East (NE) England on digital literacy. It focused on their thoughts, training, and use of digital literacy in their working environment. COVID-19 has forced the world to become more digitalised as means to communicate and explore knowledge. As a result of increasing exposure to digital literacy, teachers‘ perceptions, understanding and use of this skill set have changed.

The literature showed that little research had been done into defining DL in a primary educational context. There were no models or training course examples available in the literature to suit the multitude of skills which fit under the umbrella of DL skills and can be put into pedagogical contexts.

The purpose of this research is to generate theory that attempts to investigate, explore and “expand knowledge” (Bickman, 1981) in DL skills and the needs of Primary School teachers in educational training and Continuous Professional Development (CPD). This theory will then be used to develop and evaluate a DL framework to support student teachers with DL skills in educational interventions and a CPD framework to be used by practising teachers.

1.2 Research aims, objectives and questions.

The following aim and objectives are proposed for this research:

1.2.1 Research aim

The aim of this PhD is to develop a digital literacy framework to support teachers with digital literacy skills as part of Continuous Professional Development (CPD). This will be an intervention to empower teachers to support PS children in an ever-changing digital landscape.

To begin, the researcher will determine the meaning of DL in a primary educational context in their exploration of literature, answering the question:

What does digital literacy mean in an educational context?

This will set a foundation for the framework by defining digital literacy and breaking it into components and objective, suitable for a training curriculum. The research will continue in answering the second research question:

What are the current gaps in digital literacy for primary school teachers?

The theory-arisen objectives will be re-defined through the voices of the participants and their discussing of the perceptions of digital literacy, their experiences with digital literacy and their training needs. The framework will be designed, delivered, and evaluated to answer the question:

Can a CPD framework be developed to train teachers in the identified required skills so that they can become digitally literate?

1.2.2 Research objectives

- To review the existing state of the field and to determine the gaps in digital strategies in education.
- To define, identify and analyse the purpose of digital literacy in an educational context.
- To identify what teachers want to know about and what they think their DL training needs are.
- To identify the current availability of technological tools and digital access for both teachers and primary school children.
- To develop a curriculum for teachers to identify the skills required for digital literacy training interventions.
- To use this curriculum to develop CPD interventions to train teachers in digital literacy skills.
- To develop a framework for evaluating the designed CPD interventions.

1.3 Research parameters

This research focused on the perceptions and experiences of:

- Thirty-three practising teachers of different genders, year groups, teaching experience and positions, in NE England.
- Thirty-five third year Primary Education (BA) students from Northumbria University

Although focusing on individuals working or studying in NE England, it was hoped that the sample of maximum variation would ensure that these representatives would illustrate the concerns and needs of PST and Primary Education (BA) students throughout England.

1.4 Significance of the study

This study makes an original contribution to knowledge in three parts:

- In determining a definition for DL in a primary educational context through exploration of theory and practice, to form a basis for components that will form the structure of a training framework.
- In identifying the DL training needs of teachers through discussions in interviews, learning of their experience, practice and wants for DL in education. These identified wants and needs of the representative PST will be used to determine the objectives for a foundation framework.
- In designing, developing, and evaluating a CPD framework to determine if it has met the purpose of the research and suggested ways forward.

From the literature, there began the first challenge of this study. Research prior to this had determined that there was “no agreed” (UNESCO, 2018a), definition for the collective term of ‘digital literacy.’ Scholars had theorised about the umbrella term and had attempted to determine the exacting qualities and concepts that belong to it, aiming to identify the components one would possess to be considered a digitally literate person.

The research explored the presenting of models to determine patterns within the suggested components and attempted to find a model suited to the research context. The investigation into the term, suggested that no models had been designed to suit a primary educational context, and therefore the researcher would have to draw upon models that showed some applicability. They would then go on to determine the required skills to become a DL PST. Once the required skills are identified, training objectives can be set.

The first step had been to find relevant research to set a foundation of the components of DL in a generalised context, that could be built upon, or adapted to suit this research context. The researcher identified five models that would be suitable foundations for this study and identified six components that would be the basis of this curriculum.

The researcher would use a constructivist approach to approach persons with experience and 'expertise' within the context (practising PST), to give voice to their perceptions and experiences with DL. The researcher would use the findings from the interviews to identify the perceived DL training needs of PST to influence the objectives of the framework. The objective were to suit a diversity of skills, experience, attitudes and school contexts and therefore would be for a basic, or foundational framework, which could then be adapted for more specified content, learning styles, abilities and timings.

This research will have great significance within the sphere of education, in England. There are currently no DL training curriculums available to PST to support them with the implementation of technology into the classroom. The national curriculum (NC) in England does not give a supportive outline in teaching students DL skills. There are currently only thirteen standards in the Primary NC: six for Key Stage (KS)1, and seven for KS2. And are often not prioritised as there is confusion about their meaning, as PST aren't always familiar with ICT and are not computer-specialised practitioners. Therefore, as the digital world evolves, teachers require training in DL skills to teach their students these skills.

This framework will not only be used to develop PSTs' DL skills but will also give suggestions as to how teachers can implement the skills in their delivery, giving examples of its pedagogical attributes.

1.5 Outline of thesis

1. Chapter one: Introduction

This chapter introduces the background context of the research, within which the study was designed and implemented. It addresses the aims and objectives set and gives an indication of its significance and contribution to knowledge

2. Chapter two: Literature review

This chapter evaluates the literature, focusing on DL in theory and defining DL in a primary educational context, determining components of DL suited to this context, and identifying approached to the implementation of DL and technology into the classroom. These themes offer theories to which the research will build upon and address areas for improvement.

3. Chapter three: Methodology

This chapter, describes and justifies the chosen methodology. A constructivist inquiry approach was adopted, consisting of two-phases of research. Data was collected from three rounds of interviews and the delivery of the designed CPD course. The data was then analysed using a grounded theory approach.

4. Chapter four: Interview findings

This chapter presents the prominent themes and categories discovered in the three-rounds of interviews. It presents conceptual stem map of the categories and themes to illustrate relationships between the hierarchy of research patterns and groupings. The main themes and categories will be evidenced, using supporting quotations from the participants. It ends with an outline of the designed framework, using the findings from both the literature review and interviews to support the chosen objectives.

5. Chapter five: Intervention findings

This chapter discusses the findings from the delivery and evaluation of the framework. It draws upon the feedback from the students and practising teachers and looks at the productivity during the interactive activities within the sessions. It

combines the perceptions of participants, practising teachers and their own to identify strengths and areas for improvement as part of an action research method.

6. ***Chapter six: Emerging themes and suggested ways forward***

   Following the evaluation of the framework, this chapter considers the data from all phases of the research. It explores the data to identify theories that have arisen from the relevant literature, three-rounds of interviews and the evaluations from the interventions. It then discusses areas for concern, strengths, and adaptations to be considered for future delivery.

7. ***Chapter seven: Conclusion***

   The final chapter provides a conclusion, summarising the chapters and reviewing the process and output of the study. It formally presents recommendations to the field of study. The limitations of the project will also be explored and the contribution of the thesis is presented.

References

Belshaw, D. (2012) What is 'digital literacy?' A Pragmatic investigation., Durham theses, Durham University. Available at: http://etheses.dur.ac.uk/3446/ (Date accessed: 11.3.2019)

Deady, K. (2017). Preparing students for a digital future: How teachers can bring digital literacy into the classroom. *Teachaway.* Available at: https://www.teachaway.com/blog/preparing-students-digital-future-how-teachers-can-bring-digital-literacy-into. (Date accessed: 4.4.2020)

2. Chapter Two: Literature Review

2.1 Introduction

The aim of this literature review was to support the first research question: *How can digital literacy (DL) be defined to suit an educational context?* It aims to identify what skills are required to be considered digitally literate and to then relate these to an educational context, to identify the skills that primary school teachers (PST) require to be considered digitally literate.

The researcher analysed literature to:

1. Provide an overview of the concept and related skills in a generalised context.
2. Determine a definition of the concept and related skills in an educational context.
3. Gain an understanding of how DL skills are a requirement for practising primary school teachers.
4. Explore how the concept adapts to suit changes in situations and circumstances.

This chapter discusses the importance of DL skills in a now-digitalised world, how DL skills a should now be a requirement for PST and therefore they should receive knowledge and support for these skills to be implemented in the classroom.

2.2 Search criteria and method of selecting sources

"Evaluating online content relies on the practice of assessing it against multiple sources.
[…] *The greater the commonality, the greater the credibility"*
(Polizzi, 2020)

To identify relevant sources for the literature review, a search of key research databases was conducted. The search involved identification of key terms and phrases. To that end, the terms "digital competence" and "digital literacy" (DL) were combined with the

following terms, "student teacher", "teacher education", “measurement” and “assessment”. The following data bases ERIC, Google Scholar, Web of Science and Scopus were searched.

Trying to keep the research as relatable to primary education as possible, the researcher searched for existing definitions of DL in a broad context and then narrowed these to educational contexts, the most used competence frameworks, DL, the national curriculum (NC) and the current state of DL integration in education.

The selection criteria presented in the Table below were determined prior to the search and were applied during the screening process:

Type of criterion	*Criteria*	*Inclusion*	*Exclusion*
Type of publication	Journal articles	x	
	Conference Papers	x	
	Reports	x	
	21st Century Frameworks	x	
	Dissertations	x	
	Books	x	
	Blogs	x	
Access	Online	x	
	Paper	x	
Publication Period	2000-2022	x	
Place of publication	Worldwide	x	
Type of study	Empirical investigation	x	
	Theoretical studies	x	
Research methods	Qualitative	x	
	Quantitative		x

Table 2.1 *Table to show search Inclusion and exclusion criteria (adapted from Chalkiadaki, 2018)*

2.3 Digital literacy in theory

> *‘A review of both the most recent policy documents and literature reveals that DL is a complex and somewhat scattered field, where different perspectives coexist.’*
>
> (Nascimbeni, and Vosloo, 2019).

There is a challenge when trying to establish an agreed definition for term ‘digital literacy’ as scholars have determined “there is no one set of agreed definitions for DL” (UNESCO, 2018b) and “the most immediately obvious facts about accounts of DL are that there are many of them and that there are significantly different *kinds* of concepts on offer” (Lankshear & Knobel, 2008.) The term was introduced into literature by Gilster (1997), who defined it

as: “the ability to both understand and use digitised information.” Gilster argued that DL went beyond that of ‘computer literacy’ (Molnar, 1979) and skills solely focused on using technology but to understanding it thoroughly too: “it is about mastering ideas, not keystrokes” (Glister, 1997). Glister (1997) introduced the term as “the ability to understand and use information in multiple formats from a wide range of formats when it is presented via computers,” suggesting that ‘digital literacy’ includes ‘computer literacy.’ From this inclusion, there came about a theory that DL is an umbrella framework for several complex and integrated sub-disciplines, or “literacies,” comprised of skill, knowledge, ethics, and creative outputs in the digital network environment (Calvani, Cartelli, Fini & Ranieri, 2008.) In agreement, UNESCO (2018) suggests that DL “includes competences that are variously referred to as computer literacy, ICT literacy, information literacy and media literacy.” Through this expansion, there is an indication that the term includes a multitude of skills: “the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital technologies for employment, decent jobs and entrepreneurship” (UNESCO, 2018a).

There are disputes amongst scholars about a definition for DL perhaps because there are also those for the verb ‘literacy.’ At first, the meaning of literacy may appear obvious and clear to most. However, the depth of the concept and its various meanings are not acknowledged, and the implications of the term alter considerably over time (Bawden, 2012). Its definition has evolved as knowledge and understanding develops. There is an ignorance surrounding the true meaning, significance and complexity of the term ‘literacy’ that goes beyond the general, and very basic, definition that provokes the understanding that to be literate is simply the ability to read and write. In general discussion amongst scholars there is a tendency for the term ‘literacy’ to be used synonymously with ‘competence’ or ‘ability’ (as in ‘musical literacy’, ‘digital literacy’, ‘information literacy’ etc.) (Goodfellow, 2011). In everyday contexts it is still largely taken to mean the ability to read and write in a predominantly print context (Goodfellow,2011). Scholars suggest that the complexity of this term means that the term should be pluralised to ‘literacies’ (Lankshear and Knobel, 2003) as it is regarded as a ‘multitude of literacies’ (Lanham, 1995). There is an agreement that there are multiple components within this term and Lankshear and Knobel (2003) define ‘literacies’ as: “socially recognised ways in which people generate, communicate, and negotiate meanings, as members of Discourses, through medium of encoded texts.” McGarry (1993) is consistent with this opinion, in his statement that ‘literacy is, and always has been a relative concept’

and suggests that the term has always had (at least) a dual nature. This is approved by Gilster (1997,) suggesting the term goes beyond its simplest meaning: "the concept of literacy goes beyond simply being able to read; it has always meant the ability to read with meaning, and to understand. It is the fundamental act of cognition."

The idea of multiple literacies, or 'New Literacy Studies' (NLS) (Gee, 1991; Street 1995) acknowledges overlapping areas of influence, combining elements of multi-media literacy, computer literacy, information literacy etc., and so some scholars advocate for use of the plural "digital literacies" to reflect a fuller range of practices and abilities (Bawden, 2001; Belshaw, 2012; Hafner and Jones, 2012). Research into multiple literacies suggests that in practice literacy varies from one context to another and from one culture to another, and so, therefore, do the effects of the different literacies in different conditions (Street, 2003). It may be suggested that different forms of literacy, such as DL, will not only have a generalised, accepted definition but these will also change within different contexts and these contexts within different cultures. Definitions of DL are specified to their context and culture. These can be seen in the multitude theories involved in DL frameworks, which have been developed to suit both generalised and more-specified contexts.

> *"The concept of literacy includes visual, electronic, and digital forms of expression and communication. Modern literacy has broadened in scope, as it is tied to technology and culture, and the ability to become and remain literate requires a long-term commitment."*
>
> (Cordes, 2009).

DL is connected to Information Literacy (IL) as "every public services librarian knows intuitively that there is a close relationship between information literacy and digital literacy" (Cordell, 2013). Information is shared and received via digital means and is tied to technology through the internet, digitalised databases, information systems and search engines. When searching for information online, there is an interplay between DL and IL (Cordell, 2013). Information literacy requires the skills to find and select relevant information (Hague and Payton, 2010) by choosing which search engine to use, "which search terms to use, which limiters to employ, how to evaluate the articles in the results, how to use the information found effectively and ethically, etc." (Cordell, 2013). IL fits under the umbrella of DL (Belshaw, 2012) : "there are a number of sister concepts to DL, such as computer literacy, information literacy, 21st century skills, new media literacies and media and information literacies" (UNICEF, 2019). Laanpere (2019) states that "DL is the ability to

access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital technologies." To be digitally literate, UNESCO (2016) states that one must "be able to find, access, use and create information effectively; engage with other users and with content in an active, critical, sensitive and ethical manner; and navigate the online and ICT environment safely and responsibly," indicating that a digitally literate person must be literate in accessing and evaluating online information: "the concept is build upon the discourse to find, evaluate, use and share information" (Belshaw, 2012).

Some research views "media, ICTs and the internet light and calls for DL as a way to protect children from digital risks" (Laanpere, 2019). There is an argument that in being digitally information literate, children are given the empowerment to understand this risk and can be prepared with information-seeking skills and participate in the communication of information safely: "digital literacy becomes a means to empower children for access to information and for freedom of expression and participation" (Laanpere, 2019).

Not only is the ability to access and evaluate online information required to be considered digitally literate, Bryne, et al. (2016) suggest that DL also entails the skills to create content and present information in a digital format: "to participate fully in the digital age, greater efforts will be needed to ensure that they become content creators." This takes the skill of IL to another level; not only must one understand how to find, use and evaluate information but one must be able to share information in such a way that others can find, use and evaluate this information themselves. This shows that the umbrella of DL opens up additional elements within the additional component of IL.

As with IL, media literacy (ML) is included in the umbrella of components that make up the term DL (Belshaw, 2012). "(DL) includes information and data literacy, communication and collaboration, and media literacy (…)" (European Council, 2018). Hutchinson (2016) argues that to be fully literate, one must "be able to construct meaning from information presented in a variety of modes and media formats" and this includes digitalised information. ML, although closely linked to IL, is a separate component: "often these terms and skills are related and intersectional, but still unique from each other" (Von Gillern, et al., 2022).

It is important that citizens are given the tools to find and critically evaluate information presented through digital media to understand risks and the falsities of falsified information.

In a "post- truth" era (Chinn et al., 2021) in which misinformation permeates digital environments, it is critical for teachers to help students develop a full range of literacy skills, including digital and media literacy skills, to help students navigate textual resources of all kinds (Pilgrim et al., 2019). In this culture exposing falsified information, particularly in the realms of social media, children should be taught how to react to perceived truths and to critically analyse media information to determine its purpose and merit. "As literacy educators we have a unique opportunity and responsibility to help students develop the skills to determine the accuracy, merit, purpose, and biases in media messages" (Elmore & Coleman, 2019; Hobbs, 2010).

In defining DL, determining its components and setting guidelines for teaching the objectives of each component, teachers can give children the tools to prepare for the contents and products of the digital world.

2.3.1 Models of digital literacy

In answer to the challenge of defining digital literacy, a wide variety of educational institutions, professional organizations and others have created DL models or frameworks (Freerar, 2019). "Over the years, a variety of frameworks, models and literacies have been developed to guide teacher educators in their efforts to build digital capabilities in their students, that will support them to use new and emerging technologies in their future classrooms" (Falloon, 2020), which would provide useful as a foundation for what teachers would need to know to order their students. Brown (2017) provides a comparison of "a handful of better-known models and frameworks from the USA, UK and Europe," which the researcher drew upon due to their significance between location and social features, such as similarities in culture and educational practice.

The following frameworks are listed from deemed least to most significant by the researcher.

2.3.1.1 JISC: Seven Elements Model of Digital Literacies (2014)

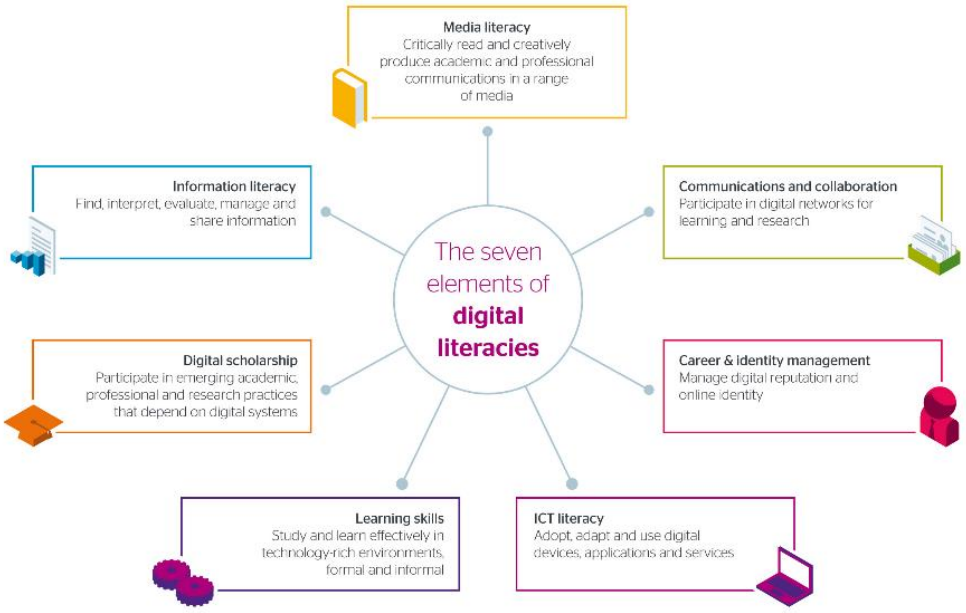


Figure 2.1 *Seven Elements of Digital Literacies (JISC, 2014)*

This model was introduced by JISC in 2014, based on a wide range of UK Higher Education (HE) DL projects. The model looks "beyond functional IT skills to describe a richer set of digital behaviours, practices and identities" (JISC, 2014). The framework encompasses seven capabilities to illustrate the complex nature of the term, giving a simple definition of using technology. The model uses a realistic visual of what learners are required to embrace, to be successful in society.

The seven components are defined as: media literacy, information literacy, communication literacy, digital scholarship, career and identity management, learning skills and ICT literacy. The researcher drew upon this framework as it incorporates educational relations: 'digital scholarship,' suggesting that DL involves *participating in emerging academic, professional and research practices that depend on digital systems.* Although, catered towards HE these components may be adapted to suit a lower level of educational research. The 'learning skills' component is catered towards a primary education context, suggesting that DL involves learning using technology as a support tool. This is relevant as teachers will require this skill in their approaches to teaching strategies.

2.3.1.2 JISC: Digital Capability Framework (2015)

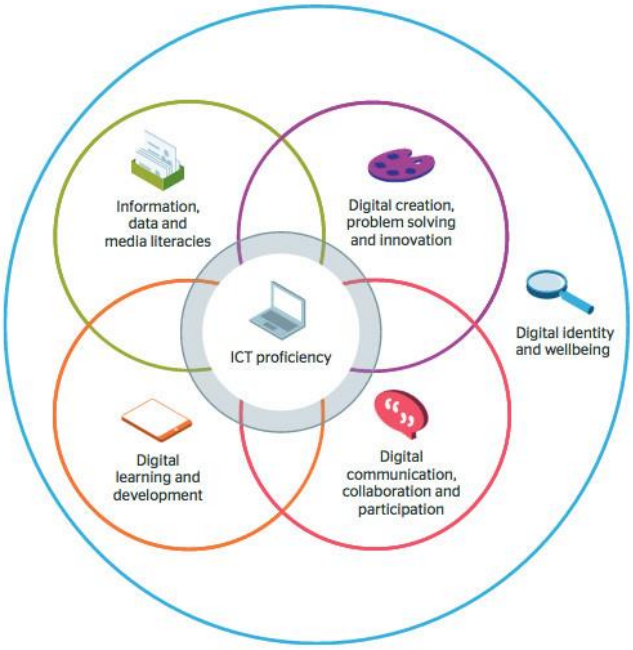


Figure 2.2 *Digital capabilities framework and its six elements (JISC, 2015)*

This framework was adapted from the original *Seven Elements of Digital Literacies (JISC, 2014)* model. The aim of this framework is "to provide a high-level, general account of the digital capabilities that we (in post-16 education) aim to develop, in our staff and in our learners" (Beetham, 2017). The project leaders (Beetham and McGill) reviewed "over sixty frameworks and relevant websites and publications, whilst at the same time interviewed dozens of experts based in Higher Education (HE) and the relevant industry spheres" (Biggins, et al., 2017). This framework was deemed relevant by the researcher as it is respected as: "one of the most cited efforts to develop a comprehensive framework for DL" in the UK and therefore relevant to the location of the study. The framework also related to an educational context, although HE, it could be used by "staff in any role and by students in any educational setting." The broader aspects of DL within this framework could be used as a foundation, where the specifics of each 'capability' could be adapted to suit its context.

2.3.1.3 Belshaw: The Essential Elements of Digital Literacy (2012)

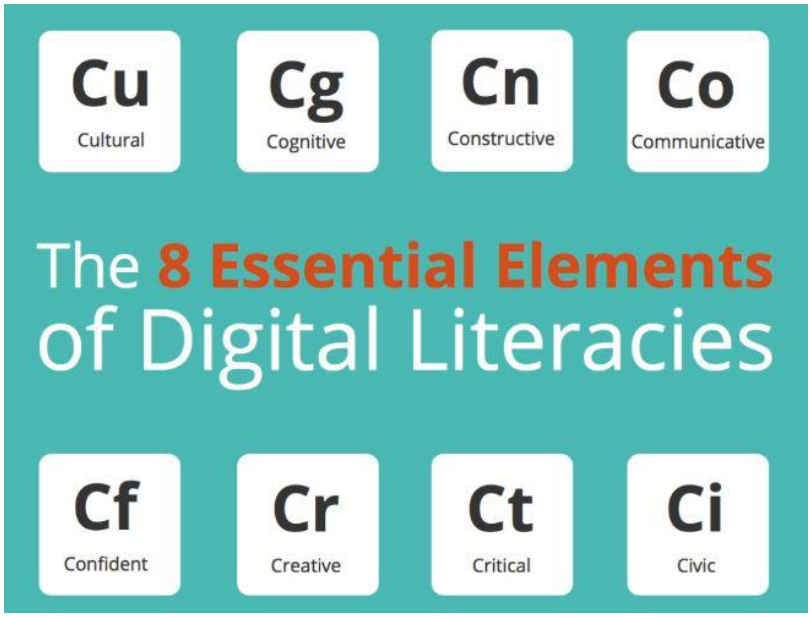


Figure 2.3 *The 8 Essential Elements of Digital Literacies (Belshaw, 2012)*

Belshaw's (2012) model separates DL into eight components: the cultural, the cognitive, the constructive, the communicative, the confident, the creative, the critical and the civic. He suggests that for an individual to be considered digitally literate, they must have a balance of these elements in their digital skills, attributes, practices and identity. As with all models of DL, "these elements are *contextual*, that is they depend on the personal, social and contextual content within which they develop" (JPodcaster, 2012). Belshaw (2012) states: "although context is extremely important, within digital literacies (e.g., from primary school pupils to working with university students) there are certain core and essential elements that serve as a starting point" implying that this framework is a foundation to be adapted to suit the context to which it will be applied. JPodcaster (2012) suggests that once applied to a particular context, they will place "a greater or lesser emphasis on certain elements."

Cultural

The cultural aspect of the framework refers to "need to understand various digital contexts an individual may experience" (Belshaw, 2012) and relates to adapting to the "issues, norms and

habits of mind surrounding technologies used for a particular purpose" (Belshaw, 2012). In order to adapt, Belshaw (2012) suggests that one must fully immerge themselves in a "range of digital environments," without restrictions. He states that educators are "tasked with preparing young people for an uncertain future" (Belshaw, 2012) and so being exposed to uncertainties and changes will equip them with adaptability skills. Digital technologies provide an opportunity to "see the world through additional lenses" (Belshaw, 2012) and with this comes an exposure to the unknown and a digital responsibility to be respectful through adaptation and understanding. This element relates to how to behave online, from netiquette to protection and privacy and recognising the differences between personal and professional use.

Cognitive

Belshaw (2012) suggests that the cognitive element refers "expanding the mind" implying exploration. Belshaw (2012) explains that this in an essential element as it is not enough to be able to use a set of technical tools, "rather it is the ability to use a set of *cognitive* tools" (Jonson, 2008) the ability to understand how to use these tools and adapt them as technology changes and evolves: "it is not the practice of using tools, but rather the 'habits of mind' such use can develop" (Belshaw, 2012).

Constructive

This element "pertains to creating something new, including using and remixing content from other sources to create something original" (Belshaw, 2012) and relates to the laws of copyright and specifies the conditions to which content is shared and how it may be used.

Communicative

The communicative element refers to how one communicates in a digital environment, through various digital and online tools and understanding the expectations, implications, and effects (identity, sharing, influence and trust) of online communities/networks. Belshaw (2012) states: "the communicative is developing a true understanding of the power of networks involves not only learning about them but being part of them."

Confident

Belshaw (2012) suggests that to participate confidently online, one must feel comfortable and a have sense of belonging. Digitally confident persons should have an understanding that the digital world differs from the physical in that it may be more forgiving as one can simply 'undo' certain actions (Belshaw, 2012). To feel a sense of belonging involves understanding these differences, reflecting on one's learning in digital spaces and being part of an online community (SALLY, 2015).

Creative

The creative element refers to the creation of value contributions relating to that of originality. Belshaw (2012) explains that "for creativity to be developed in those seeking to improve their digital literacies, they need to be guided by those who have a different mindset" and therefore those teaching DL skills need to be willing to take risks to "achieve things that were previously thought of to be out of reach by the average person." The focus is on the value created rather than the act of creation (SALLY, 2015).

Critical

The critical element refers to research and evaluation online: "it is more than dealing with text (information) in an online environment" (Belshaw, 2012) explaining that this element involves the questioning, reasoning and reflective process of online information and the trustworthiness of sources.

Civic

"The civic element is about participation, social justice and civic responsibility" (Belshaw, 2012) and therefore closely links to the Culture element, referring to how individuals participate in digital environments, understanding their rights and responsibilities and participating fully in a digital society through social movements and /or the democratic process online.

Belshaw's (2012) model implies that being digitally literate goes beyond theory, it is theory that must be put into practice through the immersion of one with technology "improving every essential element involves practical application" (Belshaw, 2012). He suggests that these elements are a matrix of intertwined skills that one must possess to be considered digitally literate.

2.3.1.4 Mishra and Koehler: Technological Pedagogical Content Knowledge (TPACK) framework (2006)

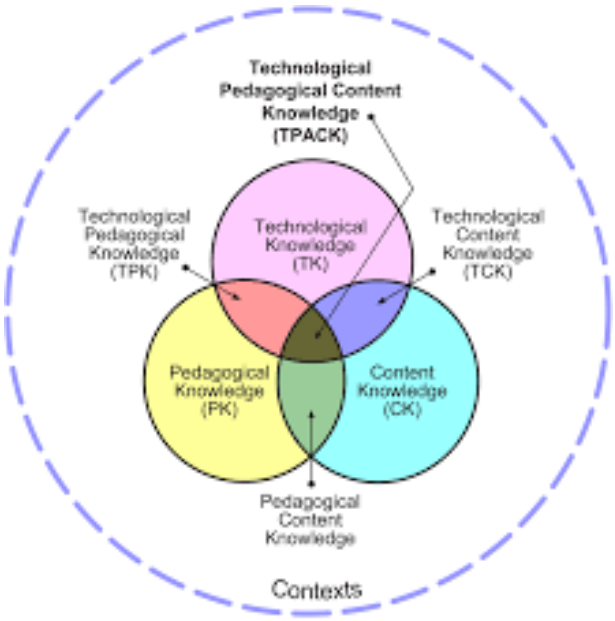


Figure 2.4 *TPAK: Technological Pedagogical Content Knowledge Framework (Mishra and Koehler, 2006)*

"When teaching about technology using technology, technology is the content as well as the means of instruction" (Guggemos and Seufert, 2021). The TPAK framework focuses on technological knowledge (TK), pedagogical knowledge (PK) and content knowledge (CK) and demonstrates how teachers can teach cross-curricular subjects whilst using technology and therefore teach about other subject areas and computing whilst using technology. In differentiation between these three types of knowledge, the framework "outlines how content (what is being taught) and pedagogy (how the teacher imports that content) must form the foundation for any effective EdTech integration" (Kurt, 2019). According to the framework, the use of technology as the content and the subject matter is the best way for students to

learn about technological skills: "it is the use of specific technological tools (hardware, software, applications, associated information literacy practices, etc) that are best used to instruct and guide students to a more robust understanding of the subject matter" (Kurt, 2019). TPACK describes the relationships and interactions that can exist between technology, learning practices and learning objectives. These relationships can be seen in *Table 2.2*:

Content Knowledge (CK)	*Teachers' own knowledge of concepts, theories, evidence and organisational frameworks within a particular subject matter. The CK is dependent upon the individual teacher and its audience.*
Pedagogical Knowledge (PK)	*Teachers' knowledge of the practices, processes and methods regarding teaching and learning. This encompasses the aims of education and delivery through learning styles, classroom management skills, lesson planning and assessments.*
Technological knowledge (TK)	*Teachers' knowledge of, and ability to use, various technologies, technological tools, and associated resources. TK concerns understanding EdTech, considering its possibilities for a specific subject area or classroom, learning to recognise when it will assist or impede learning and continually learning and adapting to new technology offerings.*
Pedagogical Content Knowledge (PK)	*Teachers' knowledge of foundational areas of teaching and learning, including curricula development, student assessment, and reporting results. PCK links pedagogy and these supportive practices by creating connections between the content and the pedagogy used to communicate it.*
Technological Content Knowledge (TCK)	*Teachers' understanding of how subject matter can be communicated via different technologies and considering which specific EdTech tools might be best suited for specific subject matters or classrooms.*
Technological Pedagogical Knowledge (TPK)	*Teachers' understanding of how particular technologies can be deployed alongside pedagogy for teaching and learning purposes, in ways that are appropriate to the discipline and the development of the lesson at hand.*

Table 2.2 *The relationships between the concepts of Technological Pedagogical Content Knowledge Framework (adapted from Kurt, 2019).*

This is an important framework as it describes three-core areas for teachers with the integration of technology in schools, however it does not give instructions on other areas of DL literacy. This framework was also introduced in 2006 and research on teachers' technological and pedagogical knowledge has progressed. TPACK research rarely addresses the usefulness of this framework to predict meaningful outcomes" (Guggemos and Seufert, 2021) such as the leading to integration of technology.

2.3.1.5 Hague and Payton: The components of digital literacy (2010)

> *"To be digitally literate is to have access to a broad range of practices and cultural resources that you are able to apply to digital tools."*
>
> (Hague and Payton, 2010.)

Hague and Payton go on to suggest that DL means to use and understand how and when digital technologies can be best used to support the processes of making and sharing meaning in different modes and formats, and to be able to create, communicate and collaborate effectively with these platforms.

For this project, a curriculum framework will be developed by adapting Hague and Payton's (2010) *'The components of digital literacy'* model to assist teachers in developing their digital capabilities to become skilled in the components of digital literacy. This model is more suitable for this project as it has educational contexts as a specific focus.

Figure 2.5 *The components of digital literacy (Hague and Payton, 2010)*

In relation to teachers, Hague and Payton define the eight components as:

Component	*Definition*
Functional skills	Teachers should improve their capabilities and confidence in using technology.
Creativity	Creating a product or output, thinking creatively and imaginatively and creating knowledge or knowledge production; and digital technologies present many more opportunities to be creative in the classroom
Collaboration	Digital technologies support a shared and social spaces, but this does not mean that it is automatically easy to collaborate using digital technologies. Teachers can facilitate effective group work by supporting students to develop strategies for making collaboration easier
Communication	Communicating effectively in a world in which much communication is mediated by digital technology. Teachers can support students to consider the implications of whether or not their output will be made publicly available online
The ability to find and select information	Teachers can give students information about how to construct their web search so that students are more likely to find relevant information
Critical thinking and evaluation	Involves transforming, analysing or processing given information, data or ideas. Fostering critical thinking requires teachers to slow the pace of classroom down a little to allow the space for thought and questioning
Cultural and social understanding	Teachers have the opportunity to make links between school learning and popular culture
E-Safety	To support young people to become competent, discerning users of technology is about helping them to develop the skills that allow them to critically question their own and others' technology use.

Table 2.3 *The components of digital literacy in a teaching context (adapted from Hague and Payton, 2010)*

Hague and Payton's (2010) model focuses on pedagogical practice: "it means being able to communicate and represent knowledge in different contexts and to different audiences (for example, in visual, audio, or textual modes) and considers different learning styles. They suggest that in using digital technologies effectively, "gives young people the ability to take advantage of the wealth of new and emerging opportunities" (Hague and Payton, 2010), however with opportunities come challenges and so teachers must educate their students how to be alert and safe. ***Table 2.4*** shows the relations ship the framework has to the Computing curriculum (for KS1 and KS2) and how the implementation of DL skills serves as pedagogical practice.

Hague and Payton (2010)	*Computing curriculum references for Key Stage 1 and Key Stage 2 (DfE, 2013)*
The ability to find and select information: To determine what sort of information you need for a task or activity, to know where and how to find information, to critically engage with sources to **select relevant, valuable and reliable information** and to be aware of intellectual property issues related to plagiarism and copyright. ***Critical thinking and evaluation:*** Being able to use reasoning skills to engage with digital media and its content, to question, analyse, scrutinise and evaluate it and to formulate and support arguments about it and the way it is used. Critical thinking involves being reflective, developing insight about underlying assumptions, interpreting meaning and determining significance in order to understand and make sense of the world	**KS2:** use **research** technologies effectively, appreciate how results are **selected** and ranked, and be **discerning** in **evaluating** digital content
Creativity: The ability to think creatively and imaginatively, and to use technology to **create outputs** and represent knowledge in different formats and modes. Knowing when and how digital technology can support creative processes and thinking creatively about technology and with technology. ***Functional skills:*** Knowing how to use a **range of** different technologies competently and having the skills and flexibility to adapt this knowledge to learn how to use new technologies.	**KS1:** use technology purposefully to **create**, organise, store, manipulate and retrieve digital content. **KS2: select, use** and **combine a variety of software** (including internet services) on a **range of digital devices** to **design** and **create** a range of programs, systems and **content** that accomplish given goals, including collecting, analysing, evaluating and presenting data and information.
E-Safety: The ability to **stay safe** when using digital technologies, such as the internet and mobile phones, and to understand what constitutes **appropriate use** and **appropriate content.** ***Cultural and social understanding***: The ability to recognise that there are social, cultural and historical influences that shape the creation of digital content and our understanding of it. This involves understanding how your own and others' perspectives have been informed by cultural heritages and **being aware** of the **social** and **cultural contexts** in which digital media is created and used	**KS1:** use technology **safely** and **respectfully.** **KS2:** use technology **safely, respectfully** and **responsibly;** recognise acceptable/unacceptable **behaviour.**
Collaboration: The ability to work successfully with others to collaboratively create and share meaning and understanding. To develop the skills of teamwork, to be able to work together when using technology and to understand how technology can support **collaboration** both inside the classroom and in the wider world. ***Communication:*** Being able to clearly express ideas and feelings so that others can understand them. Having an understanding of the different modes (visual, audio, textual, etc.) in which meaning can be represented and showing an awareness of the needs of particular audiences. Understanding how technology can support this and how to communicate effectively using different types of technology.	**KS1:** recognise common uses of information technology beyond school. **KS2:** understand computer networks including th internet; how they can provide multiple services, such as the world wide web; and the opportunities they offer for **communication** and **collaboration.**

Table 2.4 *The links between Hague and Payton's (2010) 'The components of digital literacy' model and the National Curriculum: Computing for KS1 and KS2 (Adapted from Savage, 2015)*

Summary of models

This research aims to show that teachers' DL skills are shown by way of their critical thinking skills in support of young people's use of digital technology (Hague and Payton, 2010). To be a digitally literate teacher means more than helping students with the use of technology, it requires a mastery of the eight components of DL.

Looking at these summaries of renowned DL frameworks, it may be suggested that the most suitable for application in an educational context is that of Hague and Payton (2010). However, a more refined framework, which specifically relates to a (UK) primary educational context is required, as "it is not sensible to suggest that one specific model of DL will be appropriate for all people or, indeed, for one person over all their lifetime" (Bawden, 2008, p.28).

In determining the most suitable components that would relate to a primary educational setting, the researcher created a comparison table between the models and then formed themes from grouping the concepts of each:

This framework	JISC (2014)	JISC (2017)	Belshaw (2012)	Mishra and Koehler (2006)	Hague and Payton (2010)
FUNCTIONAL SKILLS	ICT literacy; Media literacy	ICT proficiency; Digital learning and development; Learning skills	Cognitive; Confident	Technological pedagogical content knowledge (TPK)	Functional skills
E-SAFETY	Digital identity and wellbeing	Digital identity and wellbeing	Communicative; Cultural	Technological pedagogical content knowledge (TPK)	E-safety
FINDING AND RETRIEVING RELEVANT INFORMATION	Information literacy; Digital scholarship	Information data and media literacy	Critical	Content knowledge (CK)	Finding and retrieving information; Critical thinking
COMMUNICATION AND COLLABORATION	Communication and collaboration	Digital communication, collaboration, and participation	Communicative	Technological Content knowledge (TCK)	Communication; collaboration
CULTURAL SOCIAL, AND ETHICAL UNDERSTANDING	Digital creation	Digital identity and wellbeing	Cultural Civic	Content knowledge (CK)	Cultural and social understanding
CREATIVITY	Media literacy; ICT literacy	Digital creation, problem solving and innovation	Cognitive Constructive Creative Confident	Technological, Pedagogical, and Content Knowledge (TPACK)	Creativity

Table 2.5 *The relatable components of the researcher's digital literacy skills for primary educational contexts framework and JISC (2014); JISC (2017); Belshaw (2012); Mishra & Koehler (2006) and Hague & Payton (2010).*

The researcher had deemed the most relatable model to a primary educational model was Hague and Payton (2010). The researcher determined that they could compress the

components of ‘communication’ and ‘collaboration’ into one theme and the same for ‘finding and selecting information’ and ‘critical thinking.” The researcher had looked at the concepts from the other models and drawn comparisons and grouped patterns/relationships which arose within the concepts in these models.

From this, the researcher determined that digital literacy in a primary education can be defined as being knowledgeable in six components:

1. Functional skills,
2. E-safety,
3. Finding and selection relevant information,
4. Communication and collaboration,
5. Cultural, social, and ethical understanding,
6. Creativity.

2.3.2 Components of DL (Hague and Payton, 2010)

This study will be focusing on PST in the UK where the computing programme of study for Key Stages (KS) 1 and 2 closely links to the model proposed, designed, and developed and Hague and Payton (2010). The researcher felt that the ties to the NC in England made it an appropriate model for this study. The aim of the model “is to introduce educational practitioners to the concepts and context of DL” (Hague and Payton, 2010) and to support practising teachers to understand and develop DL skills into “classroom subject teaching and in real school settings,” which aligns with the aims of this research.

2.3.2.1 Functional skills

DL is often simplified to skills-based approaches, particularly related to accessing and using digital tools (Freerar, 2019) and are referred to as functional skills. Functional skills relate to the ability to use technological tools effectively. It may be suggested that functional skills are related to those of digital competence (DC) and ‘information literacy’ (IL), components of digital literacy.

"Digital Competence (DC)is the set of knowledge, skills, attitudes (thus including abilities, strategies, values and awareness) that are required when using ICT and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socializing, consuming, and empowerment."

(Ferrari, 2012, p. 3).

From the definitions provided in relation to DL, one can see similarities between the two definitions and how important they are to technological functional skills. The challenges of technology must be solved through the involvement of training and support: "developing a Digital Literacies Programme for teachers' professional development (PD) should be looking more at 'how emerging digital practices might be usefully contextualised in an academic setting." (Payton, 2012. p2) and "today many functional skills are technology-based, so development of a technology-based training program has broad importance" (Harvey, et al., 2020). For those who are uncomfortable or wary using technology, affects their implementation of technology, which can be relevant to their independence.

It has been suggested that "digital society needs digitally-competent citizens, there is a need to be able to use digital technologies confidently and safely for various purposes" (Brown, 2018). As mentioned previously, to be able to use technologies safely and effectively requires a foundation of training, guidance, and access to appropriate technologies. In educational contexts, educational and civic institutions continue to have an important role to play in providing young people with equitable levels of access to digital technologies, in terms of hardware, software and connectivity to the internet and other telecommunications networks (Selwyn., 2009). Prensky (2001) and Tapscott (2009) argue that with access to technology and digital media, young people's ability to use computers to learn in new and improved ways will increase their digital functional skills. In a similar argument, Selwyn (2010) suggests that technological hardware and software also have the potential to improve pedagogy and make learning biter, more fair, individualised, and better organised. Along the same lines, Hind (2019) suggests that technological skills will aid students for the future: "technology can be an effective tool to help reduce workload, increase efficiencies, engage students and communities, and provide tools to support excellent teaching and raise student attainment." In applying functional skills in other subjects, students will adopt a learning

through action approach and will increase skills across all subjects: ”access to technological tools is not useful if the student is not proficient in applying them in a practical environment and in a variety of contexts” Hazen (2010).

In practising using technologies, e.g., mobile phones and iPads, there has become an expectation that students of the new millennium are now able to use technologies in all contexts and formats (Prensky, 2001). However, this expectation of the era of ‘digital natives’ is considered a myth as students may use them in their everyday lives and in personal contexts but not in educational contexts.

Digital natives

As a generation of frequent users of new media and their capability to adapting to new technologies, young people have been labelled as ‘digital natives’ (Prensky, 2001) but research has deemed this a myth as not all young people are skilled in the use of online information (Bennett et al., 2008; Bennett and Maton, 2010; Hargittai, 2010; Helsper and Eynon, 2010; Herold 2012).The portrait of this ‘Google Generation’ (Oblinger and Oblinger, 2005) as being ‘technologically skilled and naturally inclined to technology’ (Loos, 2018) is based on them being surrounded by developing digital resources and growing up with them, such as technologies and the internet, being accessible and used from an early age, but many researchers argue that this is untrue (Bennett et al., 2008; Bennett and Maton, 2010; Hargittai, 2010; Helsper and Eynon, 2010; Herold 2012).

There is much thought given to society’s increasing interaction with technology and particularly on the generation that has known nothing else but the exposure to technology and the internet. There are assumptions made that exposure to technology results in being a ‘digital native’ (Prensky, 2001) and that many children are confident and appear “able to learn to operate unfamiliar hardware and software very quickly” (Hague and Payton, 2010). However, the theory of ‘digital natives’ (Prensky, 2001) does not appear to be as truthful as once thought: “many teachers are increasingly reporting that many young people are not as knowledgeable and savvy as they appear to be” (Hague and Payton, 2010). There are suggestions that some children are able to use certain software and hardware to an extent, but they have a lacking in the understanding of it and therefore are unable to use and apply it effectively. “Most children possess basic operational and safety skills, some even have

advanced digital competencies, but they all lack the maturity with which they can engage reflectively" (Chaudron, S. et al. (2015)

2.3.2.2 E-Safety

One skill which needs to be introduced to students is that of e-safety (Common Sense Education, 2019). To support young people to become competent, discerning users of technology means helping them to develop the skills that allow them to critically question their own and others' technology use. Teachers need to be able to help their students to become safe, responsible, and productive users of technology and can guide students how to navigate life both online and offline.

Teachers need to be aware of and address the privacy and security issues that are associated with using digital resources. To keep children safe online, Keen (2007) states that there is a "need to have restrictions on digital access for the safety of the younger generation-regulation and control, blocking and filtering of young people's technology use." On the one hand, technologies are perceived as dangerous, especially because of the content from which children should be protected. What is right is determined by adults, and children and youngsters are seen as consumers of what adults allow (Skutil, et al., 2021). In contrast, there are suggestions that students need to be able to acknowledge whom they can trust with their information online. In using security programmes and privacy settings to block viruses and cookies and knowing how to create strong passwords to protect their private information (Common Sense Education, 2019). Ribble, e al. (2004) suggests that restricting students online, as opposed to guiding them in e-safety, can have the opposite effect as they are unprepared for the dangers they may face online: It is important that we guide our students in e-safety. At school the are often safety measures in place so children can't access unsuitable areas but what happens when they get home?' Instead, students need to be able to '(1) identify strategies for creating and protecting strong passwords (2) spot and avoid online scams (3) understand the concept of internet safety and privacy, why companies collect information, and how to understand privacy policies (Common Sense Education, 2019). Children have opportunities to explore outside of these protected and restricted platforms, they are connecting, sharing, creating, and viewing outside of the classroom and they need to be aware of how to protect themselves and others. Children can have difficulties in

understanding what information should and shouldn't be shared and cyber-predators are known to intentionally seek out young, vulnerable children in online environments. Teachers need to teach about e-safety because it establishes clear expectations of how to behave and what to say in online environments (Morris, 2019). It's the role of a teacher to give children the skills they need to be able to become independent, have a freedom for expression and are able to act on their understanding: "another characteristic of the internet is unregulated freedom of expression" (Savage, 2015).

The concept of privacy is continuously changing with the advancement of technology and our association with social media:

> *"Using social media as a pedagogical tool holds benefits for engaging collaboratively with others in a global space. However, educators need to consider their ethical responsibility to their students if they are aware these spaces have the potential to be unsafe."*
>
> (Nagle, 2018).

Some children are now sharing huge quantities of their lives with online followers and 'digital friends.' Teachers have a responsibility for discussing online privacy issues with their students. In relation to privacy and security, teachers need to think about what can be seen behind the screen. A person's online identity and communication and how these and the media can make us victims of cyberbullying and digital drama and how these can all affect our mental wellbeing.

Digital environments are often areas for interpersonal relationships. Fictional narratives and blurred distinctions between people and fictional characteristics and can be extremely dangerous: "the anonymity of the internet is both an advantage and a potential source of illusion" (Savage, 2015). It is important to recognise and be aware of underlying material situations when considering the import and impact of narratives, considering moral and ethical judgement around tone, voice, and context. This needs to be considered and understood by teachers when developing students' digital literacies (Hinrichsen and Coombs, 2013). The internet has opened a world of possibility but has also unleashed dangers and exposed new risks. Academics have argued that social media and technology have disrupted the truth (Viner, 2016) and the credibility of reports is no longer considered. The influence of 'fake news' and the threat it poses to internet users' self-esteem and trust is a very current

issue of privacy and security. “In our digitizing society, fake news threatens the accessibility of information for citizens […] and so it is important to start teaching children at an early age how to critically evaluate online information” (Loos, 2018). Society must recognise the unreliability of digital information as fake news is becoming more common and whether young students can gauge the reliability of digital information. “54% of 414 teachers believe that the NC does not equip children with literacy skills they need to identify fake news” (Thi Ngo, et al. 2019). It is therefore crucial that we begin educating our children in new literacies, consisting of the “skills, strategies and disposition required to be successful at using and adapting to the changing information and communication technology context that defines our lives today” (Loos, 2018).

“DL becomes of particular importance in the group of people (teachers, parents, family members and students) who are responsible for facilitating the digital safety” (Tomczyk, 2019). It is the responsibility of parents and teachers to support children in DL skills (Sharma, et al., 2016) and prepare the children in “creating solutions which facilitate the effective media prevention and socialisation” (Plichta, 2017). At the critical age of development, it is the responsibility of PST to ”influence students’ habits which would enable them to protect themselves against the typical and non-standard e-threats, such as: problematic use of the Internet, cyberbullying, protection 130 of image, recognising false information, sexting, infringements of copyrights, hygiene of navigating the digital media, susceptibility to the Internet challenges” (Tomczyk, 2019). The ability to identify problems, create solutions and develop a commonality on e-safety procedures requires the necessity for teachers’ e-safety technical and pedagogical methods to be up-to-date (Tomczyk, 2019).

2.3.2.3 The ability to find and select information

“Information literacy is knowing when and why you need information, where to find it, and how to evaluate, use and communicate it in an ethical manner.”

(CILIP, 2004).

“The internet is part of the Information Age” (Savage, 2012) and has meant that information literacy (IL) skills are necessary (Shannon, et al., 2019). DL includes the ability to find and use information (otherwise known as information literacy) but goes beyond this to encompass

communication, collaboration and teamwork, social awareness in the digital environment, understanding of e-safety and creation of new information. Both digital and information literacy are underpinned by critical thinking and evaluation (The Open University, 2019). Information literacy requires an informed use of search engines, as well an awareness of different kinds of information, such as hard journalism, editorial opinion, and personal viewpoints to then understand the difference between sources that support or oppose their views, and of the kind of range of sources that are most likely to lead to 'balance' and to generate an adequate context for understanding an issue or topic. An inability to distinguish how to evaluate information and organize it into a coherent point of view means that one is not able to use or generate information effectively (Lankshear and Knobel, 2005). To avoid this, Gilster (1997) claims that we need to teach and learn "how to use the Web properly and how to be critical."

In a digital landscape, there is a multi-mediated nature to information (Lanham, 1995). Information is now presented in a variety of forms, such as text, image and sound with equal facility (Lankshear and Knobel, 2005) particularly through the medium of the internet (Glister, 1997).To be considered digitally literate under these conditions means to be skilled at 'deciphering complex images and sounds as well as the syntactical subtleties of words' (Langham, 1995) and able to move between different mediums to gain a knowledge and understanding of the information, to then know which would be the most effective medium to present the information for an easier understanding for their target audience. The value of DL is that it makes us adept at suiting the medium we use to the kind of information we are presenting and to the audience we are presenting it to (Lankshear and Knobel, 2005). In agreement with Langham, Lanshear and Knobel, Glister (1997) also emphasises that DL involves "adapting our skills to an evocative new medium, [and] our experience of the Internet will be determined by how we master its core competencies".

In DC and DL we must consider the importance of ICT as educational discipline and as pedagogical tools in developing effective educational services. In this respect ICT represents not merely tools, but also informs and shapes our modes of communication, and the processes of our thinking and our creativity. Granberg (2011) rephrases this as a shift in focus moving from learning about ICT to learning through ICT. Learners constantly seek information to address a problem at work, school, or to just satisfy a curiosity. To do so, they take advantage of digital and networked technologies not only to seek information, but also to share

information (Kitsantas and Dabbagh, 2011). Users of online search engines often find it difficult to express their need for information in the form of a query (Ruthven, 2003) and therefore we cannot expect students to develop IL skills "if their teachers lack knowledge and awareness of it and are not teaching IL skills or embedding them with IL practice" (McKeever, e al., 2017).

This Age of Information "has meant that IL skills are necessary in the workplace and wider society" (Shannon, et al., 2019) and its significance increasingly present in education (Herring, 2011; Latham et al, 2013; Sandercock, 2016): "Now is a particularly crucial time for teachers and school librarians to be working together to educate students in the skills needed to be successful in the digital age" (Latham et al, 2013 p.3). In educating children in IL skills "has benefits not only for their education, but in everyday life" (Kiebansky & Fraser, 2013; Kimmel, e al., 2014; Reed & Stavreva, 2006; Smith, 2003) where young people are seen to be able to access vast digital networks of information, resources, and people, thus learning in ways that are increasingly "situated" within authentic contexts and webs of knowledge. (Selwyn, 2009). However, children and young people are found to often display a limited ability to successfully use the internet and other research tools (Williams and Rowlands, 2007). This statement is mirrored by Hague and Payton (2010) in their statement: "students frequently struggle with their research skills and can find it hard to select the information they need." In studies of young people's information seeking behaviours which report the effectiveness of young people's use of digital information to be often contingent on their engagement with the information itself rather than the technology, i.e. the information being sought and the motivation for doing so (Dresang, 2005; Madden et al., 2007). The informational scale of the internet, databases and specialist datasets require highly developed search, locational and query formulation skills (Hinrichsen and Coombs, 2013) which teachers need to be informed in prior to teaching their students (Shannon, et al., 2019).

Regarding, teachers' IL skills, it has been suggested that teachers are aware of IL and possess the associated skills but do not know how to use them or how to promote it in the classroom (Moore, 2002; Shannon, et al., 2019). Williams & Coles (2007) suggest that "where research has been undertaken in a school context, teachers have been found to lack both knowledge of the concept and confidence or skills o efficiently retrieve and evaluate information as part of their professional research and practice." This statement shows a gap in knowledge and

understanding of IL skills and a lack of training on how to set a foundation on which to develop them in the future, representing an opportunity for improvement.

2.3.2.4 Critical thinking and evaluation

"The process of clarification of the term "critical thinking" may serve, in fact, to highlight the complexity of the term and the various skills it encompasses, such as analysis, making judgements, problem-solving, evaluating, questioning, reflecting and the like."
(Carmichael and Farrell, 2012).

In reflection of the definition above, the umbrella of the components within critical thinking highlight that it is a highly sophisticated skillset which is important to any context (Carmichael and Farrell, 2012), and as the internet becomes a greater environment for information, it is important that "students develop critical thinking skills that apply to web-based materials" (Carmichael and Farrell, 2012).

"In the era of the internet and of information society, "critical thinking" represents a major qualification" (Astleitner, 2002). The skill to analyse and evaluate the dangers of false, incomplete, and obsolete information is the "most important skill when using the internet" (Glister, 1997) and provides an armour of caution in the exposure of uncensored and inaccurate information.

DL models often include an emphasis on critical thinking and evaluation, often including searching for and accessing a wide variety of content and critically evaluating information and tools (Alexander, et al., 2017; Freerar, 2019; Hall, et al., 2014; Sparks, et al., 2016). It may be suggested that critical thinking is closely related to finding and selecting information and then assessing it according to a specific criterion, which adapts to suit the context (Feerrar, 2019).

In relation to digital natives and the exposure to, and exploration of online information, there can be an expectation of using 'common sense' by understanding the risks whilst browsing through information online. However, this expectation is unjust. To produce "critical students," "schools and teachers have to be assisted from educational theory and research"

(Astleitner, 2002). The reason that teachers themselves are lacking is because they are not educated in these skills and "there are no textbooks available" (Astleitner, 2002) and teachers must then train themselves through their own research, often online and are naïve in terms of accuracy and trustworthiness.

In his review of research into this topic over a forty-year period, a theoretical foundation has been set by Dick (1991) to describe what students and teachers must know to be successful in critical thinking:

Identifying arguments Themes, conclusions, reasons, organization
Analyzing arguments Assumptions, vagueness, omissions
Considering external influences Values, authority, emotional language
Scientific analytic reasoning Causality, statistical reasoning, representativity
Reasoning and logic Analogy, deduction, induction

Table 2.6 *An Empirical Taxonomy of Critical Thinking (Dick, 1991).*

According to Astleitner (2002), one must regard critical thinking as a a general skill that must be deepened within different subject matters and contexts. These qualities may be adapted to suit an educational framework to arm students and teachers with necessary qualities to think critically online.

2.3.2.5 Collaboration

Technology is a key tool to promote and enhance collaboration skills. "The national curriculum highlights the opportunities for communicating and collaborating afforded by computer networks such as the internet" (Savage, 2015). The internet provides "opportunities for collaborative learning such as blogging, wikis and podcasting" (Savage, 2015). There are a host of platforms teachers can use to utilise collaboration as a main component of learning

in class or at home (Webwise, 2019). This gives children an opportunity to express themselves and an opportunity to communicate and collaborate with their peers. School websites, YouTube and social networking sites can help give children a voice where their ideas can be made public and an opportunity for these ideas to be discussed, debated, and amended. Collaboration can be created using online mediums such as Google classroom, as these allow users to edit and modify both content and structure collaboratively. It can be used for homework purposes, giving the option for it to be completed at school or at home, individually or as groups.

Not only is collaborative learning a great opportunity for school children but also for teachers. Collaboration is the important driving force behind DL and pedagogy. Teachers are collaborating more effectively than ever before in online shared environments and professional learning networks. (Feist, 2018). It is now easier to create or find blogs of interest online and microblogs such as Twitter, hyper-local blogs (which focus on the immediate location of the blogger) and live blogs which report on the events as they happen (Chapman, 2013). It is important for teachers to understand that blogging can provide an opportunity for communication and collaboration but also has disadvantages. Teachers need to be aware that school children need to think about their internet profile and e-safety. Using a different name can provide some anonymity, but this includes both positive and negative affordances (Savage, 2015). Anonymity can encourage confidence to express ideas but can also cause the confidence to retaliate to negative comments and upsetting remarks through the perception of hiding behind a screen (Savage, 2015).

In an educational context, teachers should be aware that software such as Wordpress.org and www.j2e.com content management system for schools enables teachers to have more control on safety, security, and restriction to unsuitable content. In doing this, teachers can then "arrange for groups of children to use a shared blog space without potential for disturbance from unwelcome outsiders" (Savage, 2015). Accessing blogs from a search engine can be a useful start for discussion and group learning, which can be used both inside and outside of school. Creating a school site enables children, groups, and teachers to share their own ideas, classwork and photos and make comments. It has been suggested that blogs can offer new opportunities for the development of online learning communities (Farmer, 2004). A study by Efimova and de Moor (2004) concludes that weblogs serve as a true conversation tool, supporting fast and meaningful reactions, exchange of multiple perspectives and joint

development of ideas. There is strong evidence that social media can facilitate the creation of Personal Learning Environments (PLEs) that help learners aggregate and share the results of learning achievements, participate in collective knowledge generation, and manage their own meaning making (Dabbagh and Kitsantas, 2011).

Prior to COVID-19, studies indicated that there was little in the way of online collaboration (between teachers in a school, between schools, between countries), even though examples of this indicated that implementation of digital collaboration could be extremely valuable and useful for teachers and schools to increase the effectiveness of their use of digital teaching (ICF International, 2015). Hague and Payton (2010) state "we want our students to be able to work successfully with others to collaboratively create and share meaning and understanding. To develop the skills of teamwork, to be able to work together when using technology and to understand how technology can support collaboration both inside the classroom and in the outer world." Remote learning provided an opportunity for students and teachers.

Digital collaboration is closely related to digital communication but is more about participation in digital teams and working groups. It's about discussion, the sharing of resources, web pages, digital writing and presentations. Again, there is a perfect opportunity to support learning in collaborating using shared digital tools and media, and to work effectively across cultural and social boundaries.

2.3.2.6 Communication

When thinking about first world communication today, most of it is now digitalised. Some scholars see DL as a new form of literacy, as it moves away from the more traditional and physical modes of communication (Davies & Merchant, 2007). Digital literacy has brought about a new form of writing, we are now using online communication platforms, such as emails, texts, discussion forums, blogs and photo sharing sites. In using digitalised communication methods of writing and passing on information can be interwoven with more traditional forms of communication to create different affinity groups with a shared purpose (Gee, 2004). Communication through blogs is seen as a "new form of social practice," (Davies & Merchant, 2007), bringing about a practice which "reconfigures relationships and can engender new ways of looking at the world"(Davies & Merchant, 2007).

Communication through the internet, has allowed the world to experience a myriad of communication experiences and diverse discussions with a multitude of people like never before. As well as blogging, digital communication can be using wireless technological devices mobile phones, tablets, personal computers, and games consoles, as multimodal (La Caze 2017), causing a huge paradigm shift in society and redefining social communications (Shang, et al., 2008) and giving society an opportunity to experience new cultures, symbols and languages. In the change in communication to digital forms, has brought about new forms of language, e.g., "multiculturism," where the languages of a mixture of diverse nationalities begin to integrate and form new phrasings and grammar within the language (Baron, 2000,) which has been brought about through the diversity in digitalised cultural communication, creating digital literacy to understand this form of information and communication (Liu, 2016).A similar new language that has arisen from digital communication is "text speak," often used for the shortening of words for speed whilst texting.

> "*By the mid- 1990s, the emphatic and singular connotations of the term 'literacy' were beginning to work not- so- well. The mass media and then the internet spawned whole new genres of text which meant that narrowly conventional understandings of literacy were fast becoming anachronistic".*
>
> (Cope & Kalantzis, 2015).

However, these new forms of language are not seen as "proper English" and therefore has affected children's spelling and grammar, causing a negative impact on children's literacy (Aziz, et al., 2013; Myhra , 2010;Van Dijk, et al., 2016), suggesting the digital communication techniques have had some negative effects on written standards on English. effective information management, collection.

During the COVID lockdown, the only form of language for those outside of your home was through digital platforms. "Today, communication takes place mainly by using electronic tools" (Kuusimäki, 2019). Communications between living beings began with the voice, and the three biggest voice systems in the world are the telephone, and the cellular and radio broadcasting systems (Ha, 2010). Today, in 2022 being able to communicate online is now a key digital skill needed throughout our lives (University of Queensland Library, 2022).

"People use online tools to discuss topics, share information, complete tasks and work on group assignments and projects. To thrive in a digital world, we need the skills to communicate effectively in any situation."

(University of Queensland Library, 2022).

We have moved away from Ha's (2010) statement that the telephone, and the cellular and broadcasting systems, to three main ways we communicate online today, in 2022, are all connected to a mobile phone:

- **Text based:** including email, discussion forums, texts, messaging and chats.
- **Video and audio**: including online meetings and conferences, screen and application sharing, virtual worlds and gaming.
- **Social media:** can encompass a variety of media, including text, images. and video.

(University of Queensland Library, 2022).

These are all ways to send our information through an online portal. "The ultimate aim of a communication system is to provide reliable transmission of information to the user" (Ha, 2010). This fundamental foundation theory was established and developed in 1948 by Claude Shannon, the founding father of 'information theory' (Gallager, 2088), and led eventually to the development of modern digital communication (Ha, 2010). Digital communication means to effectively communicate in digital medias and spaces. In 2019, it was stated "today, communication takes place mainly by using electronic tools" (Kuusimäki, 2019) and this is even more true today, especially during lockdown, when the only option for some time had been to communicate via online platforms, phone calls or texts. Society is interacting with one another using technology, and in the global pandemic it was happy to do so.

Communication and collaboration using digital resources has become the foundation for remote learning (Bubb & Jones, 2020). We can support learning in this way through webinars and tutorials using platforms such as Zoom, Loom, Microsoft Teams and Panopto and sometimes pre-recoding lessons on these platforms (Sharp, et al., 2020).

"The role of Information and Communication Technology (ICT) in education continues to serve the development of teaching and learning."

(Sarkar, 2012).

During lockdown, schools were able to support parents via online communication, such as emails, through school websites, phone calls, social media, and texting (Nwankwo, et al., 2022). Online communities are great places to communicate and collaborate with people that share common interests, opinions, and goals in a virtual space (Addeo, 2019). These communities were helpful and supportive for both teachers and students. This current climate has provided an opportunity for us to support both teachers, learners, and their parents (Aliyyah, 2020; Duraku, & Hoxha, 2020) to be able to communicate effectively in academic and professional contexts and to understand the norms in different settings.

2.3.2.7 Cultural and social understanding

> *"Environments characterised by diversity are the new reality and developing the required open-mindedness that will allow one to work in them more smoothly and productively is a target."*
>
> (Heinrichs, 2016).

As globalisation is becoming more "of an everyday reality" (Heinrichs, 2016; Mercuri & Ramos, 2014), through digital means, an important component of DL is understanding cultural, social, and ethical issues. There is a powerful argument to suggest that an education system has a responsibility to provide the young with the tools and understandings necessary for interpreting the constructed nature of popular culture, and to provide a critical view (Merchant, 2007). Teachers have the opportunity to make links between school learning and popular culture.

"Technology is playing an increasing role in culture generally" (Hague and Payton, 2010). Since this statement in 2010, children's engagement with and use of digital media, films, computer games, worldwide news has and is increasing. This means that children and young people are actively participating in and manipulating digital media, affecting social and cultural life (Hague and Payton, 2010). Digital media can contribute, as in the educational field (Soler Costa, et al., 2020) but their use can also lead to harm (Soler Costa, et al., 2021), such as addictions to smartphones (Rodríguez-García, et al., 2020) and cyberbullying (Pivetta, et al., 2019). The use of ICTs and social media can also have repercussions and

rather than using for sharing information with those with similar interests in online communities (Soler-Costa, et al., 2021) they are also being used as "a weapon of hate" (Dawson, 2018), In using these digital means (digital devices, social media. digital communication portals, etc.) children need to be taught about the states of negativity involved with using the internet and accept digital responsibility for the contents they may produce and learn how meaning can be presented through digital portals (Raisingchildren.net.org).

An approach called 'netiquette' has been introduced to teach children to understand children about cultural, social, and ethical understanding and their online responsibilities.

"The Internet, as well as promoting access to knowledge or creating new professions, has created the non-face-to-face label. This can be seen in traditional face-to-face customs such as giving condolences, the development of which through social networks, especially Facebook, has become standardized."

(Sabra, 2017).

NETIQUETTE is an acronym for:

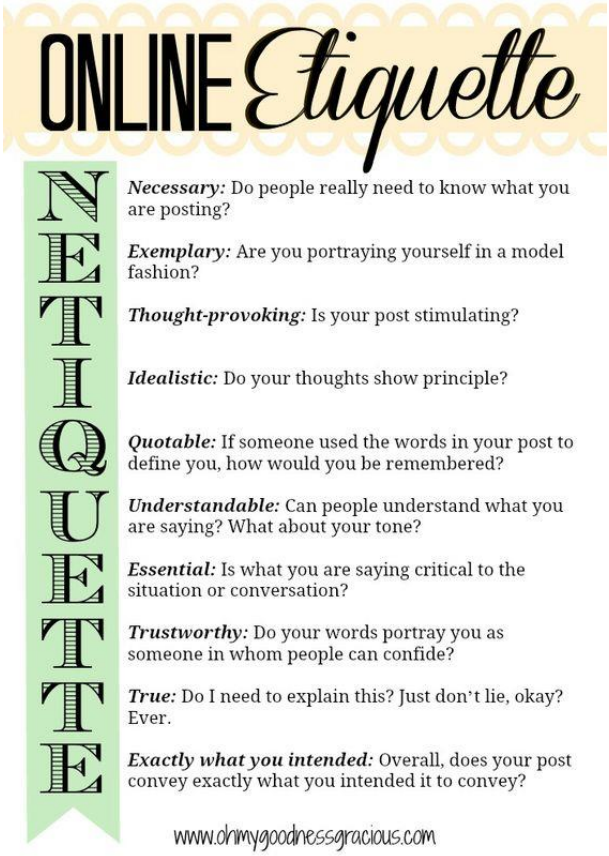


***Figure** 2.6 Rules of 'Netiquette' poster (ohmygoodnessgracious.com, 2013).*

In thinking about (our online) cultural, social, and ethical understandings, there is an association between the internet and education. It is up to teachers as educators to discuss and give guidance on these issues. Therefore, a key training requirement is "in current and future teachers whose preparation in the digital field continues to be analyzed" (Buelens, et al., 2007; Garzon, et al., 2020). The pandemic has emphasised our reliance on technologies and raising an awareness that children too need training on their cultural, social, and ethical understandings whilst they are online.

2.3.2.8 Creativity

One of the most discussed personal skills in literature is that of creativity (Chalkiadaki, 2018), particularly in relation to innovation (Cruz & Orange, 2016; Sheikh & Siti, 2016) and the concepts of curiosity and imagination (Abdullaha & Osmanb, 2010; Teruggi & Zuccoli, 2015; Wagner, 2008). It should be acknowledged that technology can provide great opportunities for self-expression, creativity, and learning (Hague and Payton (2010). The possibilities for children to explore a multitude of learning styles with video, visual, audio. and kinaesthetic (VAK) tools is "much to be excited about" (Hague and Payton, 2010). Technology should be used effectively to expand on children's skills of exploration, rather than preventing children from accessing and engaging with technology, educators should be focusing on teaching children how to use technology creatively: "we can't put the genie back in the bottle. Young people today expect to be able to appropriate and circulate media for their own self-expression." (Ito, 2009).

In the motion of creativity, constructivism in education allows children to "learners can actively construct mental models to understand the world round them" (Crick, 2017) Often more focused towards early years. sometimes using a "learning through play" (Pramling Samuelsson and Johansson, 2006) pedagogy. This allows for a creative approach to learning through exploration and practice, as opposed to having understanding "dumped into their brains" (Esper, et al., 2012). It is argued that qualities of play, expression, reflection and exploration should be better reflected in the ways that young people are encouraged to consume information and engage with learning; leading to the proposition of various forms of "e-assessment", "pedagogical mashup", "remix curricula" and refocusing of the teacher's role

away from provider of information and towards facilitator and guide (Fisher and Baird, 2009). Many children and young people will continue to require support in the creation and communication of content, with many still lacking the experience, confidence, or motivation to be involved in the process of designing, implementing and evaluating self-created content. (Selwyn, 2009).

The ability to use digital technologies is commonly seen as a twenty-first century skill (Henriksen,, et al., 2018) for learning and teaching (Craft, 2010), often argued that the connection between creativity and technology is a key issue for twenty-first century education (Page & Thorsteinsson, 2017). When used and integrated well, technology has potential to help create world-class education, training, and care for everyone, whatever their background. (Hinds, 2019). To deliver world-class teaching, technology should be used a purpose of driving student engagement and attainment and to support effective working environments where staff can focus on teaching (Hinds, 2019).

When discussing creativity and technology in the twenty-first century, scholars suggest that because of the effects of globalisation and digital technology advancement, they have had an impact on the way we think, live, work, think, communicate and create (Zhao, 2012). With the expansion of digitalisation and digital change, creativity has become more necessary as an effective teaching tool to aid children with the shifts in globalisation and technology development.

"Given the digital world in which education is increasingly situated, there has been much consideration of what teachers need to know to use technology effectively in the classroom, and the competencies needed to develop digitally-fluent, creative students."

(Mishra and Mehta 2017).

Technology can be used as a support tool for motivation and engagement. Bowen (2012) suggests that "technology provides to motivate students for deeper critical exploration, application and integration of information." As opportunities to use technology have arisen, and are becoming more available, through government funding since the national lockdown, these should not be taken for granted. A key factor in the task of using technology for motivation and engagement is being shown how to do so need extensive training.

2.4 Digital literacy in an educational setting

"The future of education is linked to technology."

(Skutil, et al., 2021)

Research suggests that we are now living in a digitalised society as "the world has become digital" (Deady, 2017). "We are living in a digital world with technology transforming the way we live our lives, both at home and in the workplace"(Hinds, D., DfE, 2019) and "with technology evolving faster than before, it is time that we implement more of the digital era inside of classrooms" (Diaz, 2017). However, Hague and Payton (2010) argue "although there is increasing policy and research attention paid to issues related to DL, there is still little information about how to put this into practice in the classroom," and this continues to be applicable (Sánchez-Cruzado, et al., 2021). This being the case, teachers do not feel as confident about implementing technology into their subject areas.

"The identity and purpose of education are based on is purpose […] the areas held of importance, the skills and competencies to be developed within the practice, the beliefs that will guide the decisions, the means to be used" (Chalkiadaki, 2018). The purpose of investment into education, is to develop a country's economic wellbeing and sustainability; we educate the next generation in the tools we deem necessary for the future. As the world becomes more digitalised, the purpose of education is to educate the next generation in DL skills, as the advancement of technology has permeated every aspect of our lives. Employers expect their workforce to have the skills needed to live, work, and thrive in a digital society. So, when preparing pupils for the world of work, DL is essential (Promethean, 2017). UNICEF (2019) discusses how "investing in children's DL means building more responsible, employable and tolerant future citizens" and suggests that DL is a necessary requirement to building a better future. Although making children employable is obviously a priority in education, it should also be noted that DL is not only an employability skill but should now be considered an essential life skill (Promethean, 2017).

However, it should be noted that this 'essential life skill' has still not been defined in an educational setting. Without defining its principles, it is difficult to guide teachers on the teaching and implementation of DL into their classrooms and what resources they require to

do so. It is interesting to note that the most prominent voices within the debate (of CPD training) are from outside of the profession itself" (Akins, 2018). As little opportunity has been given to teachers to define their own profession and its relationship towards DL skills in an educational setting, it seems necessary that teachers are given a voice to determine what they feel DL is and what their training needs may be.

"DL should be the fourth pillar of a child's education alongside reading, writing and mathematics and be resourced and taught accordingly" (House of Lords Report, 2017). It should be acknowledged that the development of DL should have its own place in the NC and a thoroughly detailed set guidelines should be available for teachers to follow.

2.4.1 Computing in the national curriculum in England

The new Computing curriculum (DfE, 2013) was introduced into English schools in September 2014 and for the first time "established computer science and computational thinking as foundational subjects alongside English, mathematics and the sciences" (Crick, 2017). For KS1 and KS2, the statutory guidance states that pupils should be able to:

Key Stage 1	Key stage 2
• understand what algorithms are, how they are implemented as programs on digital devices, and that programs execute by following precise and unambiguous instructions • create and debug simple programs • use logical reasoning to predict the behaviour of simple programs • use technology purposefully to create, organise, store, manipulate and retrieve digital content • recognise common uses of information technology beyond school • use technology safely and respectfully, keeping personal information private; identify where to go for help and support when they have concerns about content or contact on the internet or other online technologies	• design, write and debug programs that accomplish specific goals, including controlling or simulating physical systems; solve problems by decomposing them into smaller parts • use sequence, selection, and repetition in programs; work with variables and various forms of input and output • use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and programs • understand computer networks, including the internet; how they can provide multiple services, such as the World Wide Web, and the opportunities they offer for communication and collaboration • use search technologies effectively, appreciate how results are selected and ranked, and be discerning in evaluating digital content • select, use and combine a variety of software (including internet services) on a range of digital devices to design and create a range of programs, systems and content that accomplish given goals, including collecting, analysing, evaluating and presenting data and information • use technology safely, respectfully, and responsibly; recognise acceptable/unacceptable behaviour; identify a range of ways to report concerns about content and contact

Table 2.7 *The Computing curriculum standards for Key Stages 1 and 2 in England (adapted from DfE, 2013).*

When the DfE released a final draft of the NC in 2013, they had removed both the use of the terms ICT and DL, opting for a solely computer science focus (Larke, 2019). There were suggestions that "this proposed Computing Programme of Study is not fit for purpose" (Twining, 2013) as it focuses on specified areas of programming to help with "opportunities for the workplace" (DfE, 2013) but was criticised because "most workers do not need to be able to program computers" (Twining, 2013). Twining (2013) suggests that the curriculum should be amended to focus on areas of DC and DL as "all members of our society need to be digitally competent."

In the certainty of a digital age, where DL is deemed to a necessary skill for everyone (Eryansyah, et al., 2019) and Hague and Payton's statement back in 2010: "the notion of DL and how it may translate to teaching and learning is not always well understood" is still significant now, The Royal Society (2017) stated that there was an enthusiastic response to this from parents and schools in its infancy, but there was also recognition that PST cover a range of subjects, and are classed as generalists rather than specialists: "most PST are generalists, who teach all subjects to a particular class. Computing is not their main focus

(Brown, et al., 2014). For this reason, specialist knowledge, such as teaching algorithms require specialist training. Crick noted that when a primary school teacher (generalist) met a computer specialist they asked about algorithms: *"Thank goodness! Are you going to tell me what an algorithm is?"* (Brown, et al., 2014). It may be noted that specialist subject areas that have not been visited require more instruction and training for it to be delivered effectively" "a subject in its infancy needs high-quality teacher training and development, best practice in the classroom, and reliable materials for students" (Crick, 2017).

Approaches to teaching DL skills differ significantly, causing difficulties in identifying the skills which students need to be taught (Polizzi, 2020) and without a set of standards, "countries like the UK and others in Europe lack a unified framework on how it should be taught" (Frau-Meigs, Velez, & Michel, 2017). Research shows that more than half of primary and secondary school teachers in the UK think the school curriculum "does not equip children with the literacy skills they need" in the digital age (National Literacy Trust, 2018, p. 4), and it may be argued that because the necessary skills have not been exclusively determined, there are difficulties in determining what revisions can made to this curriculum (Polizzi, 2020). Even through the NC identifies some criteria about the skillset children require regarding computing, the advancements in technology have changed dramatically since its release in 2013. In his research in 2019, Polizzi states "the government thinks the NC needs no revision to promote DL, but there is evidence to suggest otherwise" and proposes that there should be revisions mad to the NC in England to: "promote DL as a cross-curricular subject."

Schools are increasingly encouraged to embed the use of ICT in all subject areas across both the primary and secondary curricula. Considering how DL supports subject knowledge can help to ensure that technology-use enhances teaching and learning rather than simply becoming an 'add-on.' (Hague and Payton, 2010). However, some teachers feel that the content in the NC is "developmentally inappropriate and too narrow" (Larke, 2019), and as the implementation of this significantly undefined NC, teachers determine what curriculum standards reach their students, and if those are difficult to interpret, they will not be practiced effectively. For this reason, "teachers' perspectives should be given due consideration during the development of any new curriculum in order to improve the likelihood of implementation" (Larke, 2019). It may be suggested that further research is required to

identify how England's NC computing standards could be modified to better meet teachers' beliefs, needs and abilities (Larke, 2019).

Ball & Bowe (1992, p. 109) suggest that a teacher's "professional responsibility does not begin and end with the NC" and so "as professionals they may choose to enact the curricular standards in a way that they feel will best benefit their students" (Biesta, 2012). As the NC is a guidance for more generalised standards, it is up to teachers to appropriately interpret them to suit their individual contexts. Larke 2019 states that the NC exists in three different states: the "intended policy," the "actual policy," and the "policy-in-use." It might be suggested that if the "policy-in-use" does not meet the "intended policy," then changes to the "actual policy" need to be made.

Findings in the literature suggest that the Computing curriculum in England is not very detailed or thorough and therefore does not give a good indication of required digital practices and well-structured standards, as they are too vague. It is surprising to find that there are no specific mentions of DL in the TS and therefore some amendments should be considered, perhaps with direct references to the Computing curriculum to advise teachers in how to meet these standards in their teaching practice. The lack of literature regarding DL in a primary educational setting may be in response to the lack of guidance from both the NC and is not seen as a priority in the TS in England: "Educational professionals and scholars are faced with a range of perspectives, in which perspectives, terms and relations, and research procedures are ill advised." (Alexander, et al., 2006).

2.4.2 Teacher training in digital literacy skills

After the release of the new Computing Curriculum in 2013, many teachers were dismayed and "felt betrayed" (Larke, 2019) as here were suggestions that the NC had been influenced by industry rather than educational specialists (Larke, 2019). No additional funds for training, digital resources, or guidance beyond those listed in the NC were provided and primary schools and their teachers (all subject generalists) "were left to figure out the curriculum on their own" (Larke, 2019). Left with an, often, already stretched budget, schools had to prioritise their training needs, and this often meant that training in DL skills was pushed aside.

'Realising the potential of technology in education: A strategy for education providers and the technology industry' was released by the Department for Education (DfE) in 2019 to mark a 'new era' for schools, in an attempt to reduce teacher workload, boost student outcomes, increase efficiency and improve accessibility and inclusion (DfE, 2019). For technology to have a positive impact, teachers need to understand how technology can support positive change and how to implement it into their teaching through DL training. The document acknowledges that teachers face barriers and have 'a need for greater digital capability and skills' to inspire confidence and to understand privacy, safety and data security as well as technological skills (DfE, 2019). "There is a critical gap in the field's understanding of how best to teach modern DL skills on a nationwide scale" (Larke, 2019)

"Professional development is not simply an activity to be completed, but rather a lifelong process of continual self-improvement" (Hardy 2012, Evans 2002), training is essential for mental stimulation, teaching quality and remaining current with teaching strategies and knowledge. As technology changes and develops, as does the knowledge and understanding associated with it.

2.4.2.1 Digital strategy for schools

In 1997 the 'Information and Communications Technology in UK Schools' report, looking into how computers could be used effectively in UK schools and how teachers trained to use them, was commissioned. Blair stated that 'Technology has revolutionised the way we work and is now set to transform education. Children cannot be effective in tomorrow's world if they are trained in yesterday's skills' (DfE, 1997a, p.1). As the use of technology in schools was just being introduced, there was an acknowledgement that this was new and unfamiliar and therefore training was a necessity. There was a 'drive to reform schools through new technology' (Cuban, 2001) but there are theories that 'money has been spent on ICT on the basis of faith or blind belief of its vocational (and pedagogical) value, rather than on any basis of evidence, let alone proof' (Wellington, 2005). However, the reliance on technology to deliver teaching during the outbreak of the 2020 pandemic has given evidentiary support to the necessity and value of technology in schools.

Training was more accessible as the conservative government created the Microelectronics Education Programme (MEP) and received £8 million in funding between 1981 and 1984 (Wellington, 2005).

Initial teacher training in digital literacy skills

"Professional development to become a teacher comes long before a student enters teacher education" (Helleve, et al., 2020), as with anyone, the beliefs and practice of a student transitioning to becoming a teacher are influenced by their experiences, memories and guidance. Therefore, the personal affects the professional and vice versa. This means hat students should be taught during their studies about how to "move from a private to a professional position" (Helleve, et al., 2020), However, "ideas of privacy and teacher conduct are not yet sufficiently defined in the online world" (Foulger, e al., 2009). Just as with practising teachers, there are no standards outlined regarding DL in teacher education. Although many schools will expect a level of DC, as teachers are expected to be able to teach the Computing Curriculum, they are often not guided in this practice: "common criticism among student teachers is a perceived gap between practical teaching (knowing how) and the university coursework (knowing what)" (Korthagen 2010, Kvernbekk 2012). It is not enough for student teachers to be theoretically told how to act in the classroom, particularly concerning technology, student teachers must combine theoretical with practical knowledge for professional learning Gravett, e al., 2017).

"The government views the key concern of teachers as a need to focus on practical classroom skills, rather than theoretical, pedagogical understanding" (Atkins, 2018).

2.4.2.1 Methods of Professional Development

When considering how to develop a training curriculum, the researcher had to identify delivery methods and consider the ways practising teachers learn. Theories on learning were adapted from Dille and Rokenes (2021) and discussed below:

Socio-cultural theory and learning

In applying socio-cultural theory and Vygotsky's (1978) thoughts and ideas, Warford (2011) claims that teachers' learning is situated. This method insinuates that teachers learn through conversation, experience and the discussion of the experiences of others and then "attaching their own meaning relating to the content by conversation, or in dialogue with a text" (Dille and Rokenes, 2021). This theory suggests that the more competent others, these may be colleagues, external colleagues or other resource persons (Dille and Rokenes, 2021) can promote the learning of teachers in the "awakening of their previous knowledge and experiences during their learning process" (Dille and Rokenes, 2021) and then making this knowledge relatable and may be put into an educational context. This reflective notion is "a key to teachers' learning and development" (Postholm, 2008). The reflective process can show a sphere of possible actions (Lempert-Shepell, 1995) and through the reflection and organisation of thoughts, theory and practice can be brought closer together (Lempert-Shepell, 1995). The understanding of thoughts, emotions and motivational actions can be an influence on the actions of others, understood within a socio-cultural frame of reference (Dille and Rokenes, 2021). This is a useful strategy as teachers may go on to use this in their practice, as they become the more competent other.

Metacognitive processes and learning

This learning method relates to the processes involved in thinking into one's thinking. It involves critical analysis of two contexts: (1) one's thinking and learning and (2) oneself as a thinker and learner (Chick, 2013) Metacognitive practices increase students' abilities to transfer or adapt their learning to new contexts and tasks (Bransford, Brown, & Cocking, 2000) and this is done by gaining an awareness above subject matter (Chick, 2013). In the context of this study, "it means teachers learning to learn" (Dille and Rokenes, 2021), through participating in development situations in self-regulated learning. This further reflective process has the "intention not to satisfy goals but to assess how the goals are to be or have been satisfied" (Dille and Rokenes, 2021). The use of metacognitive strategies " means that learners can plan, lead, regulate and control their own learning" (Boekaerts, Pintrich, and Zeidner 2000; Flavell 1976; Zimmerman 2001, 2006) and going on to determine which strategies can be used in different situations. This strategy involves learning and dealing with the expected and the unexpected and consciously changing and improving

teaching practice through action learning. "When a teacher develops a metacognitive attitude they are aware of their own practice" (Dille and Rokenes, 2021) and so interact and construct knowledge with their students during their activity in the classroom. This strategy is suited to this study as the researcher and the participants will interact and construct knowledge together.

2.4.3 Teachers' need for training in digital literacy skills

"No education system can be better than the quality of its teachers."

(DfE, 2010)

As discussed, for a successful education system, a high standard of teacher professionalism is required (Akins, 2018). In her thesis *'Exploring teachers' professional development and digital literacy: a grounded theory study,'* Atkins (2018) investigates the development and focuses on teaching as a profession and how this has been adapted through the transitions of governments in England since the late 1970s. The meaning of a teaching profession relates to that of "top graduates, trained with a focus on classroom practice" (DfE, 2010) and from this, Pollard (2010) adds that a quality teacher "should engage in reflective practice; constantly reviewing teaching methods based on current research." As the context and requirements for education develop, teachers need to constantly be professionally developing their skills, both theoretically and practically, to ensure the quality of education in England.

As the 'digital world' evolves, teachers "require a complex range of skills, knowledge and understanding" (Facer, 2009) to be considered 'digitally literate.' ICT has had to become more present as an educational tool and teachers are expected to be able to create successful learning environments using technology. However, teachers lacking these skills risk not utilising these resources to their full potential: 'an introduction of such technologies in schools for producing change and innovation is not enough, it requires digitally competent teachers to facilitate the use of ICT in education' (Hassan & Mirza, 2021). DL skills are extremely important for teachers to support alternative teaching strategies.

Huber and Shalavin (2018) discuss the 'DL landscape in […] HE" and suggest: "in order to produce digitally literate graduates, it is necessary for institutions to have digitally literate

staff." This is relatable to primary education, as teachers should have a knowledge and understanding of DL in order to be able to teach their students these skills.
The simple fact is that DL is now essential for successfully living, learning and working in today's increasingly digitalized society and knowledge economy. This fact is the new reality of life in the 21st Century and is reflected in growing concerns by governments that many citizens lack basic digital skills.

Hague and Payton (2010) explain that: "teachers should be interested in DL and how it is relevant to their subject teaching" and their DL handbook can be viewed as a preparation course for the impact of COVID-19 in education, as the "increasing role of technology in young people's lives."

Consensus may be that teachers play a crucial role in the process of integrating technology into instruction (Dillenbourg, 2010; Kirschner, 2015; Lawless & Pellegrino, 2007; Moreira, 2015). Guggemos and Seufert (2021) argues that there are two areas in which teachers are supposed to integrate technology in their practise: (1) to use technology in their instructions to support different learning needs: "teachers are supposed to use technology to achieve pedagogical goals" (Guggemos and Seufert, 2021) and (2) to teach about technology itself, and adopting these instructions to suit the development of technology: "integrate new content into their instruction or change the instructional focus due to digital transformations" (Guggemos and Seufert, 2021). Teachers should be educated in DL skills as "it has been shown to be an important predictor for instructional quality" (Banmert, et al., 2010). The greater the knowledge in DL skills, the more capable the teacher at implementing instructions at using technology effectively.

Polizzi (2019) suggests that "teachers need training about how to teach children the skills and knowledge they require, while we also need knowledge on teachers' levels of digital literacy."

2.4.4 Implementation of digital literacy into schools

"Few studies have been conducted on how mandatory computing education policies are translated into classroom practice."

(Larke, 2019).

The lack of implementation of digital literacy into schools

Guggemos and Seufert (2021) theorise that it is "the individual teachers' will (attitudes) and skills (behavioural control) predict the use of technology" in the classroom. From this, it may be stated that a positive attitude with strong DL skills often causes teachers to be more likely to using technology in their teaching practise. On the other hand, negative attitudes towards technology in the classroom will result in a lack of implementation. A shortage in skills often results in reduced confidence and therefore results in a lack of implementation. To improvement in the implementation of technology in schools is dependent upon practising teachers. Guggemos and Seufert (2021) hypothesise:

H1: Positive attitudes towards technology in instruction positively predict the use of technology in instruction.

H2: Positive attitudes towards technology as content positively predict the use of technology-related content.

It is necessary to have teachers with positive attitudes, confidence and defined DL skills; therefore, training specifying the required DL skills, technological pedagogical knowledge and instruction of technology implementation in cross-curricular subjects is required.

As the 'digital world' evolves, teachers 'require a complex range of skills, knowledge and understanding' (Facer, 2009) but they are anxious about this expectation and about technologies because they have not been formally trained. There are suggestions that practising teachers believe that 'more traditional methods always seem like a 'safer bet" (Timbuktu, 2015). There are other indications that some teachers want to acquire these skills but fear the 'unknown': 'teachers show up at large, industry-driven conferences feeling more

than a little like middle school students at their first dance. They want to be there so badly, but they are completely confused as to how they fit in and what role they should adopt' (Rubin, 2013). Martin Bailey of Animate2Educate suggests that the toughest challenges that teachers face when they are required to integrate technology are the lack of confidence in using the technology and what to do when things go wrong. A positive attitude is essential for digital learning; a can-do approach is infectious and will benefit your students as they mirror your behaviour (Wise, 2016).

The extent of the effect in improving DL skills is "highly dependent on the level of capabilities of the teachers in using digital learning tools and resources effectively to achieve learning outcomes" (Scottish Government, 2015). "The explosive growth in use of digital technologies for learning has left subject disciplines, government agencies and many practitioners with a problem" (Belshaw, 2012). This not only relates to who should teach these skills and how they should be taught but also how we go about doing this. These strategies can remain vacant as teachers do not have the understanding or skills to implement them.

Effective learning using digital resources depends on how teachers use them; effectively or not. Schools ought not to assume that teaching staff are ready to operate technology and transfer digital skills from the outset (Melhuish & Falloon, 2010), but should actively create adequate opportunities for professional development. A lack of relevant training, a shortage of technical support and the absence of a policy related to the knowledge and understanding of the components of DLcan prevent staff from implementing digital skills on a regular basis (Oliviera, 2014). It is, therefore, essential that adequate support is provided to teachers charged with introducing technology and teaching DL skills, as the established pedagogy observed in schools does not change simply with the introduction of new technology (Osborne & Hennessy, 2003).

Although children can adapt to using new technologies and engage with them, being so called 'digital natives' (Prensky, 2001), there are debates on whether they really understand their purposes and development capabilities. For most, they need guidance and teaching in the importance of DL so that they have an understanding of the essential components to remain safe and on-par with the evolution of a digital world. Teachers need to be trained in using digital resources creatively to gain confidence in the classroom and to educate children in

their own knowledge and understanding. Research literature also identifies the factors that bring about more effective implementation of digital learning and teaching (Scottish Government, 2015) and addresses that teachers require some support in overcoming their anxieties and their experimentation with technologies, use of digital resources and in their maintaining and upgrading of equipment. Successful implementation requires that teaching staff are given opportunities to embed digital learning and an environment that allows them to continue to develop their professional development with guidance on the use of digital tools (Scottish Government, 2015).

The successful implementation of ICT into the classroom in dependent on a school's "well-defined mission that describes technology's place in Education" (Bennet, 1996, p.60). This indicates that teachers need to be made aware of "exactly how ICT is used as a teaching and learning tool" (Afshari, et al., 2009) and will be armed will the tool to know how to use technology effectively in the classroom and what to do if any problems arise. The act of teaching and educating is dependent on planning. The National Curriculum is a grid for "developing, planning and communicating ideas" (Isobe and Yamazaki, 2004) and this format needs to be reiterated when teaching teachers about using technology effectively. By making a vision and plan available to teachers about the contribution of ICT to education sets a training foundation and "a vision gives us a place to start, a goal to reach for, as well as a guidepost along the way" (Ertmer, 1999, p. 54) and " an ICT integration plan provides a detailed blueprint of the steps and methods needed to translate the school ICT vision into reality" (Afshari, et al., 2009). Teachers require the opportunity to "study, observe, reflect, and discuss their practice, including their use of ICT, in order to develop a sound pedagogy that incorporates technology (Kearsley & Lynch, 1992). In allowing teachers to contribute their knowledge, skills and creativity (Afshari, et al., 2009), a vision should inspire positive attitudes and develop confidence in the expectations for the implementation of technology in the classroom.

2.4.4.1 Confidence in DL skills

"Confident teachers will teach content that meets their professional standards."

(Larke, 2019)

A lack of DL skills often relates to a lack of confidence in digital skills. In her 2018 research, Palamino suggests that 'the root causes of teachers' negative attitudes towards ICT use stems from shortcomings in training. A lack of confidence in digital skills can 'constitute a barrier that prevents these resources from being introduced in a classroom setting' (Hew & Brush, 2007; Mueller, Wood, Willoughby, Ross & Specht, 2008). An apparent lack of confidence from a teacher can transfer to their students and so 'a positive attitude is essential for digital learning; a can-do approach is infectious and will benefit your students as they mirror your behaviour' (Wise, 2016). To inspire confidence, teachers need to be trained in all areas of DL so that their knowledge and understanding can also be transferable to their students.

2.4.4.2 Use of and access to digital devices

There are theories that teachers' personal use of digital devices can affect and develop their functional skills and their creativity in the classroom: 'with the use of technology the home can become an extension of the classroom' (Sawmiller, 2010). The use of digital devices creates a familiarity with DL and this feeds into professional work (Cunningham, Kerr, McEune, Smith & Harris, 2003).

Considerations about the availability and accessibility of devices should be taken into account when contemplating the integration and training implementation of technology in the classroom: "school equipment and resources, e.g., digital devices and high-speed internet, seem to play an important role for use" (Europena Commission, 2019; Fraillon, et al., 2019).

As previously mentioned in this chapter, a vision and plan should be considered a necessity for the implementation of technology in Education. "A school must develop a vision before they make substantial investments in hardware and software" (Means and Olson, 1997) as schools can then develop their blueprint around these resources and funding towards these.

The digital divide

The 'digital divide' emerged in the 1990s to describe the gap in access between digital 'haves' and 'have nots' (Allmann and Blank, 2021; Brown, Barram, and Irving, 1995). Attewell (2001) suggests these 'have nots' refers not just to accessibility but extends to "the skills to make effective use of digital technologies." As we have not moved into a 'digital-by default' (The Cabinet Office, et al., 2012), speaking in terms of the agenda for solely digitalised government services the first or only port of call, it is crucial to understand the requirement for digital skills. Although there is a great need for these skills as ICT are intertwined almost every aspect of social and economic activities (Cruz-Jesus, et al., 2016), countries are not meeting the potential uses of ICTs due to the digital divide.

The digital divide can relate to two aspects: (1) access and (2) use, although similar, these are not the same. On must consider socio-economic situations, where those with lower incomes or education levels, disabilities, living in rural areas, belonging to ethnic minorities, women and the elderly, are considered to be disadvantaged and are more likely to suffer from digital inequalities (Azari and Pick, 2005; Crenshaw and Robison, 2006; Ferro et al., 2011; Hilbert, 2011; Hill et al., 2015; Lengsfeld, 2011; Payton, 2003). Those who do have access to technologies are more likely to use them and therefore funding should be provided so that children can all access them a school.

2.4.5 Impact of COVID-19 on digital literacy skills

"The COVID-19 outbreak opened a new scenario where teachers must have adequate DLto teach online and to implement a current and innovative educational model."

(Sánchez-Cruzado, et al., 2021)

After the emergence of the Coronavirus (Covid-19) and with its huge impact on the education industry, the concern about DC has reached a new height (Zhao, et al., 2021). "Recent months showed how important it is for teachers and students to have appropriate ICT knowledge and skills" (Potyrała and Tomczyk, 2021). DL skills are extremely important for teachers to support alternative teaching strategies, which became apparent during COVID-19: "concerns about the digital skills gap have been particularly acute during the COVID-19

pandemic as people have been more reliant on digital skills for accessing education" (UK Parliament Post, 2021).

The outbreak of COVID-19 (2020) in England forced schools throughout the nation to close, with only two days' notice, and the expectation of delivering home-based learning to all students. "|School's out, but class is 'on" (Zhou et al, 2020) and so teachers were required to fulfil their job expectations; forced to deliver teaching remotely, find methods to monitor progress and discovering ways to communicate with their colleagues, students and parents alike, when neither party had been fully trained to do so: "for the first few weeks only the most intrepid teachers or, rather, those professionals who were digitally adept, continued teaching" (Sánchez-Cruzado, et al., 2021). Unarmed with significant DL skills, teachers went above and beyond their job descriptions.

Concerns about the future of education arose, yet some researchers wonder if the virus has created an opportunity for the development of DLskills (Tejedor, et al, 2020; Tzifopoulos, 2020): "during the period of self-isolation, 92.6% of parents noted that they have become a confident user, since they easily find the necessary information and know the sites of interest" (Pavlenko and Pavlenko, 2020) and this was reflected on their children's digital literacy. Serpa, et al. (2020) suggest that COVID-19 also contributed to the advancement of technology in (higher) education: "it may be a pivotal moment of opportunity for the reformulation of teaching, notably with the implementation, development and dissemination, among academics and students, of digital technologies," showing encouragement for governments to update their NCs and Teachers' Standards to suit this revolutionary movement. Prior to the global pandemic, there was no requirement for teachers to be digitally literate (Teachers' Standards, DfE, 2011) and so many had very basic skills and lacked the confidence to implement the digital skills that they had into their teaching. This situation brought to light the essentiality to be digitally literate as the world becomes more digitalised and education was forced to become virtual. Now that DL skills have been founded and developed, questions have arisen concerning whether schools will take advantage of the impact of digital education, and they will continue learning cycles to remain active and confident in DL skills (Tzifopoulos, 2020).

In April 2020, GOV.UK introduced the 'Get help with technology' (2020a) programme. It provided with access to digital devices and the internet, the ordering of technology for

schools and training and support for children, families and young people using the devices received GOV.UK, 2020a). There was no mention of a provision of training for teachers. However, GOV.UK did offer a 'Training and support for remote and face-to-face education' programme, delivered by 'schools and colleges who have significant experience and expertise into the effective use of education technology' (GOV.UK, 2020b), although it may be suggested that this would not cover the amount of support required.

The *Educational Technology (EdTech) Survey 2020-21* reported that as schools had closed in response to COVID-19 and therefore had to change to online teaching strategies: "almost all headteachers (primary 94%, secondary 97%) indicated that their school had introduced, increased, or upgraded technology in the previous 12 months" (Government Social Research, 2021). A greater investment was needed as schools had to provide the tools to support their staff and students with remote access to receive work. The report showed that "most primary schools have introduced, increased or upgraded a **learning platform to set and receive pupils' work**" (Government Social Research, 2021) due to COVID-19. *Figure 2.7* shows the types of technology English schools (primary and secondary) had introduced, increased, or upgraded in response to COVID-19:

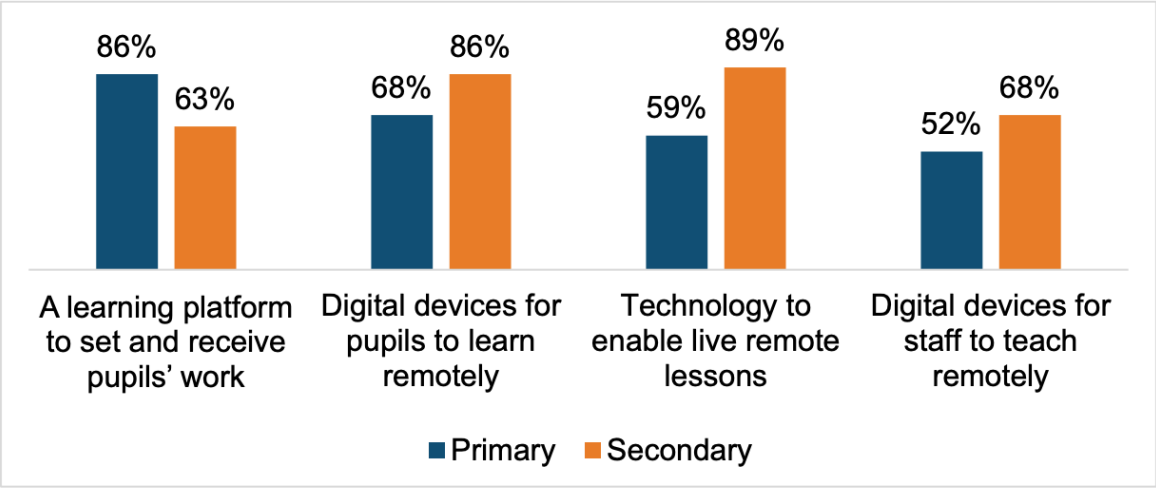


Figure 2.7 *The types of technology English schools (primary and secondary) had introduced, increased, or upgraded in response to COVID-19, from Government Social Research (2021).*

The report shows that huge investments had been made into technology as a result of the closure of schools and change to remote learning.

Although investments had been made into technology the pandemic highlighted the shortcomings of the English educational system, particularly its teachers, regarding DL: ““DL is not a reality that has favoured the teaching–learning process” (Sánchez-Cruzado, et al., 2021). For this reason, the designing of a training curriculum is urgently needed “for teachers to reach optimal levels of digital skills, so as to undergo a true paradigm shift, ultimately combining methodology and educational strategies” (Sánchez-Cruzado, et al., 2021).

2.4.6 Defining Digital Literacy in an Educational Setting

Using their findings from the reviewed literature, the researcher has defined DL as:

Digital literacy in education involves using technology creatively and developing functional skills, through exploration and practice. It is the understanding of e-safety by critically questioning the use of technology and information and the risks involved. This involves critically conducting searches to find and select relevant information using digital tools. It involves the ability to communicate and collaborate effectively online and with this have knowledge and understanding of cultural, social, and ethical behaviours.

2.5 Limitations

The researcher recognises that this review is not exhaustive of all existing DL frameworks, policies, and programmes, as they were bound by time constraints and a lacking in the availability of relevant literature in this subject area.

The researcher notes that the literature available is rather static and hence material used is not recent (in terms of chronological date) but is still modern with respect to current thinking on DL.

This meant that the researcher had no direct comparisons to make and use as a foundation to build upon. Although this ensured originality, the literature review meant that the researcher had limited theoretical foundations to influence the research questions. However, with limited research on this research topic, the researcher was able to identify gaps in literature, presenting a need for further development in this area.

2.6 Chapter Summary

This chapter sought to explore the meaning of digital literacy and to focus, particularly, on its meaning in an educational context. The researcher identified that there is no agreed upon definition for this term in a broader context and that definitions of DL are specified to their context and culture. In an attempt to form a definition, the researcher explored a multitude of theories involved in DL frameworks, which have been developed to suit both generalised and more-specified contexts, and focused on five frameworks that were most comparable and relevant to a primary educational context.

It was noticeable that none of the reviewed frameworks, including those not included in this literature review, related solely to the context of primary school teachers. There was no framework that presented a set of standards which aligned with the NC in England and the necessities of implementing DL skills into primary school teaching practice. As many frameworks and models of Dl have been composed following heavy research into defining DL skills. For this reason, the researcher chose not to develop their own framework, but rather to adapt existing frameworks to suit the context of this study: primary school education. The researcher will use the proposed component commonalities and define each with standards that relate to the NC in England.

The researcher created a comparison between five existing frameworks: Belshaw (2012), Hague and Payton (2010), JISC (2014), JISC (2016) and Mishra and Koehler (2006) and from the literature and research in these models, the researcher has identified six components of digital literacy: functional skills, e-safety, finding and retrieving relevant information, communication and collaboration, cultural, social, and ethical understanding, and creativity. Definitions for each of these components were then defined in primary educational contexts, in combining the findings from the literature and the interviews, combining theory with practice.

References

Abdullah, M., & Osman, K. (2010). 21st century inventive thinking skills among primary students in Malaysia and Brunei. Procedia - Social and Behavioral Sciences, 9, pp. 1646- 1651. doi:10.1016/j.sbspro.2010.12.380

Addeo, F., Paoli, A. D., Esposito, M., & Bolcato, M. Y. (2019). Doing social research on online communities: The benefits of netnography. *Athens Journal Of Social Sciences*, *7*(1), pp. 9-38.

Afshari, M., Bakar, K.A., Luan, W.S., Samah, B.A. and Fooi, F.S. (2009). Factors affecting teachers' use of information and communication technology. *International journal of instruction*, *2*(1).

Alexander, B., Adams Becker, S., Cummins, M. and Hall Giesinger, C. (2017), Digital Literacy in Higher Education, Part II: An NMC Horizon Project Strategic Brief, No. 3.4, The New Media Consortium, Austin, TX. Available at: https://library.educause.edu/resources/2017/8/digital-literacy-in-highereducation-part-ii-an-nmc-horizon-project-strategic-brief. (Date accessed: 3.5.2019).

Aliyyah, R. R., Rachmadtullah, R., Samsudin, A., Syaodih, E., Nurtanto, M., & Tambunan, A. R. S. (2020). The perceptions of primary school teachers of online learning during the COVID-19 pandemic period: A case study in Indonesia. *Journal of Ethnic and Cultural Studies*, *7*(2), pp. 90-109.

Allmann, K. and Blank, G. (2021). Rethinking digital skills in the era of compulsory computing: methods, measurement, policy and theory. *Information, Communication & Society*, *24*(5), pp.633-648.

Atkins, L. (2018). *Exploring teachers' professional development and digital literacy: a grounded theory study.* Available at: https://dora.dmu.ac.uk/bitstream/handle/2086/17158/Lucy%20Atkins%20Thesis.pdf?sequence=1 . (Date accessed: 12.5.2020)

Attewell, P. (2001). Comment: The first and second digital divides. *Sociology of Education*, *74*(3), pp. 252-259.

Astleitner, H. (2002). Teaching critical thinking online. *Journal of Instructional Psychology*, *29*(2), pp.53-76.

Azari, R. and Pick, J.B. (2005). Technology and society: socioeconomic influences on technological sectors for United States counties. *International Journal of Information Management*, *25*(1), pp.21-37.

Ball, S. J., & Bowe, R. (1992). Subject departments and the 'implementation' of National Curriculum policy: An overview of the issues. Journal of Curriculum Studies, 24(2), pp. 97–115.

Barber, W. and King, S. (2016). Teacher-Student Perspectives of Invisible Pedagogy: New Directions in Online Problem-Based Learning Environments. *Electronic Journal of e-Learning*, *14*(4), pp. 235-243.

Bawden, D. (2001). Information and digital literacies: a review of concepts. *Journal of documentation*.

Bawden, D. (2008) 'Origins and Concepts of Digital Literacy' in C. Lankshear, & M. Knobel, Digital Literacies: Concepts, Policies and Practices New York: Peter Lang Publishing

Beetham, H. (2017). Digital capabilities framework: an update. *Jisc Building Capability Blog.* Available at: https://digitalcapability.jiscinvolve.org/wp/2017/03/09/digital-capabilities-framework-an-update/. (Date accessed: 2.5.2020)

Belshaw, D. (2012) What is 'digital literacy?' A Pragmatic investigation., Durham theses, Durham University. Available at: http://etheses.dur.ac.uk/3446/ (Date accessed: 11.3.2019)

Bennett, C. (1996), "Schools, Technology and Educational Leadership: A Framework for Change", NASSP Bulletin, Vol. 80 No. 577, pp. 57-65

Bennett, S., Maton, K., & Kervin, L. (2008). The 'digital natives' debate: A critical review of the evidence. *British Journal of Educational Technology*, *39*(5), pp. 775-786.

Bennett, S., & Maton, K. (2010). Beyond the 'digital natives' debate: Towards a more nuanced understanding of students' technology experiences. *Journal of Computer Assisted Learning*, 26(5), pp. 321-331.

Biesta, G. J. J. (2012). Giving teaching back to education: Responding to the disappearance of the teacher. Phenomenology & Practice, 6(2), pp. 35–49.

Biggins, D., Holley, D., Evangelinos, G. and Zezulkova, M. (2017). Digital competence and capability frameworks in the context of learning, self-development and HE pedagogy. In *E-learning, E-Education, and Online Training*. pp. 46-53. Springer, Cham.

Boekaerts, M., P. Pintrich, and M. Zeidner. (2000). Self-regulation: An introductory review. In Handbook of self-regulation, ed. M. Boekarts, P.R. Pintrich, and M. Zeidner, 1–9. San Diego, CA: Academic Press.

Bowen, J. A. (2012a). Technology for engagement. In Teaching naked: How moving technology out of your college classroom will improve student learning. pp 129-152. San Francisco: Jossey Bass

Bransford, John D., Brown Ann L., and Cocking Rodney R. (2000). *How people learn: Brain, mind, experience, and school*. Washington, D.C.: National Academy Press.

Brown, G. and Harris, L.R., (2018). Methods in feedback research. *Cambridge Handbook of Instructional Feedback*.

Brown, M. (2017). The Challenge of Digital Literacy; Beyond Narrow Skills to Critical Mindsets. Available at: https://www.linkedin.com/pulse/challenge-digital-literacy-beyond-narrow-skills-critical-mark-brown. (Date accessed: 4.4.2019)

Brown, R.H., Barram, D.J. and Irving, L., (1995). Falling Through the Net: A Survey of the" Have-Nots. *Rural and Urban America*.

Bubb, S., & Jones, M. A. (2020). Learning from the COVID-19 home-schooling experience: Listening to pupils, parents/carers and teachers. *Improving Schools*, *23*(3), pp. 209-222.

Buckingham, D. (2015). Defining digital literacy-What do young people need to know about digital media?. *Nordic journal of digital literacy*, *10*(Jubileumsnummer), pp.21-35.

Buelens, H., Totté, N., Deketelaere, A., & Dierickx, K. (2007). Electronic discussion forums in medical ethics education: the impact of didactic guidelines and netiquette. *Medical Education*, *41*(7), 711-717.
711–717.

Bugeja, M. (2007). Making whole: The ethics of correction. *Journal of Mass Media Ethics*, *22*(1), pp.49-65.

Byrne, J., Kardefelt-Winther, D., Livingstone, S., Stoilova, M. (2016). Global Kids Online Research Synthesis, 2015−2016. *UNICEF Office of Research Innocenti and London School of Economics and Political Science.*

The Cabinet Office. (2012) *Government Digital Strategy.* Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/296336/Government_Digital_Stratetegy_-_November_2012.pdf. (Date accessed: 11.2.22)

Calvani, A., Cartelli, A., Fini, A. and Ranieri, M. (2008). Models and instruments for assessing digital competence at school. *Journal of E-learning and Knowledge Society*, *4*(3), pp.183-193.

Carmichael, E. and Farrell, H. (2012). Evaluation of the Effectiveness of Online Resources in Developing Student Critical Thinking: Review of Literature and Case Study of a Critical Thinking Online Site. *Journal of University Teaching and Learning Practice*, *9*(1), p.4.

Chalkiadaki, A., (2018.) A systematic literature review of 21st century skills and competencies in primary education. *International Journal of Instruction*, *11*(3), pp.1-16.

Chaudron, S., Beutel, M., Cernikova, M., Navarette, V. D., Dreier, M., & Fletcher-Watson, B. (2015). Young children (0-8) and digital technology. *A qualitative exploratory study across seven countries. Joint Research Centre. European Commission*.

Chick, N. (2013). Metacognition. *Vanderbilt University Center for Teaching.* Available at: https://cft.vanderbilt.edu/guides-subpages/metacognition/#:~:text=Metacognition%20is%2C%20put%20simply%2C%20thinking,as%20a%20thinker%20and%20learner. (Date accessed: 22.9.2020)

Chinn, C.A., Barzilai, S. and Duncan, R.G. (2021). Education for a “post-truth” world: New directions for research and practice. *Educational Researcher*, *50*(1), pp.51-60.

CILIP. (2004). Found in: Armstrong, C., Boden, D., Town, S., Woolley, M., Webber, S. and Abell, A. CILIP defines Information Literacy for the UK. Available at: http://eprints.rclis.org/7459/1/Article_Update_25102004.pdf. (Date accessed: 11.1.2022).

Corbin J, Strauss A (2015) Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory. Fourth edition. Sage, Thousand Oaks, Ca

Cordell, R.M., 2013. Information literacy and digital literacy: Competing or complementary?. *Communications in Information Literacy*, *7*(2), p.14.

Cordes, S., 2009. Broad horizons: The role of multimodal literacy in 21st century library instruction. In *World library and information congress: 75th IFLA general conference and council*.

Craft, A. (2010). *Creativity and Education Futures: Learning in a Digital Age*. Trentham Books Ltd: Stoke on Trent.

Crenshaw, E.M. and Robison, K.K. (2006). Globalization and the digital divide: The roles of structural conduciveness and global connection in Internet diffusion. *Social Science Quarterly*, *87*(1), pp.190-207.

Crick, T., 2017. Computing education: An overview of research in the field. London: Royal Society.

Cruz-Jesus, F., Vicente, M.R., Bacao, F. and Oliveira, T. (2016). The education-related digital divide: An analysis for the EU-28. *Computers in Human Behavior*, *56*, pp.72-82.

Cruz, M. & Orange, E. (2016). 21st Century skills in the teaching of foreign languagesat primary and secondary schools. *Turkish Online Journal of Educational Technology.* Special Issue for IETC, ITEC, IDEC, ITICAM 2016. 1-12.

Cunningham, M., Kerr, K., McEune, R., Smith, P. and Harris, S. (2003) Laptops for Teachers: An evaluation of the first year of the initiative. *ICT in School research and evaluation Series No.19.* Becta/DfES.

Davies, J., & Merchant, G. (2007). Looking from the inside out: Academic blogging as new literacy. *A new literacies sampler*, *29*, 115-136

Deady, K. (2017). Preparing students for a digital future: How teachers can bring digital literacy into the classroom. *Teachaway.* Available at: https://www.teachaway.com/blog/preparing-students-digital-future-how-teachers-can-bring-digital-literacy-into. (Date accessed: 4.4.2020)

Department for Education (DfE). (2010) The importance of teaching. London: HMSO, Cm 7980. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/175429/CM-7980.pdf. (Date accessed: 11.2.2021)

Department for Education (DfE). (2013). National curriculum in England: computing programmes of study. Available st: https://www.gov.uk/government/publications/national-curriculum-in-england-computing-programmes-of-study. (Date accessed: 10.4.2019)

Dewey, J. (1929). The quest for certainty.

Diaz, C. (2017). Behind the Digital World: High School Education Evolved. Available at: https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=the+digital+world+is+evolving+in+education&btnG=#d=gs_cit&u=%2Fscholar%3Fq%3Dinfo%3AL0JsKAR3JbsJ%3Ascholar.google.com%2F%26output%3Dcite%26scirp%3D1%26hl%3Den). (Date accessed: 1.3.2022)

Dick, R.D. (1991). An empirical taxonomy of critical thinking. *Journal of Instructional Psychology*, *18*(2), p.79.

Dille, K.B. and Rokenes, F.M. (2021). Teachers' professional development in formal online communities: A scoping review. *Teaching and Teacher Education*, *105*, p.103431.

Dillenbourg, P., & Jermann, P. (2010). Technology for classroom orchestration. In *New Science of Learning*. pp. 525-552. Springer, New York, NY.

Dresang, E. T. (2005). Access: The information-seeking behavior of youth in the digital environment. *Library Trends*, *54*(2), pp. 178-196.

Duraku, Z. H., & Hoxha, L. (2020). The impact of COVID-19 on education and on the well-being of teachers, parents, and students: Challenges related to remote (online) learning and opportunities for advancing the quality of education. *Retrieved online from https://www. researchgate. net/publication/341297812*. (Date accessed: 4.4.2020)

Elmore, P. G., & Coleman, J. M. (2019). Middle school students' analysis of political memes to support critical media literacy. Journal of Adolescent & Adult Literacy, 63(1), pp. 29– 40

Ertmer, P. A. (1999). Addressing First- and Second-Order Barriers to Change: Strategies for Technology Integration. Educational Technology Research and Development, 47(4), pp.47-61.

Eryansyah, E., Erlina, E., Fiftinova, F. and Nurweni, A., (2019). EFL Students' Needs of Digital Literacy to Meet the Demands of 21stCentury Skills. | IRJE| Indonesian Research Journal in Education|. pp.442-460.

Esper, S., Simon, B. and Cutts, Q. (2012), September. Exploratory homeworks: An active learning tool for textbook reading. In *Proceedings of the ninth annual international conference on International Computing Education Research* pp. 105-110.

European Council. (2018). COUNCIL RECOMMENDATION of 22 May 2018 on key competences for lifelong learning (Text with EEA relevance). *Official Journal of the European Union.* (Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604(01)&rid=7). (Date accessed: 29.11.2022)

Evans, L. (2002) What is teacher development? Oxford Review of Education, vol.28(1), pp. 123– 137.

Facer, K. (2009). Facer, K.. Educational, social and technological futures: a report from the Beyond Current Horizons Programme. Beyond Current Horizons Programme.

Farmer, L. (2004). Using technology for storytelling: Tools for children. *New Review of Children's Literature and Librarianship*, *10*(2), pp. 155-168.

Feist, D., & Reid, D. (2018). Technology and teaching: Technology and student-centered pedagogy in 21st century classrooms. In *Handbook of research on digital content, mobile learning, and technology integration models in teacher education* (pp. 69-87). IGI Global.

Ferrari, A. (2012). Digital competence in practice: An analysis of frameworks. *Sevilla: JRC IPTS*, *10*, p. 82116.

Ferro, E., Helbig, N.C. and Gil-Garcia, J.R. (2011). The role of IT literacy in defining digital divide policy needs. *Government Information Quarterly*, *28*(1), pp.3-10.

Fisher, M., & Baird, D. (2009). Pedagogical mashup: Gen Y, social media, and digital learning styles. *Handbook of Research on New Media Literacy at the K-12 Level, IGI Global, Hershey, PA*.

Flavell, J.H. 1976. Metacognitive aspects of problem solving. In The nature of intelligence, ed. L.B. Resnick, 231–5. Hillsdale, NJ: Earlbaum

Foulger, T.S., Ewbank, A.D., Kay, A., Popp, S.O. and Carter, H.L. (2009). Moral spaces in MySpace: Preservice teachers' perspectives about ethical issues in social networking. *Journal of Research on Technology in Education*, *42*(1), pp.1-28.

Fraillon, J. (2019). Digital literacy: Myths and realities. *Australian Council for Educational Research, Research Conference 2019*.

Frau-Meigs, D., Velez, I. and Michel, J.F. eds. (2017). *Public policies in media and information literacy in Europe: cross-country comparisons*. Taylor & Francis.

Freerar, J. (2019). Development of a framework for digital literacy. *Reference Services Review*.

Gallager, R. G. (2008). *Principles of digital communication*(Vol. 1). Cambridge: Cambridge University Press.

Garzon Artacho, E., Martínez, T. S., Ortega Martin, J. L., Marin Marin, J. A., & Gomez Garcia, G. (2020). Teacher training in lifelong learning—The importance of digital competence in the encouragement of teaching innovation. *Sustainability*, *12*(7), 285

Gee (1991) Social Linguistics: Ideology in Discourses, Falmer Press: London

Gee, J. P. (2004). *An introduction to discourse analysis: Theory and method*. Routledge.

Goodfellow, R. (2011). Literacy, literacies and the digital in higher education. *Teaching in Higher Education*, *16*(1), pp.131-144.

Granberg, C. (2011). *ICT and learning in teacher education: The social construction of pedagogical ICT discourse and design* (Doctoral dissertation, Interaktiva medier och lärande (IML), Umeå universitet).

Gravett, S., de Beer, J., Odendaal-Kroon, R. and Merseth, K.K. 2017. The affordances of case-based teaching for the professional learning of student-teachers. *Journal of curriculum studies*, *49*(3), pp.369-390.

Guba, E.G., (1990). The paradigm dialog. In *Alternative Paradigms Conference, Mar, 1989, Indiana U, School of Education, San Francisco, CA, US*. Sage Publications, Inc.

Guggemos, J. and Seufert, S., (2021). Teaching with and teaching about technology–Evidence for professional development of in-service teachers. *Computers in Human Behavior*, *115*, p.106613.

Ha, T. T. (2010). *Theory and design of digital communication systems*. Cambridge University Press.

Hafner, A. L., Allison, B., Jones, A., & Stewart, I. H. (2012). Assessing the development of apprentice principals in traditional and residency programs. *Procedia-Social and Behavioral Sciences*, *69*, 1134-1141.

Hague, C. and Payton, S. (2010) Digital literacy across the curriculum'. *Futurelab.* Available at: https://www.nfer.ac.uk/media/1770/futl06.pdf *(*Date accessed: 1.3.2019)

Hall, R., Atkins, L. and Fraser, J. (2014). Defining a self-evaluation digital literacy framework for secondary educators: the DigiLit Leicester project.

Hardy, I. (2012) The Politics of Teacher Professional Development: Policy, Research and Practice. Abingdon: Routledge

Hargittai, E. (2010). Facebook privacy settings: Who cares?. *First Monday*

Harvey, P.D., Tibiriçá, L., Kallestrup, P. and Czaja, S.J. 2020. A computerized functional skills assessment and training program targeting technology based everyday functional skills. *JoVE (Journal of Visualized Experiments)*, (156), p.e60330.

Hassan, M.M. and Mirza, T. and Hussain M.W, (2021). The Digital Literacy in Teachers of the Schools of Rajouri (j&K)-India: Teachers Perpactive. *International Journal of Education and Management Engineering.* 11(1), pp.28-40

Hazen, E. P., Goldstein, M. A., & Goldstein, M. C. (2010). *Mental health disorders in adolescents: A guide for parents, teachers, and professionals*. Rutgers University Press

Helleve, I., Grov Almås, A. and Bjørkelo, B. (2020). Becoming a professional digital competent teacher. *Professional Development in Education*, *46*(2), pp.324-336.

Helleve, I., Ulvik, M., & Roness, D. (2019). Expectations to mentoring as support for professional development. *Nordisk tidsskrift for utdanning og praksis*, *13*(2), 56-75.

Heinrichs, C. R. (2016). Exploring the influence of 21st century skills in a dual languageprogram: A case study. International Journal of Teacher Leadership, 7(1), 37- 56.

Henriksen, D., Henderson, M., Creely, E., Ceretkova, S., Černochová, M., Sendova, E., ... & Tienken, C. H. (2018). Creativity and technology in education: An international perspective. *Technology, Knowledge and Learning*, *23*(3), 409-424.

Helsper, E. J., & Eynon, R. (2010). Digital natives: where is the evidence?. *British educational research journal*, *36*(3), 503-520.

Herold, D. (2012). Digital natives: Discourses of exclusion in an inclusive society. *Generational use of new media*, 71-86.

Herring, J. (2011). Improving students' web use and information literacy: A guide for teachers and teacher librarians. London: Facet.

Hilbert, M., 2011). Digital gender divide or technologically empowered women in developing countries? A typical case of lies, damned lies, and statistics. In *Women's Studies International Forum* (Vol. 34, No. 6, pp. 479-489). Pergamon.

Hill, R., Betts, L.R. and Gardner, S.E. (2015). Older adults' experiences and perceptions of digital technology:(Dis) empowerment, wellbeing, and inclusion. *Computers in Human Behavior*, *48*, pp.415-423.

Hinds, D. (2019). Realising the potential of technology in education: A strategy for education providers and the tehnology industry.

Hillrich, R. (1976), Towards an acceptable definition of literacy, English Journal, 65, 50-55.

Hinrichsen, J., & Coombs, A. (2013). The five resources of critical digital literacy: a framework for curriculum integration. *Research in Learning Technology*, *21*.

Hobbs, R. (2010). Digital and media literacy: A plan of action. A white paper on the digital and media literacy recommendations of the knight commission on the information needs of communities in a democracy. The Aspen Institute.

Horn, I. S., & Campbell, S. S. (2015). Developing pedagogical judgment in novice teachers: Mediated field experience as a pedagogy for teacher education. *Pedagogies: An International Journal*, *10*(2), 149-176.

Huber, E., & Shalavin, C. A. (2018). Surveying the digital literacy landscape for academic and professional staff in higher education.

Hutchison, A. C., Woodward, L., & Colwell, J. (2016). What are pre-adolescent readers doing online? An examination of upper elementary students' reading, writing, and communication in digital spaces. Reading Research Quarterly, 51(4), pp. 435– 454

ICF International (Firm), 2015. *Literature review on the impact of digital technology on learning and teaching*. Social Research.

Instefjord, E., Munthe, E. (2017) Educating digitally competent teachers: A study of integration of professional digital competence in teacher Education. *Teacher and Teaching Education.* 67 pp. 37-45c

Isobe, M. and Yamazaki, S., (2004). Evaluation Criteria for" Developing, Planning and Communicating ideas" for'Design and Technology'in the Revised National Curriculum of 1999 in England. *International Journal of Curriculum Development and Practice*, *6*(1), pp.1-7.

Ito, M (2009). Media literacy and social action in a post-Pokemon world. A keynote address for the 51st NFAIS Annual Conference. Available at: www.itofi sher.com/mito/publications/media_literacy.html (date accessed: 11.3.2019)

JISC. (2014). Developing digital literacies. Available at: https://www.jisc.ac.uk/full-guide/developing-digital-literacies. (Date accessed: 11.5.2019)

JISC. (2015). Digital Capabilities Framework. Available at: https://repository.jisc.ac.uk/6611/1/JFL0066F_DIGIGAP_MOD_IND_FRAME.PDF. (Date accessed: 11.5.2019)

JPodcaster. (2012). Making Sense of the 8 Elements of Digital Literacy. *Professionalism in the Digital Environment.* Available at: https://digilitpride.wordpress.com/2012/10/01/making-sense-of-the-8-elements-of-digital-literacy/. (Date accessed: 15.3.2022)

Kearsley, G., Lynch, B. (1992). Educational Leadership in the Age of Technology: the new Skills, Journal of Research on Computing in Education, 25 (1),50–61.

Kelentrić, M., Helland, K., & Arstorp, A. T. (2017). Professional digital competence framework for teachers. *The Norwegian Centre for ICT in education*, 1-74.

Kimmel, L., & Kestenbaum, J. (2014). What's up with WhatsApp: a transatlantic view on privacy and merger enforcement in digital markets. *Antitrust*, *29*, 48.

Klebansky, A., & Fraser, S. P. (2013). A strategic approach to curriculum design for information literacy in teacher education-implementing an information literacy conceptual framework. *Australian Journal of Teacher Education (Online)*, *38*(11), 103-125
Kirschner, P. A. (2015). Do we need teachers as designers of technology enhanced learning? Instructional Science, 43(2), 309–322

Korthagen, F.A., 2010. How teacher education can make a difference. *Journal of education for teaching*, *36*(4), pp.407-423.

Kitsantas, A., & Dabbagh, N. (2011). The role of Web 2.0 technologies in self-regulated learning. *New directions for teaching and learning*, *2011*(126), 99-106.

Kurt, S. (2019). TPAK: Technological Pedagogical Content Knowledge Framweork. *Educational Technology.* Available at: https://educationaltechnology.net/technological-pedagogical-content-knowledge-tpack-framework/. (Date accessed: 11.3.2020)

Kuusimäki, A. M., Uusitalo-Malmivaara, L., & Tirri, K. (2019). Parents' and teachers' views on digital communication in Finland. *Education Research International*, *2019*.

Kvernbekk, T. (2012). Argumentation in theory and practice: Gap or equilibrium?. *Informal logic*, *32*(3), pp.288-305.

La Caze, S. (2017). Changing classroom practice through blogs and vlogs. *Literacy Learning: The Middle Years*, *25*(1), 16-27.

Lanham, R. (1995). Digital literacy. *Scientific American*, 273(3). pp. 198-200

Lankshear, C., & Knobel, M. (2003). *New literacies: Changing knowledge and classroom learning*. Open University Press.

ankshear, C., & Knobel, M. (2005) E-Learning and Digital Media Editorial. *E-Learning. 2(2).*

Lankshear, C. & Knobel, M. (Ed.) (2008). *Digital literacies: Concepts, policies and practices.* New York: Peter Lang Publishing Inc.

Larke, L.R. (2019). Agentic neglect: Teachers as gatekeepers of England's national computing curriculum. *British Journal of Educational Technology*, *50*(3), pp.1137-1150.

Latham, D., Gross, M. and Witte, S. (2013) Preparing teachers and librarians to collaborate to teach 21st century skills: The views of LIS and Education faculty. School Libraries Research, 16, pp. 1-23.

Lawless, K. A., & Pellegrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. Review of Educational Research, 77(4), 575–614

Legislation.gv.uk. (1999(. *The New Opportunities Fund (Specification of Initiatives) Order1999.* Available at: https://www.legislation.gov.uk/uksi/1999/966/contents/made. (Date accessed: 11.7.2021)

Legislation.gov.uk. (2012 and 2016), The School Publications (England) (Amendments) Regulations, Available at: https://www.legislation.gov.uk/uksi/2016/451/introduction/made. (Date accessed: 31.3.2010).

Lengsfeld, J.H. (2011). An econometric analysis of the sociodemographic topology of the digital divide in Europe. *The information society*, *27*(3), pp.141-157.

Lempert-Shepell, E. (1995). Teacher self-identification in culture from Vygotsky's developmental perspective. Anthropology and Education Quarterly, 26, 425-442.

Lin, H. & Lee, G. (2006). Determinants of success for online communities: an empirical study. Behavior and Information Technology, 25(6), 479-488. Littlejohn, A., Beetham, H. & McGill

Lohnes, S., & Kinzer, C. (2007). Questioning assumptions about students' expectations for technology in college classrooms. *Innovate: Journal of Online Education*, *3*(5)

Loos, E., Nimrod, G., & Fernández-Ardèvol, M. (2018). Older audiences in the digital media environment: A cross-national longitudinal study.

Madden, M., Smith, A. W., & Vitak, J. (2007). Digital footprints: Online identity management and search in the age of transparency.

McGarry, K. (1993), The changing context of information (2nd edn.), Library Association Publishing, London.

McKeever, M. (2017). Educational inequality in apartheid South Africa. *American Behavioral Scientist*, *61*(1), 114-131.

Melhuish, K., & Falloon, G. (2010). Looking to the future: M-learning with the iPad

Merchant, G. (2007). Writing the future in the digital age. *Literacy*, *41*(3), 118-128.

Mercuri, S. & Ramos, L. (2014). Technology-based biliteracy centers for the 21st century learner. GIST Education and Learning Research Journal, 9. 196-216

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for integrating technology in teachers' knowledge. Teachers College Record, 108 (6), 1017–1054

Molnar, A.R., (1979). The next great crisis in American education: Computer literacy. *Journal of Educational Technology Systems*, *7*(3), pp.275-285.

Moore, P. (2002). An analysis of information literacy education worldwide. White Paper prepared for UNESCO, the U.S. National Commission on Libraries and Information Science, and the National Forum on Information Literacy, for use at the Information Literacy Meeting of Experts, Prague, The Czech Republic.

Moreira, M.A., OECD (2015): Students, Computers and Learning: Making the Connection. PISA, OECD Publishing. *HUMANIDADES DIGITALES*, p.18

Morris, K. (2019) . Teaching Digital Citizenship: 10 Internet Safety Tips For Students (With Posters). *Helping Teachers create digitally literate global learners*: Primary Tech.

Nagle, J. (2018). Twitter, cyber-violence, and the need for a critical social media literacy in teacher education: A review of the literature. *Teaching and Teacher Education*, *76*, 86-94.

Nascimbeni, F. and Vosloo, S. (2019). Digital literacy for children: Exploring definitions and frameworks. *Scoping Paper, 1*. Available at: https://www.researchgate.net/profile/Fabio-Nascimbeni-2/publication/344751370_Digital_literacy_for_children_exploring_definitions_and_frameworks/links/5f8db53d458515b7cf8bb18e/Digital-literacy-for-children-exploring-definitions-and-frameworks.pdf. (Date accessed: 11.3.2020)
National Literacy Trust. (2018). Fake news and critical literacy: The final report of the Commission on Fake News and the Teaching of Critical Literacy in Schools. Available at: https://literacytrust.org.uk/research-services/research-reports/fake-news-and-critical-literacy-final-report/. (Date accessed: 11.9.2020)

Nwankwo, M. C., Achufusi-Aka, N. N., & Eke, J. A. (2022). Chapter Nine Covid-19 Impact on Mode of Teaching and Learning Science Education in Nigeria. *Attaining Sustainable Development Goals in Families, Companies and Communities*, 111.

ohmygoodnessgracious.com. (2013). A broken invisibility cloak. *ohmygoodnessgracious.com.* Available at: http://www.ohmygoodnessgracious.com/2013/01/24/a-broken-invisibility-cloak/. (Date accessed: 1.4.21).

Oblinger. Diana. E. D. U. C. A. U. S. E., Oblinger, J., Roberts, G., McNeely, B., Windham, C., Hartman, J., ... & Kvavik, R. (2005). *Educating the net generation* (Vol. 272). Brockport Bookshelf, Book.

Oliviera, J. (2014). Students' and teachers' attitudes and views on employing the use of iPads in science lessons (MPhil Dissertation). Faculty of Education, University of Cambridge.

The Open University, (2019). Digital and Information Literacies. Found in *Education and Development.* Available at: https://www.open.edu/openlearn/mod/oucontent/view.php?id=64085&section=1. (Date accessed: 11.5.21).

Osborne, J., & Hennessy, S. (2003). Literature Review in Science Education and the Role of ICT: Promise. *Problems and Future Directions, Bristol: United Kingdom*
Page, T., & Thorsteinsson, G. (2017). The Impact of Conventional School Education on Students Creativity. *Journal on School Educational Technology*, *13*(1), 12-20.

Pavlenko, G.V. and Pavlenko, A.I. (2020). Digital Literacy as a Condition for Positive Experience of the COVID-19 Lockdown for Families With Preschool Children. In *Research Technologies of Pandemic Coronavirus Impact (RTCOV 2020)* (pp. 507-512). Atlantis Press.

Pedró, F. (2009, September). New millennium learners in higher education: Evidence and policy implications. In *International Conference on 21st Century Competencies, Brussels: OECD/CERI*.

Pilgrim, J., Vasinda, S., Bledsoe, C., & Martinez, E. (2019). Critical thinking is critical: Octopuses, online sources, and reliabil-ity reasoning. The Reading Teacher, 73(1), pp. 85– 93

Pivetta, E., Harkin, L., Billieux, J., Kanjo, E., & Kuss, D. J. (2019). Problematic smartphone use: An empirically validated model. *Computers in Human Behavior*, *100*, 105-117.

Plichta, P., (2017). Socialization and education of children and adolescents with intellectual disabilities in the digital age. (Translated from Polish). Toruń: Wydawnictwo Adam Marszałek (2017).

Pollard, A. (2010). Professionalism and pedagogy: A contemporary opportunity: A commentary by the Teaching and Learning Research Programme and the General Teaching Council for England.

Polizzi, G. (2020). Digital literacy and the national curriculum for England: Learning from how the experts engage with and evaluate online content. *Computers & Education*, *152*, p.103859.

Postholm, M.B. (2008). Teachers developing practice: Reflection as key activity. Teaching and Teacher Education 24, no. 7: 1717–28.

Potyrała, K. and Tomczyk, Ł. (2021). Teachers in the lifelong learning process: examples of digital literacy. Journal of Education for Teaching, 47(2), pp.255-273.

Pramling Samuelsson, I. and Johansson, E., (2006). Play and learning—inseparable dimensions in preschool practice. *Early child development and care*, *176*(1), pp.47-65.

Prensky, M. (2001). Digital Natives, Digital Immigrants. On the Horizon, 9(5): 1–6.

Raisingchildren.net.org, (date unknown). Digital citizenship: teens being responsible. *Raisingchildren.net.org*, Available at: https://raisingchildren.net.au/pre-teens/entertainment-technology/digital-life/digital-citizenship. (Date accessed: 1.4.21).

Ribble, M.S., Bailey, G.D. and Ross, T.W., (2004). Digital citizenship: Addressing appropriate technology behavior. *Learning & Leading with technology*, *32*(1), p.6.

Rodríguez-García, A. M., Moreno-Guerrero, A. J., & Lopez Belmonte, J. (2020). Nomophobia: An individual's growing fear of being without a smartphone—a systematic literature review. *International Journal of Environmental Research and Public Health*, *17*(2), 580.
Rubin, M. J. (2013, March). The effectiveness of live-coding to teach introductory programming. In *Proceeding of the 44th ACM technical symposium on Computer science education* (pp. 651-656).

Ruthven, I., & Lalmas, M. (2003). A survey on the use of relevance feedback for information access systems. *The Knowledge Engineering Review*, *18*(2), 95-145.

Sá, M.J. and Serpa, S. (2020.) The COVID-19 pandemic as an opportunity to foster the sustainable development of teaching in higher education. *Sustainability*, *12*(20), p.8525.

Sabra, J. B. (2017). "I hate when they do that!" Netiquette in mourning and memorialization among Danish Facebook users. *Journal of Broadcasting & Electronic Media*, *61*(1), 24-40.

SALLY. (2015) Digital Literacy has 8 Essential Elements. *Finding Heroes.* Available at: https://findingheroes.co.nz/2015/06/11/digital-literacy-has-8-essential-elements/. (Date accessed: 11.2.2022)

Sánchez-Cruzado, C., Santiago Campión, R. and Sánchez-Compaña, M., 2021. Teacher digital literacy: The indisputable challenge after COVID-19. Sustainability, 13(4), p.1858.

Sandercock, P. (2016) Instructor perceptions of student information literacy: comparing IL models to reality. Journal of Information Literacy, 10(1), pp. 3-29.

Savage, M. (2015) *Digital literacy for Primary Teachers*. Norwich: Critical Publishing

Sawmiller, A. (2010). Classroom blogging: What is the role in science learning?. *The Clearing House*, *83*(2), pp.44-48.

Scottish government. (2015). Literature Review of the Impact of Digital Technology on Learning and Teaching. Available at: https://www.gov.scot/publications/literature-review-impact-digital-technology-learning-teaching/. (Date accessed: 22.7.2020).

Selwyn, N. (2009). The digital native–myth and reality. *Aslib Proceedings* 61(4), pp. 364-379.

Selwyn, N. (2010). *Schools and schooling in the digital age: A critical analysis*. Routledge.

Selwyn, N. (2012). Making sense of young people, education and digital technology: The role of sociological theory. *Oxford Review of Education*, 38(1), 81-96.

Selwyn, N. (2013). *Distrusting educational technology: Critical questions for changing times*. Routledge.

Shannon, C., Reilly, J. and Bates, J. (2019). Teachers and information literacy: understandings and perceptions of the concept. *Journal of information literacy*, *13*(2), pp.41-72.

Sharma, Ravi, Arul-Raj Fantin, Navin Prabhu, Chong Guan, and Ambica Dattakumar. (2016). Digital Literacy and Knowledge Societies: A Grounded Theory Investigation of Sustainable Development. Telecommunications Policy 40 (7): 628–43. doi:10.1016/j.telpol.2016.05.003

Sharp, E. A., Norman, M. K., Spagnoletti, C. L., & Miller, B. G. (2021). Optimizing synchronous online teaching sessions: a guide to the "new normal" in medical education. *Academic pediatrics*, *21*(1), 11-15.

Sheikh A. & Siti H. (2016). Transforming science teaching environment for the 21st century primary school pupils. Malaysian Online Journal of Educational Technology, 4(4). 68-76

Skutil, M , Maněnová, M , Wolf, J , Vítová, J . (2021). Analyzing the factors influencing the primary school students' digital literacy skills during covid-19 period. International Journal of Quality in Education (5): 1-13.

Soler Costa, R., Mauri Medrano, M., Lafarga Ostáriz, P., & Moreno-Guerrero, A. J. (2020). How to teach pre-service teachers to make a didactic program? The collaborative learning associated with mobile devices. *Sustainability*, *12*(9), 3755.

Soler-Costa, R., Lafarga-Ostáriz, P., Mauri-Medrano, M., & Moreno-Guerrero, A. J. (2021). Netiquette: ethic, education, and behavior on Internet—a systematic literature review. *International journal of environmental research and public health*, *18*(3), 1212.

Sparks, J.R., Katz, I.R. and Beile, P.M. (2016). Assessing digital information literacy in higher education: A review of existing frameworks and assessments with recommendations for next-generation assessment. *ETS Research Report Series*, *2016*(2), pp.1-33.

Spengler, S. S. (2015). *Educators' perceptions of a 21 st century digital literacy framework* (Doctoral dissertation, Walden University).

Street, B. (1995) Social Literacies Longman: London

Street, B. (2003). What's "new" in New Literacy Studies? Critical approaches to literacy in theory and practice. *Current issues in comparative education*, *5*(2), pp.77-91.

Tapscott, D. (1998) Growing Up Digital: The Rise of the Net Generation. New York: McGraw Hill.

Tejedor, S., Cervi, L., Pérez-Escoda, A. and Jumbo, F.T. (2020). Digital literacy and higher education during COVID-19 lockdown: Spain, Italy, and Ecuador. *Publications*, *8*(4), p.48.

Teruggi L.A.& Zuccoli F. (2015). The status of twenty-first century skills within the University of Milan- Bicocca's degree programme in primary education. EPedagogium, 2. 75- 87.

Tomczyk, Ł. (2019). Digital literacy in the area of e-safety among teachers (second stage of the primary school) in Poland. In *Conference proceedings of» eLearning and Software for Education «(eLSE)* (Vol. 15, No. 02, pp. 130-135). Carol I National Defence University Publishing House.

Tomte, C., Enochsson, A. B., Buskqvist, U., & Kårstein, A. (2015). Educating online student teachers to master professional digital competence: The TPACK-framework goes online. *Computers & Education, 84*, 26-35.

Torgerson, C. J., & Zhu, D. (2004). Evidence for the effectiveness of ICT on literacy learning. *The impact of ICT on literacy education*, *99*, 34-68.
Twining, P., 2013. PeterT's bliki. EdFutures.

Tzifopoulos, M. (2020). In the shadow of Coronavirus: Distance education and digital literacy skills in Greece. International Journal of Social Science and Technology, 5(2), pp. 1-4, 5(2). Available at: https://www.researchgate.net/profile/Menelaos_Tzifopoulos/publication/341358736_Tzifopoulos_M_2020_In_the_shadow_of_Coronavirus_Distance_education_and_digital_literacy_skills_in_Greece_International_Journal_of_Social_Science_and_Technology_52_1-14/links/5ebc533e458515626ca7e3f5/Tzifopoulos-M-2020-In-the-shadow-of-Coronavirus-Distance-education-and-digital-literacy-skills-in-Greece-International-Journal-of-Social-Science-and-Technology-52-1-14.pdf. (Date accessed: 4.9.2020)

UK Parliament Post. (2021) Post Note 643: Developing essential digital skills. Available at: https://researchbriefings.files.parliament.uk/documents/POST-PN-0643/POST-PN-0643.pdf. (Date accessed: 12.10.2021)

UNESCO (2018b). Global Education Monitoring Report: Migration, displacement and education, building bridges, not walls. Paris: UNESCO. Available at: https://www.unicef.org/globalinsight/media/1271/file/%20UNICEF-Global-Insight-digital-literacy-scoping-paper-2020.pdf. (Date accessed: 23.11.2022).

UNICEF. (2019). Digital Literacy for Children: exploring definitions and frameworks. *UNICEF OFFICE OF Global Insight and Policy.* Available at: https://www.unicef.org/globalinsight/media/1271/file/%20UNICEF-Global-Insight-digital-literacy-scoping-paper-2020.pdf. (Dare accessed: 23.11.2022).

University of Queensland Library. (2022). Communicate and Collaborate online. *University of Queensland Library*. Available at: https://web.library.uq.edu.au/research-tools-techniques/digital-essentials/communicate-online. (Date accessed: 21,4.2021).

Van Dijk, C. N., Van Witteloostuijn, M., Vasić, N., Avrutin, S., & Blom, E. (2016). The influence of texting language on grammar and executive functions in primary school children. *PloS one*, *11*(3), e0152409.

Viner K. 2016. How technology disrupted the truth. The Guardian, 12th July, pp.25-27.

Vygotsky, L.S. (1978). Mind in society. The development of higher psychological processes. Cambridge, MA: Harvard University Press.

Von Gillern, S., Gleason, B. and Hutchison, A. (2022.) Digital citizenship, media literacy, and the ACTS Framework. *The reading teacher*, *76*(2), pp.145-158

Wagner, T. (2008). Rigor redefined. Educational Leadership, 66(2). 20-25.

Warford, M.K. (2011). The zone of proximal teacher education. Teaching and Teacher Education 27, no. 2: 252–8.

Webwise.ie. (unknown). Digital Literacy Skills: Cultural and Social Understanding. *Advice for Teachers.* Available at: https://www.webwise.ie/teachers/advice-teachers/digital-literacy-cultural-social-understanding/ . (Date accessed: 22.12.2021).

Williams, D. & Coles, L. (2007). Evidence-based practice in teaching: An information perspective. Journal of Documentation, 63 (6), pp.812-835

Zhao, Y., Llorente, A.M.P. and Gómez, M.C.S., (2021). Digital competence in higher education research: A systematic literature review. Computers & Education, p.104212).

Zhou, L., Wu, S., Zhou, M., & Li, F. (2020). 'School's out, but class' on', the largest online education in the world today: Taking China's practical exploration during The COVID-19 epidemic prevention and control as an example. *Best evid chin edu*, *4*(2), 501-519.

Zimmerman, B.J. 2001. Theories of self-regulated learning and academic achievement. *In Self regulated learning and academic achievement: Theory, research, and practice,* ed. B.J. Zimmerman and D. Schunk, 1–25. New York: Springer-Verlag.

Zimmerman, B.J. 2006. Development and adaption of expertise: The role of self-regulatory processes and beliefs. In *The Cambridge handbook of expertise and expert performance*, ed. K.A. Ericsson, N. Charness, P.J. Feltovich, and R.R. Hoffman, 705–22. Cambridge: Camb

3. Chapter Three: Methodology

3.1 Introduction

Clough and Nutbrown (2012) state that 'any piece of research emerges from a distinct purpose.' The purpose of this research is to generate theory that attempts to investigate, explore and 'expand knowledge' (Bickman, 1981) in digital literacy skills and the needs of Primary School teachers in educational training and Continuous Professional Development (CPD). This theory will then be used to develop and evaluate a digital literacy framework to support student teachers with digital literacy skills in educational interventions and a CPD framework to be used by practising teachers.

Research decisions are based on the notion of 'fitness for purpose' (Cohen, Manion and Morrison, 2011: 73). Following Kuhn's (1970) reports that research does not proceed through immanent laws but through the facilitation of paradigms; a characteristic set of beliefs and perceptions held by a discipline,' the characteristics and perceptions in this research have been determined through data collection techniques. Von Glaserfield (1995: 7) asserts, 'to the constructivist, concepts, models, theories and so on are viable if they prove adequate within the context they were created.' This study has adopted a constructivist approach in an effort to provide 'rich, contextual, specific information at a local level' (Pickard, 2002) from the perspectives of undergraduate student teachers at Northumbria University and participating practising teachers, to be adapted and transferred to other educational interventions and CPD training in both a local and globalised picture.

Initially, the framework was planned to offer training solely to practising teachers. However, the outbreak of coronavirus (2020) in the UK created a chaotic environment for schools and placed new pressures on teachers and their availability. As schools had to prioritise mentoring their own staff and practising teachers were busy struggling with adapting their teaching methods, they were unable to allocate time to participate in these interventions. The need to support and mentor their own staff meant that student teachers were not all able to participate in their assigned placements. This provided an alternative opportunity to deliver the framework to those undergraduate student teachers at Northumbria University who would no longer be able to attend their assigned placements, as they would now be available. It was

decided that delivering this training would be appropriate and beneficial to these students who would require more-advanced digital literacy skills and understanding prior to entering the workforce. Cook (1993) suggests that 'planning is an iterative process, and that replanning is sometimes called for as real-world event force deviations from the original plan.'

This chapter presents the research design excursion and discusses reasoning for the choices made.

3.2 Theoretical Assumptions

Theory is extremely important to the foundations of a research study as it "allows persons to gather information, give meaning, and make sense of what is happening around them" (Corbin and Strauss, 2015). Using this foundation, a researcher can form a methodology; constructing a plan of action to solve problems and reach their desired goals. As theories evolve a researcher is able to build on them to adapt their own perspectives and plans. "Theoretical knowledge is relevant to time and place and must be updated to keep pace with change over time" (Corbin and Strauss, 2015) and as newer theories emerge influenced by actions and the interactions of subjects and multiple perspectives, events can be explained and can give insight into problematic situations which leads to reflective inquiry: " the test of ideas, of thinking generally, is found in the consequences of the acts which the ideas lead, that is in the new arrangement of things which is brought into existence" (Dewey, 1929). In their reading of relevant literature, the researcher was influenced by other worldviews and was able to determine gaps in research to be explored through the development of ideas, actions, and interactions.

Qualitative research is guided by "educational training and relative literature, advice dispensed from research advisors and through the scholarly communities we engage with," (Creswell, 2016) all of which contribute to theoretical assumptions that begin a research design process. In this study, the conduct and writing of the study were informed by the researcher's previous experience as a teacher, their worldviews, paradigms and sets of beliefs (Creswell, 2007) and therefore these assumptions were used as a background to help to determine research design and questions and the interpretation of the research data.

The theoretical research framework is illustrated through a research paradigm (Kuhn, 1996). "A research paradigm reflects the researcher's beliefs on the world they live in and the world they want to live in […] how they view, interpret and act in that world" (Lather, 1986). In the context of research, a paradigm 'has significant implications for every decision made in the research process, including choice of methodology and methods' (Kivunja, 2017). It is a set of ontological and epistemological questions which will define the focus of the study and how it can be understood (Hammersley, 2012). In the nature of inquiry, three main questions must be considered:

1. The ontological question: what is the nature of reality?
2. The epistemological question: how do we know something?
3. The methodological question: how do we go about discovering knowledge?

(Guba, 1990)

'These questions unearth how we view knowledge, how we see ourselves in relation to that knowledge, and the methods we employ to discover it' (Atkins, 2018). This study is influenced by the constructivist paradigm (Lincoln & Guba, 1986) as it aligns with the researcher's own understandings of the world and knowledge. It was an appropriate paradigm as the study intended to give a voice to the participants (student and practising teachers) to develop and understand their digital literacy needs.

3.3 Constructivist Inquiry

"In a fairly unremarkable sense, we are all constructivists if we believe that the mind is active in the construction of knowledge."

(Schwandt, 1998).

"To ensure a strong research design, researchers must choose a research paradigm that is congruent with their beliefs about the nature of reality" (Mills, Bonner and Francis, 2006). This study followed a constructivist paradigm aligned with the belief that "to understand the world of meaning we must interpret it through clarification of what and how meanings are embodied in the language and actions of social actors" (Schwandt, 1994).

The constructivist perception assumes complex behaviours and that the 'subjects' being studied must at a minimum be considered knowing beings, and that the knowledge they possess has important consequences for how behaviour or actions are interpreted' (Magoon, 1977). In this case, the 'knowing beings' were both the student and the practising teachers, whose knowledge has influenced the design of this framework. As the practising teachers had more experience in this field, it appeared that they were able to impart more knowledge concerning gaps and needs earlier in the design. Constructivists view researchers as craftsmen, as toolmakers (Spivey, 1995. p, 314) who are part of a network that creates knowledge (Osborne, 1996)) and ultimately guides practice. The claim is made that a significant part of the context of behaviour that educational researchers observe is a structure produced by the constructions of the observed subject. The dynamic focus, in contrast, proposes that educational researchers examine acts of construction as they occur in schools (Note 1; Robinson, 1974 in Mehan, Cazden, Coles, Fisher, & Maroules).

This study allowed the researcher to converse and participate rather than be mere "information processors or reactor" (Mir and Watson, 2000). In simply observing and reporting findings, they play a role in the process and generate knowledge and strategy through a series of rule-based conversations. The data collected from this action research aligns with the premise that the researcher always approaches a problem with a preconceived notion (a default theory) about the nature of the problem, in this case a lacking in the training of digital literacy skills, and by implication will provide suggestions for possible solutions (Fosnot, 1996). The use of action research allowed for the initial 'sculpting' (Mir and Watson, 2000) of the problem and solutions to become more specifically defined. "Man comes to know the world by actively constructing it" (Kant, 1949).

Chronbach (1975) proposes that the constructivist approach to research should reverse the traditional priorities placed on building generalisations about the effects of variables and give careful attention to particular cases first. This research began with data collection from a sample selection of thirty-three practising primary school teachers in North-East England where digital literacy needs were identified and a framework to support these needs was designed. The first phase gathered empirical data, placing the researcher in the field to gather an understanding of perceptions of digital literacy and needs of teachers. With previous experience as a primary school teacher, putting the researcher on a plane of understanding, almost a psychological closeness (Geertz, 1983), as those they were researching. "A major

advantage of constructivist inquiry is that it can offer understandings of the meanings of individuals" (Pickard, 2002). "From this perspective, meaning depends upon the context, and the interpretation of action or opinion must take account of the setting in which it is produced' (Dey, 1993 p.110). The researcher's specialist experience made it easier to "use information strategically in three areas: to make sense of change in its environment; to create new knowledge for innovation; and to make decisions about courses of action" (Choo, 1996).

The constructivist approach to research is based on understanding human experiences (Cohen and Manion, 1994) which the researcher aimed to achieve through the interaction with the participants in the interviews. The initial plan had been to conduct one round of interviews to assess practising teachers' knowledge, understanding and experiences with DL but COVID-19 and remote learning changed DL in an educational context. A further two rounds of interviews were conducted to assess the development of DL skills as technology became more prominent in education. In alignment with a constructivist conceptualisation of knowledge, the researcher relied on the participants' views on this study, that is the importance of supporting teachers with DL in the classroom: "a researcher must rely upon the "participants' views of the situation study" (Creswell, 2003). Further rounds of interviews were conducted to assess whether participants' views were changing during this time and to validate if their DL needs had changed.

The constructivist approach operationalises an important tenet: the "social negotiation of meaning" (Mojtahed, 2014) in creating moments of discussion and developing understanding between the researcher and participant at the moment of data collection " (Mojtahed, 2014). The interviews were a method of assessment to help the researcher gain a deep understanding of the current DL needs of practising primary school teachers and would validate the significance of a training curriculum framework. This validation was then used to influence the design of the framework.

This research adopts a qualitative methodology, within the interpretivist paradigm, applying constructivist inquiry. The researcher will follow the interpretivist procedure of watching, listening, asking, recording and examining to determine whether the outcome is useful and worthy of adoption.

3.4 Research Model

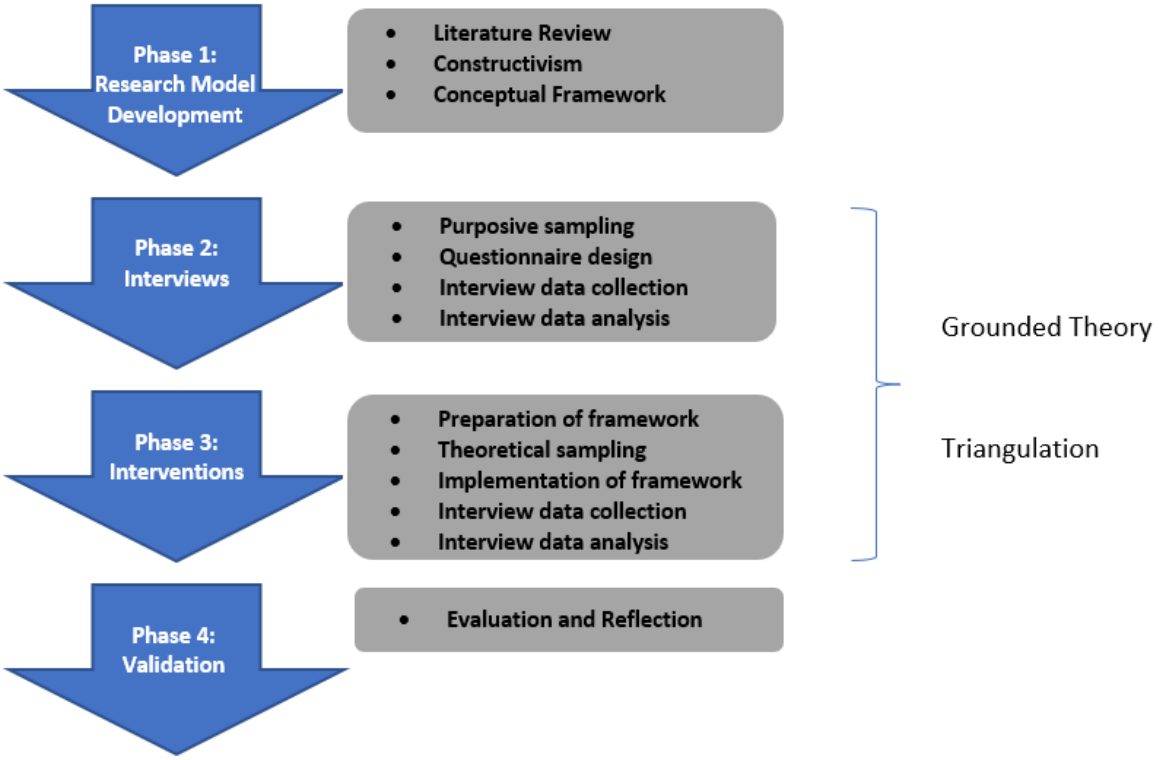


Figure 3.1 *Structure of the research project*

The research comprises of four stages, each utilising different methods. Phase 1 began in defining the analysis through a systematic review of literature and designing a conceptual framework. The focus of this work was to use the literature to influence the foundations of the framework and to use the information to establish questions to be used in the interviews.

Phase 2 of the research consisted of three rounds of interviews (prior to, during and after the first round of lockdown COVID-19) conducted with a sample of thirty-three practising primary school teachers based in North-East England. Each questionnaire influenced by the data gathered in Phase 1.

Phase 3 of the research focused on the implementation of the framework to thirty-five Primary Education Bachelors' (BA) students from Northumbria University and the feedback gathered from the interventions, influenced by the findings in Phase 2.

Phase 4 of the research involved evaluating the findings from the feedback given by the participating students in Phase 3 to conclude the impact of the training curriculum framework.

Figure 3.1 on the previous page shows the structure of the entire research project.

3.4.1 Study Design

Creswell (1998) suggests that "the best studies have a strong inquiry procedure" (p. 27.) In having a process of collecting and interpreting data with clear objectives enables the researcher to formulate a strategy on how to answer the research question in a timely and efficient manner (Li, et al., 2009). "After identifying the research topic and formulating questions, selecting the appropriate design is perhaps the most important decision a researcher makes" (Abutabenjeh and Jaradat, 2018). As "research design is a messy, iterative process and often involves considering multiple factors simultaneously and constant adjusting and revising of components" (Guest, 2013), the researcher adapted Guest's (2013) model, establishing the steps shown in the table below:

Step		Option for this study
1	Determine study's primary purpose	To understand the current state of teachers' digital literacy skills To build knowledge/ theory in this area To develop an intervention training framework
2	Determine study's primary audience	Educators (practising and student teachers, school Senior Leadership Teams) Scholars Researchers Academicians
3	Determine the study's population and geographic parameters	**Number of sites:** practising teachers' individual areas in North-East England and Northumbria's student portal (Blackboard collaborate) **Study population(s) boundaries:** 33 practising

		teachers based in North-East England and 40 undergraduate student teachers from Northumbria University **Elicitability criteria:** 1. carrying out ethical research 2. identifying importance of the research 3. clarity and coherence of the research report 4. use of appropriate and rigorous methods 5. importance of reflexivity or attending to researcher bias 6. importance of establishing validity or credibility 7. importance of verification or reliability.
4	Decide if and what comparative elements to include	**Between groups comparison**: practising teachers vs student teachers **Within groups comparison:** comparison of: individual practising teachers' answers and feedback Student teachers' individual answers and feedback
5	Determine temporal orientation of design	Longitudinal study
6	choose your research objective verb(s)	Identify, explore, describe, explain, evaluate, other
7	Choose your qualitative approaches	Grounded theory
8	Select attributes of human experience to examine (for EACH population in you study)	Behaviour attitudes/opinions/perceptions values and emotions knowledge

		culturally shared meaning social structure and relationships processes and systems environmental context
9	Select data collection methods	participant observation in depth interviews feedback forms fieldnotes and memos document analysis
10	Determine if/how additional activities/procedures will inform study	listing categorising timelines drawing/mapping post-event reflection
11	**Establish sampling procedures**	*determine sampling flexibility*: inductive vs a prior sampling, *determine sampling strategies:* census, purposive, quota, convenience, sample random, systematic, othet *determine/estimate sample size(s)*
12	**Determine recruitment method(s)** in each population and data collection method in your study)	investigator initiated (contact with previous colleagues and snowballing effect) socially based (approached colleagues at conferences)
13	**Time and resource constraints**	consider what, if any, the scheduling expectations are for the study (3 years, stages shown in research proposal) know what your budget's bottom line is balance the research scope with the time and budget parameters (3 years) manage Funder (Northumbria University) expectations as

		required
14	**Review, revise, repeat**	include participants, collaborators, Northumbria University, and colleagues in review process

Table 3.1 *Research design steps*

3.4.2 Action Research

The goal of using a qualitative method for data collection is to develop an understanding, explain multiple realities and capture naturally occurring behaviours in the environment being studied (Harrison et al., 2017).'Qualitative research has established it's own place in research on teaching and teaching standards' (Silverman, 1997) and the reliability and validity of qualitative research in this study was done in the context of a study about teacher's current knowledge and practicality relating to digital literacy.

This study adopted an Action Research method approach. In the context of this research, "action research supports practitioners in seeking out ways in which they can provide an enhanced equality" (Kashy 2010) of education. This research method was appropriate as it is suited to improving digital literacy education and training provision for teachers: "Action research is a community-based study and cooperative enquiry used for improving conditions and practices" (Lingard, et al, 2008), supported by Koshy (2010) who suggests it "is a method used for improving practice. It involves action, evaluation, and critical reflection and based on the evidence gathered changes in practice are then implemented." Parkin (2009) maintains that the purpose of undertaking action research is to bring about change in specific contexts.

Action research was the most suitable method as "it is suited to practitioners who seek to improve practice by development and practice, this method enables change" (Pickard, 2013) and "it integrates theory, practice and meaningful applications of research results" (Bolander Laksov, 2018). For teachers, action research can "encourage change in practice, empower individuals through collaboration with one another, encourages teacher reflection and examines new methods and ideas" (Kappalumakkel, 2008). This research sought to seek discovery of the digital literacy needs of primary school teachers in a bid to increase confidence and improve digital literacy skills through the creation of a digital

literacy framework. The data sources (student teachers, practising teachers and course leaders) identified their training needs and part reviewed and reflected the interventions, to allow for the development and improvement of the framework.

In recent years, action research has become increasingly popular as a method of teacher professional development and as an approach to gaining new, practice-based, knowledge (Cochran-Smith & Lytle, 1999). This methodology aimed to empower those at the centre of this research (practising and student teachers) and enable them to have a voice in decisions about their own CPD. It also provided information about the reality of what happens when practising teachers are engaged in research and allowed for the researcher to become an active participant in the collaborative process (Stringer, 1999).

Research suggests that Teacher Training Colleges and Primary Schools are not providing enough and adequate digital literacy training for primary school teachers in England (Bingimlas 2009; Polizzi, 2020; Sánchez-Cruzado, et. al, 2021). To inform the development of an appropriate framework, thirty-three practising teachers of different ages, genders, experience, teaching year group and views were interviewed to gain an understanding of their perceptions and training and experience of digital literacy skills. This data identified gaps in knowledge, understanding and training in these skills, providing a foundation for the framework design. The framework was then delivered to a cohort of third-year Primary Education (BA) students at Northumbria University.

The action research cycle is characterised by examining the current process of the data collected, identifying necessary changes, taking action to improving these processes and then analysing the changes that have been made. This applied research strives ‘strives to improve our understanding of a problem, with the intent of contributing to the solution of the problem’ (Bickman & Rog, 2009).

Figure 3.1 *Action Research Cycle (Mertler, 2017)*

The action research cycle for this research:

Reflect	Plan	Act	Evaluate
• Review relevant literature. • Collect information from teachers about their current understanding of digital literacy. • Question teachers about their feelings about their digital literacy training needs.	• Review relevant literature. • Define research objectives. • Ethical requirements. • Quality assurance/ control requirements. • Identify and approach participants. • Establish interview questions. • Establish data sources and resources required. • Develop curriculum framework.	• Review relevant literature. • Models of communication. • Interviews. • Interventions. • Records and Materials.	• Review relevant literature. • Analysis of data. • Reflection theme constructions. • Develop evaluation framework(s). • Problem solving. • Impact of research.

Figure 3.2: *Step by step process of a digital literacy intervention framework for practising teachers (Middleton, 2019).*

3.4.3 Establishing Trustworthiness

"The trustworthiness of research results is one of the cornerstones of qualitative research."

(Slettebø, 2021).

When engaging in qualitative research, researchers use many sources of evidence to increase the validity (or trustworthiness) of the study (Yin, 2014). This study used triangulation to verify recurring themes using multiple data sources: interview transcriptions, observation notes, feedback forms and discussion notes in order to establish authenticity and validity. This research relied upon interviews, observation, and document analysis, each giving "thick description" (Erlandson, et al., 1993) of individual realities.

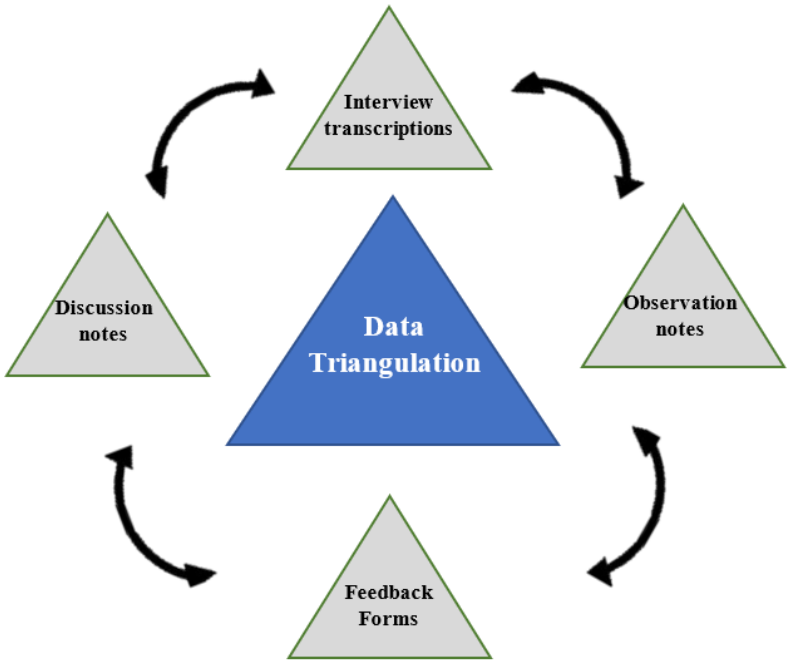


Figure 3.3: *Applying triangulation using multiple data sources to verify themes within research study.*

Figure 3.3 shows that the data sources were compared against each other to determine whether the identified themes were recurring. As a theme was identified, they were narrowed down to those that were more prominent within the data.

This was done to strengthen evidentiary support for the data analysis as it is suggested that triangulation "reduces the risk that your conclusions will reflect only the systematic biases or limitations of a specific collection method" (Maxwell, 2005). Member checking provides a way for the researcher to ensure the accurate portrayal of participant voices by allowing participants the opportunity to confirm or deny the accuracy and interpretations of data, thus adding credibility to the qualitative study (Creswell & Miller, 2000; Lincoln & Guba, 1986; Stake, 1995).

As each source and type of data had both limitations and strengths, (Patton, 1990) the use of multiple approaches to data collection compensated for any limitations of individual approaches (Marshall and Rossman, 1989). Interviews present obvious personal bias that can be attributed to many factors (Pickard, 2002). Observations focus on external behaviour, but this could be distorted by the presence of the observer. There is also weakness in documentation, used as raw data as it may be incomplete or inaccurate and there may be issues with preparation, selection, and improper use of context.

According to Shannon and Hambacher (2014), "methodological rigor in constructivist inquiry is established through assessment of trustworthiness and authenticity." In relation to trustworthiness, positivism establishes a criterion of reliability and validity (Guba, 1981; Guba & Lincoln, 1989; Lincoln & Guba, 1985; Manning, 1987) but authenticity is unique to qualitative inquiry and has no parallel in the positivist paradigm (Manning, 1997; Rodwell, 1998). The researcher ensured her findings were valid through the d

"The constructivist paradigm asserts that perceptions of reality are located in time and place and are constructed by the individual or individuals" (Guba & Lincoln 1989). To ensure genuine understanding of DL in primary schools in NE England (at the time of the study), the researcher engaged in several processes to ensure that the findings were credible, not only from the participants' experiences but also with regard to the larger implications of the research; the impact on primary school teachers' development of DL and the impact on education in England as a whole (Shannon and Hambacher, 2014). Therefore, establishing trustworthiness within is not solely concerned with the topic of study but with "how it has the potential to benefit society" (James, 2008). The researcher identified recurring themes within the interviews to identify the needs of primary school teachers and this data was then used to design and deliver a framework which attempts to benefit practising and student teachers.

Lincoln and Guba (1985) suggest there are five dimensions of authenticity to consider when evaluating a constructivist inquiry:

- fairness,
- ontological authenticity,
- educative authenticity,
- catalytic authenticity, and
- tactical authenticity

(Lincoln and Guba, 1985).

These are described in *Table 3.2* below:

Authenticity principle (Guba and Lincoln, 1989)	Nelson, et al., 2003 cited in (Wilson and Clissett, 2011)	Definition (Guba and Lincoln, 1989)	Definition (Frels and Onwuegbuzie 2012)
Fairness	All viewpoints are represented even-handedly.	The extent to which all competing constructions have been accessed, exposed, and taken into account in the evaluation report, that is, in the negotiated emergent construction.	Researcher's ability to value and to honour the evaluation process.
Ontological Authenticity	Participants understand their situation in more informed ways as a result of participation in the research.	The extent to which individual constructions (including those of the evaluator) have become more informed and sophisticated.	Criteria for assessing an increased level of awareness among participants in the research study.
Educative Authenticity	Participants understand the situations of others in more informed ways as a result of participation in the research.	The extent to which individuals (including those of the evaluator) have become more understanding (even if not more tolerant) of the construction of others.	Extent to which participants understand and appreciate diverse value systems of others.
Catalytic Authenticity	Participants have a greater insight into actions that they might take to change their situation as a result of participation on the research.	The extent to which action (clarifying the focus at issue, moving to eliminate or ameliorate problems, sharpening values) is stimulated and facilitated by the evaluation.	Appreciations and constructions that lead to actions or decisions by the participants.
Tactical Authenticity	Participants feel empowered and enabled to act as a result of participation in the research	The extent to which individuals are empowered to take the action that the evaluation implies or proposes.	Degree of empowerment of participants and stakeholders to act on increased understanding that emerged from the study.

Table 3.2 *Definitions the five dimensions of authenticity (adapted from Guba and Lincoln, 1989)*

Using this constructivist framework, participants were chosen to partake in the interviews and interventions. To ensure authenticity and trustworthiness, the researcher had to ensure that the

participants understood their situation in an informed and sophisticated way (Nolan, et al., 2003). The researcher asked questions that would provide the participants to reflect on their practise, to clarify their experiences and speak of significant issues they were facing or felt they needed to understand more.

The researcher had to consider how to assess the range of viewpoints from all the participants and represent these in a fair manner. This was done by encouraging the participants to have a voice, not only in the one-to-one interviews, but in participating in the intervention activities and peer review notes. Through this, the researcher was able to demonstrate authenticity in showing different perspectives and a depth of understanding that could fairly represent these perspectives. Prolonged engagement through interviews and conversations, persistent observation during the interventions and member checking were critical processes for ensuring fairness (Mays & Pope, 2000; Reason, 1981; Sands, 2004). The student teachers had experience in a school environment in their placements and had formed relationships with their fellow students, colleagues, parents, and children during their placements and therefore students had an understanding of the complexity of the social environment. These relationships were used to determine that the ontological authenticity was credible as the students understood the contextual reality through their experience in a school environment and had formed relationships with others with first-hand experience in an educational environment, such as, fellow students, practising teachers, lecturers and parents and children within schools. The educative authenticity was assessed by determining the extent to which students experienced and increased awareness and respect for the viewpoint of others (Lincoln and Guba, 1985; Manning, 1997; Shannon and Hanbachet, 2014) shown in their group activities, interviews, feedback forms and fieldwork observational notes. In examining whether the research stimulated action, using the framework in educational interventions, post intervention reviews by practising teachers and participants and notes from the reflective journal, there was a measuring of catalytic authenticity. Finally, tactical authenticity was assessed by examining whether a change, to the training in digital literacy skills for teachers, is possible.

3.4.4 Reflexivity

"A researcher's background and position will affect what they choose to investigate, the angle of investigation, the methods judged most adequate for this purpose, the findings considered most appropriate, and the framing and communication of conclusion" (Malterud, 2001). In this study, the researcher had previously practiced as a primary school teacher for five years before beginning this research. Her recent experience, understanding and passion for DL helped to form the research questions to abstract greater in-depth data. Aligning with contemporary theory of knowledge, this research acknowledges "the effect of a researcher's position and perspectives and disputes the belief of a neutral observer" (Nagel, 1986). This being true, the researcher is responsible to make a commitment towards reflexivity to ensure validity in their findings.

To determine a truer understanding, one must acknowledge that "the perspective of the observer is always limited and determines what can be seen" (Harraway, 2020) and therefore be dependent on other positions and perspectives. In the case of this study, the researcher chose to access "different, although equally valid, representations of the situation that is studied" (Malterud, 2001) in their discussion of the topic with their PhD supervisors and in research groups. In doing so, these discussions brought new knowledge and different ways of approaching the same subject, resulting in an increased understanding of complex phenomena so can strengthen the design of the study (Malterud, 2001). These discussions were not had for the purpose of consensus or identical readings, but to supplement and contest each other's statements to strengthen authenticity and validity. The researcher not only looked for variety in the voice of the participant but also in the voice of the expert.

The researcher was careful to clearly describe the "contextual intersecting relationships (e.g., race, socio-economic status, age, cultural background) between the participants and themselves" (Berger, 2015) to increase the credibility of her findings and to deepen their understanding of their work. It was essential that the researcher recognised her similarities to the participants from her previous experience as a teacher but also to acknowledge to differences for a wider context. When analysing interview transcripts, she had to take into account the traits of that individual participant and compare them to her own. It was necessary that the researcher be aware of her unconscious bias to articulate the way others react to situations and how their needs and reactions may differ. The researcher chose to use participatory action research (PAR) to minimise these biases and to bring more equality between the power of the researcher and participant "as all who participate in the research are

seen as equal partners in developing, creating, analysing, and disseminating research products" (Dodgson, 2019).

As well as a continuous questioning of her own bias, the researcher used the participant's own reflexivity to validate findings. This study looked for a multitude of positions and perspectives through its variety in sources and sampling strategy. The researcher chose to not only represent the voice of the practising teacher in the initial stage of data collection (interviews) but then asked that a sample of those participants would analyse the delivery of the framework to share their opinions as to whether their voices had been heard and a representative training framework had been designed and delivered effectively.

3.4.5 Research Instrument

Lincoln and Guba (1985) first introduced the concept of the human being as research instrument to stress the uniqueness of the researchers' role in the process of scientific inquiry. This uniqueness lies in the notion that "only people construct and bring meaning into the world through their qualities of sensitivity, responsiveness and flexibility, making them the most appropriate instrument for inquiries aiming to arrive at understanding, meaning, the promotion of critical awareness, emancipation, and movement toward deconstruction or decolonization" (Peredaryenko and Krauss, 2013). Lincoln and Guba (1985) suggest that the human being is adaptable; people can grasp confusing pieces of data, process and explore them in-depth as soon as they are made available: "The human instrument has the unique capability of summarising data on the spot and feeding it back to an informant for clarification, correction and amplification" (Lincoln and Guba, 1985).

"Qualitative researchers have come to embrace their involvement and role within the research" (Winter, 2000) and should be presented to record changes before and after they occur. Therefore, the credibility of qualitative research is dependent. There has been intense debate about the potential bias, in that the perspective of a human nature may create "interpretive research begins and ends with the biography and self of the researcher" (Denzin, 1989). Other researchers have suggested that in becoming involved in the research, they can be a productive part of the process and development. Prior to this study, the researcher had experience in this research context, previously being a primary school teacher, giving them

an advantage in being able to "draw on one's inner experiences can be used to get closer to the informants of a given study in order to understand them better" (Rennie, 1994; Schneider, 1999). Therefore, this choice of research instrument can be considered most suitable in acquiring knowledge "about research informant's social and cultural worlds" (Lave and Kvale, 1995). Previous contextual experience, knowledge and, the researcher as instrument enables application of appropriate tacit knowledge to each situation and event as it occurs (Pickard, 2002).

3.4.6 Fieldwork

Qualitative researchers study things in their natural settings, attempting to make sense of, or to interpret, phenomena in terms of the meanings people bring to them (Denzin & Lincoln, 2005, p. 3.). Fieldwork aims to provide a naturalistic, interpretative approach, concerned with exploring a phenomena from the 'interior' (Flick, 2009). In taking in the perspectives and accounts of research participants from interviews, the researcher will go onto to study those of student teachers and make comparisons of experience and needs to influence the development of the framework. Constructivist grounded theory leads researchers to concentrate on what is happening in the research field, acknowledge that they are part of it, remain flexible, follow empirical events, attend to language and meaning, and take on moral responsibilities arising through their research, which can bring researchers into the public sphere (Charmaz, 2020).

Problems with this method include becoming too close to one's informants, side-stepping relevant theory in favour of accenting popular assumptions about one's informants (Wacquant, 2002: 1523) or making "known previously unknown or misknown social worlds the primary objective" (Emerson, 1987: 72-3). Snow, Morrill and Anderson (2002) suggest that "ethnographers too often enter the field with only goals of description and interpretation to guide them, treating theoretical development as a black box or ignoring it altogether," resulting in a rough transition from getting started and data collection to the analysis and construction of theory. The researcher therefore was responsible for being objective as possible to avoid ethnocentricity and to ensure that deception of participants was to be fully justified.

The process of developing qualitative fieldwork involved conceptualisation of the field, directives for getting started, negotiating access, developing and maintaining fieldwork notes, writing fieldnotes and even leaving the field (Adler and Adler, 1987; Emerson, et at., 1995; Lofland and Lofland, 1995; Gupta and Ferguson, 1997).

3.4.6.1 Gaining access and ethical considerations

Practising teachers were approached through individual emails, emails to primary schools in the North-East of England, contacting colleagues of accepting participants, telephoning and via social networking. The researcher had previously worked for five years as a primary school teacher in North-East England, providing her with a wealth of contacts known to her from past experience in the education sector. This provided her with an opportunity to approach them as potential participants and to benefit from extended networking options. They were given details about the purpose and plan of action for the study and then invited to participate.

In order to deliver the framework in an undergraduate module at Northumbria University, the researcher had to approach the Head of the Education department at Northumbria University and seek permission to deliver to an appropriate cohort. Once permission had been granted, the researcher and the Primary Education (BA) course leader scheduled a meeting to organise a schedule for the delivery and select a cohort that would be most suitable for the research. The students were given an overview of the educational interventions on their student portal and offered a certificate of attendance from the University if they attended and gave feedback on all six sessions. Ethical clearance for the study was obtained prior to the commencement of the research.

Some of the instruments to be adopted for ethical compliance of this study were guided by literature (Lincoln & Guba 1985; Tisdall et al 2008; Stringer 2014) and the Research Ethics and Governance Handbook of Northumbria University. These instruments ensured rigor of the study by establishing truthfulness and trustworthiness of the research (Lincoln & Guba 1985). These tools include:

- Informed consent
- Checks for Credibility and Confirmability

Stakeholders and participants were informed on the objective and purpose of this research with clear information on what the study was about or entailed and any possible consequences of partaking in the study (Tisdall et al 2008a; Stringer 2014). Those participating in the interviews were given written consent forms, outlining the purpose of the study, the collection, storage and analysis of the data and asked to fill out and give a written signature to confirm their understanding and consent in participating in the study. If they did not wish to participate, they were given the option to opt out of the study at any time. Verbal consent was sought from the student participants and they were given the option of opting out of the study at the beginning of each session when they were informed that they were being recorded and if they did not have to contribute to verbal and written discussions if they did not wish to participate in the study. Deliberate actions were taken to ensure protection of privacy and confidentiality of participants and sources appropriately.

3.4.6.2 Sample strategy and phases of research

3.4.6.2.1 Initial, Purposive Sampling

'Grounded theory studies are characterised by theoretical sampling but this requires some data to be collected and analysed' (Sbaraini, et al., 2011). As in any qualitative study, sampling must thus begin purposively, selecting "information-rich cases related to the phenomenon of interest" (Palinkas, et al., 2015). "This involves identifying and selecting individuals or groups of individuals that are especially knowledgeable about or experienced with the phenomenon of interest" (Creswell and Plano Clark, 2011). In addition to knowledge and experience, there was a great importance placed on selecting participants who were available and willing to participate, had the ability to communicate experiences and opinions in an articulate, expressive, and reflective manner (Palinkas, et al., 2015). The objective of this study was to sample for maximum variation, (Patton, 1990), selecting a "relatively small sample of great diversity which would produce detailed, information-rich data, and would highlight any shared themes which emerged" (Pickard, 2002). Embedded in a maximum variation strategy is the ability to compare and contrast, to identify similarities and differences in the phenomenon of interest. The selected participants were interviewed three times in this grounded theory study.

In her previous experience as a teacher, the researcher had been able to contact ex-colleagues to request their participation in the study and for them to either contact or give contact details to other practising PSTs who may be willing to participate. The researcher was able to use this 'passing on of contact details' to reach out to a collection of PSTs and alongside this method, contacted other schools and teachers to gather the thirty-three participants listed below:

Teacher	Gender	Age	Experience (yrs)	Year group	Catchment area	Social hierarchy stance
1.	F	29	5	3	Sunderland	Deprived
2.	M	46	25	3/4/5	Sunderland	Extremely deprived
3.	F	35	14	5	Esh	Affluent
4.	F	64	41	Supply: 2, 4, 6	Academy trust in Horden and Murton	Extremely deprived
5.	F	52	30	5/6	Peterlee	Deprived
6.	F	56	20	1	South Hetton	Extremely deprived
7.	F	28	NQT	4	Middlesbrough	Deprived
8.	F	32	10 (6 in Primary and 4 in Secondary)	5	Sunderland	Deprived
9.	M	33	NQT	5	Sunderland	Extremely deprived
10.	M	29	6	6	Houghton-le-Spring	Affluent
11.	F	29	7	6	Lanchester	Extremely deprived
12.	M	30	6	PPA	Durham	Affluent
13.	F	31	7	5	Gateshead	Deprived
14.	F	29	2	Reception	Chester-le-Street	Affluent
15.	F	28	3	2	Washington	Deprived
16.	F	40	18	Reception	Peterlee	Deprived
17.	F	42	20	6	Sunderland	Extremely deprived
18.	F	62	40	EYFS	Seaham	Deprived
19.	M	39	6	6	Kenton	Deprived
20.	F	26	4	5	Jarrow	Extremely deprived
21.	M	39	11	3/4	Horden	Extremely deprived

22.	F	35	12	1	Peterlee	Extremely deprived
23.	F	33	4	3	Hartlepool	Affluent
24.	M	55	21	6	Murton	Deprived
25.	F	27	15	1	Shotton Colliery	Extremely deprived
26.	F	28	5	2	Rye Hill	Extremely deprived
27.	F	33	2	Reception	Gosforth	Affluent
28.	F	29	3	Reception	South Shields	Deprived
29.	M	37	5	6	Wingate	Extremely deprived
30.	M	36	14	4	Fenham	Extremely deprived
31.	F	41	5	6	Horden	Extremely deprived
32.	M	34	6	Reception	Sunderland	Deprived
33.	F	29	4	6	Gateshead	Deprived

Table 3.2, *The criteria of participants*

3.4.6.2.2 Theoretical Sampling

Once data had been collected from the purposive sampling participants, it was then analysed to search for similarities and differences. “Sampling in grounded theory is thus sequential, beginning with purposive sampling and moving into theoretical sampling when concepts begin to emerge” (Draucker, et al., 2007). Once data has been collected, coded and analysed, the researcher must then “decide what data to collect next and where to find them, in order to develop his theory as it emerges” (Glaser, 1978. p, 36). Glaser goes on to recommend that once theoretical sampling begins, the researcher may want to become more open by changing interview styles, sites or participants; follow up on recurring patterns in participant data; and asking key participants to give more information on categories that seem central to the emerging theory.

> “When doing theoretical sampling, researchers must determine what data sources (e.g., groups of people, documents, bodies of literature could yield the richest and most relevant data” (Draucker, et al., 2007).

This study began with a purposive sample collection, where participants were determined prior to the research by time, space, identity, or power, according to the aims of the research (Grauss, 1978). Unlike purposive sampling, which is determined prior to the study, theoretical sampling must be determined during data collection as "the researcher cannot know in advance precisely what to sample for and where it will lead him" (Glauss, 1978). In theoretical sampling, the existing data guided the researcher to look for the next group of participants, based on characteristics for comparison and developing new theory. As the study progressed, circumstances changed due to COVID-19 and new categories were discovered relating to CPD training, experience in digital literacy skills and theories relating to digital natives. The researcher used their prior knowledge and experience in schools to request data collection opportunities with practising teachers. As analysis of the existing data grew, particularly due to the impact of COVID-19, new theories emerged. This led the researcher to conduct a further two rounds of interviews with practising teachers and then adapt the developing framework to suit these changes.

Theoretical sampling took place during Phase 3 of the research, the interventions. During this stage, the researcher delivered the framework to student teachers and chose four of the thirty-three practising teachers (with authoritative and experienced positions) to analyse the video recordings of the interventions. The aim of theoretical sampling in this third phase was to confirm the theory that DL consists of six components and that teachers require effective training in these to become digitally literate practitioners in their classrooms. In developing and delivering a training framework, theoretical saturation was considered to have been achieved and this premise was being evaluated by these final participants when they were asked for feedback. They were asked to comment upon aspects of the theory such as resonance, cohesiveness, and completeness.

3.4.6.2.3 Theoretical Saturation

"In most cases of inductive qualitative research, information is extracted from information sources and translated into codes" (van Rijnsoever, 2017). Data is considered to be saturated when "no new elements are found and the addition of new information ceases to be necessary, since it does not alter the comprehension of the researched phenomenon. It is a criterion that enables the establishment of the validity of a data set" (Nascimento, 2017). Atkins (2018) states that "the ease archer's theoretical sensitivity is required to make a

judgement on when saturation is reached." The researcher followed Fontanella's (2008), five steps to determine theoretical saturation.

Step 1. Recording of raw data: initial interviews were conducted with teachers from schools in North-East England.
Step 2. Immersion in data: through reading of data obtained in initial interviews. Formulations of new categories were foreseen and were registered for further discussion.
Step 3: Compilation of individual analyses of each interview were written in memos and organised through colour coding.
Step 4: For each pre or new category, the themes or types of statements were gathered and recorded in thematic codes in Nvivo.
Step 5: Attainment of theoretical data saturation through absence of new elements for each grouping.

It was decided that theoretical saturation would be reached once data collected from new sources did not create any new categories. In the third round of interviews, statements were gathered and strengthened existing categories but no new categories were formed and this was the same with the feedback from interventions.

3.5 Data Collection

"A major part of qualitative research is based on writing and text" (Flick, 2017). In this study, the researcher gathered data from interviews, intervention observations and documentation of notes and feedback, in an "attempt to gain access to the insider's view of his or her social worlds without making judgements" (Carter and Henderson, 2005). "There can be no research without data" (Corbin and Strauss, 2015). Data collection could not begin until the researcher's proposal had been reviewed and approved by their research committee. In their proposal, the researcher had to consider:

- What would be addressed in their proposal and presented to their research committee?
- Guides to each of the data collection methods
- Approaching participants and informed consent
- Confidentiality and anonymity

- Researcher responsibilities
- Acknowledging bias and assumptions

(Corbin and Strauss, 2015)

The collection of data is at the core of any research and analysis is only as good as the data that has been collected. For this reason, the data gathered needed to formulate more conclusive evidence to support the phenomenon being explored. “Numerous types of data collection are needed to provide stronger evidence to support their hunches” (Jackson and Bazeley, 2019) and so it was decided that to support a constructivist approach, data would be gathered from multiple sources: interviews, intervention observations and fieldnotes.

It was important that the researcher did not collect all the data at once as they would need time to analyse and develop concepts. It was decided that the process of data collection would begin with an initial round of interviews with practising teachers and once analysed would then “provide a sense of direction of where to go and what to do next” (Corbin and Strauss, 2015). The researcher went on to do two more rounds of interviews, providing further information about the changes to teachers’ digital literacy skills throughout the pandemic, which led to the adaptation of the training framework. Once the framework had been developed, the next stage of the data collection process began with observations and ended with feedback regarding the development and delivery of the sessions.

3.5.1 Interviews

Interviews were a chosen method for data collection as “they tell the program’s story by capturing and communicating the participants’ stories” (Patton, 2002. p.10) and through this technique, detailed insights into preferences, thought processes and an understanding of the participants’ experiences can be established. This research followed a funnel pattern, beginning with ‘broader and more general types of questioning and moving to more specific and structured types of inquiry as more about a topic is learned’ (Guest, 2013) shown below in *Figure, 3.4.*

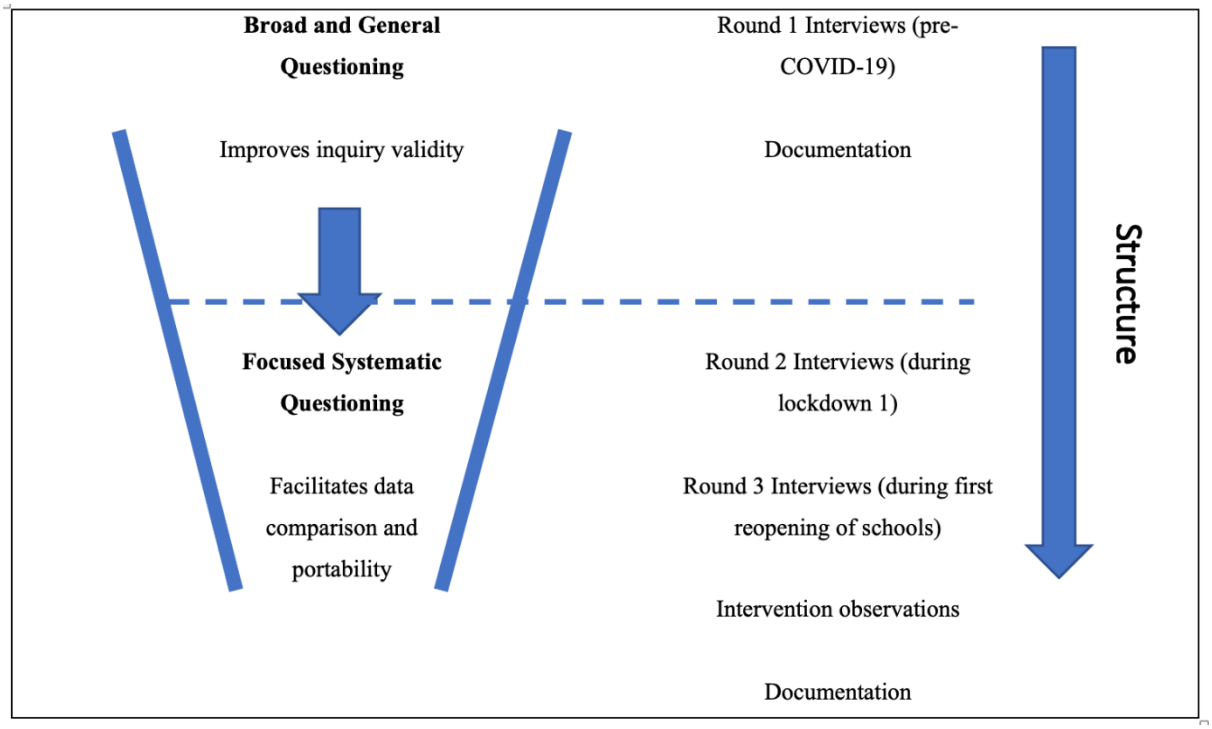


Figure 3.4 *Funnell pattern process of interviews in this research (adapted from Guest, et al, 2013).*

In the initial interviews, data was collected in both face-to-face and telephone interviews using semi-structured questions (see Appendix x) based loosely on the research questions. One-hour in-depth interviews were conducted. This was to allow their voices and thoughts to emerge from a "structured conversation" (Kyale, 2007) to learn about their uses of digital resources, to gain an understanding of their changing digital literacy skills and how they had gained these skills, such as in training or through exploration. The main goal of the preliminary interviews was to find out teachers' perceptions of DL; their understanding, experience, abilities and attitudes. The data was then analysed to identify areas of weakness to be developed in the framework design.

Interviews were digitally recorded and transcribed by the researcher. Teachers were interviewed via audio call or at a location convenient to them, such as the primary school they worked at.

"A major advantage of the interview is that it permits the respondent to move back and forth in time - to reconstruct the past, interpret the present, and predict the future, all without leaving a comfortable armchair."

(Lincoln and Guba, 1985, p273).

The first interview in each case was of an exploratory nature, encouraging the participants to "engage with the researcher in less structured conversations so that their hidden assumptions and constructions began to surface" (Erlandson, Harris, Skipper and Allen, 1993 p81). The researcher employed semi-structured questioning and aimed not to take control of the process (Tagg, 1985) as "the purpose was to access what was in, and on, the interviewee's mind, as the researcher did not want to put ideas that may not have existed prior to the interview" (Stenhouse, 1984). The progression of this line of questioning was an attempt to "obtain more and more details about the readers' perceptions and to delve into specifics" (Guest, 2013) such as individual training experiences. Guest (2013) goes on to say that "in collaboration with the participant, the interviewer helps create a narrative that is rich, has depth, and informs the overall study objective."

A set of pre-constructed, semi-structured interview questions were designed to ensure that each participant would each give data covering similar subject areas and give the researcher direction in the conduct of the interview (Pickard, 2002). The interviews took place once they had been informed of the purpose and nature of the interview.

The second set of interviews, which followed this phase, were conducted in April, 2020, at the beginning of the COVID-19 outbreak in the UK during the first lockdown and closure of schools. Interviews were conducted via telephone or digital communication platforms such as Zoom due lockdown regulations and for the participants' convenience. Interview guides were developed for individual participants who had shown their ability to communicate their experiences and opinions in an articulate, expressive, and reflective manner (Palinkas, et al., 2015). The interview guide was designed based on previous information from that individual participant and from the initial general interview. The outbreak of COVID-19 had forced schools to employ remote learning strategies by digital means, causing a need for the understanding and development of digital literacy skills. Questions were constructed to give insights about how, or if, gaps highlighted in the initial interviews had been acknowledged or amended.

The third set of interviews were conducted in November, 2020, during the first reopening of schools in the UK. As with the second set of interviews, they took place via telephone and digital media platforms and followed a similar interview guide. The semi-structured questions

sought to explore the experiences of practising teachers before, during and after pandemic lockdown and to gain an understanding of digital literacy teaching and strategies at these times.

3.5.2 Intervention observations

"Theory has an integral role at the design of interventions and studies aimed at evaluating the effects of interventions."

(Fleury, et al., 2018).

The designing of the framework for the interventions was based on theory that for PSTs to be digitally literate, they needed to be trained in the six components of DL. The purpose of the study was to impact PST's training in DL. The framework design was not only affected by COVID-19 but as were the participants it was initially designed for. The development of DL skills and needs were redefined after the third round of interviews and the framework revised to suit these changes. It was then decided that the framework would be delivered to student teachers, as opposed to practising, but the delivery would then be analysed by four practising teachers to help measure its impact.

Following on from the interviews with practising teachers, the initial framework that had been designed after the first round of interviews was further developed to suit the changing needs of the participants. The initial framework had contained more basic-level training in components which were then adapted to suit an intermediate and experienced audience.

The adapted framework was then delivered to forty, third-year Primary Education (BA) students at Northumbria University. During participant observation, a researcher may interact with participants and become a part of their community (Driscoll, 2011). In this part of the study, the researcher observed the student teacher cohort participating, contributing, and interacting with their peers during the digitalised educational interventions. Since the interventions were delivered as a training course as part of a module, the students "may have viewed the researcher as a lecturer or authority figure" (Fleisher, 1989). If this were to be the case, the students may see the researcher as some specialist or type of 'expert' and "may be inclined to ask advice and this would be unavoidable" (Pickard, 2002). It can be assumed that

the researcher would no longer be able to be perceived as an outsider, and so a balance would be needed between outsider and participant to understand the situation as an insider and be able to describe it as an outsider (Maykut and Morehouse, 1994). “Participant observation ranges across a continuum between mostly observation to mostly participation” (Glesne & Peshkin, p. 40).

In this instance, the researcher managed to both participate and observe, using a method to understand the dynamics of the environment that is being investigated (Kelly, 2017). The amount to which the researcher participates or observes is dependent on the situation. In most studies, the researcher usually begins by distancing themselves from the subjects being investigated and works to develop acceptance (Kelly, 2017). Once a relationship has been established, the researcher is able to participate more freely and frequently.

> ' The more you function as a member of the everyday world of the researched, the more you risk losing the eye of the uninvolved outsider: yet, the more you participate, the greater your opportunity to learn' (Glesne & Peshkin, 1992).

The researcher had to continuously consider this during observation, they were not there to evaluate but instead had to be open to changing their point of view, and through continuous analysis, would be searching for meaning of the actions of their subjects. Through participant observation, the researcher should “learn first-hand how the actions of others correspond to their words; see patterns of behaviour, experience the unexpected, as well as the expected; and develop a quality of trust with your others that motivates them to tell you what they otherwise might not” (Glesne and Peshkin, 1992, p. 39).

3.5.3 Documents

Documents that were of significance in this study were: interview transcripts, fieldnotes, observation notes, school policy documents, local and national government policy documents, such as: Teachers’ Standards Documents, Department for Education (England) documents, relevant published articles, notes from practising and student teachers, audio or videotapes, the framework presentation slides and script and the researcher’s diary. These all acted as valuable sources of information during this study.

3.5.4 Modes of Recording Data

Research diary

Following the advice of Maykut and Morehouse (1994) a researcher's diary was maintained from a very early stage. This first method of recording data began from the start of the study, beginning solely as supervisory meeting notes, which contained discussions about the process and progression of research and forward planning for further tasks. This was continuous throughout the research process. The supervisory meeting notes acted as the two forms of recording the research, first it concerned logistics and provided a step-by-step account of the path taken by this study (Pickard, 2002). The second were reflective notes which contained notes on recurring ideas, questions, concerns, discussions, and points when major decisions had been made concerning the direction of the research process. These two forms were then separated into the research time frame and reflective notes. These enabled the researcher to go and find thoughts and ideas that may have been forgotten and to then incorporate them into the research process, it became more than a private record; it became essential to organise thoughts ideas for the research process. "For many researchers, the most important thing is to have a personal diary or log in which everything is kept" [Stake, 1995, p.55].

Audio recordings of Interviews

In the literature, there is a debate regarding whether fieldnotes, transcripts or audio recordings should be used to record data collected through interviews (Tessier, 2012). Lincoln and Guba [1985] recommend the use of fieldnotes during interviews, although they acknowledge that they do not offer the high fidelity of audiotape. They give the following reasons for advocating notes:

- Not as threatening to the participant.
- Process of note taking keeps the researcher alert and responsive.
- Not subject to the technical difficulties of recording.
- Notes provide ready access to earlier points in the interview that may be referred back to for clarification.
- The researcher can add their own notes and comments on the participants' behaviour.

There are issues of reliability, cost and loss of data, among others. For this reason, Patton (1990), suggests that recording interviews is a far superior method of recording data; '[a] audio recorder is part of the indispensable equipment of researchers using qualitative methods.' [p348]. Patton (1990) states:

- Audio recordings do not drift away from the conversation.
- They do not change what has been said by interpretation.
- They do increase the accuracy of the data collection.
- Allow the interviewer to be more attentive to the interviewee.
- Taking verbatim notes can seriously affect the interactive nature of an in-depth interview.

Tessier (2012) argues that each method offers possibilities that the other does not and therefore instead of being discarded these methods should instead be combined. The combination could either mitigate against, or compound, the disadvantages of both (Pickard, 2002). In this study, the interviews were recorded, and fieldnotes were made during the interview, which indicated participant behaviour, and any recurring themes. In recording the interviews and storing the data on encrypted storage systems, the data was more secured and allowed the researcher to become involved in the interview without fear of missing any significant statements. “Taking notes allowed ‘value’ to be added to the process in terms of capturing the reactions and non-verbal indicators as witnessed by the researcher” (Pickard, 2002).

Fieldnotes of Observations

“Fieldnotes are descriptive, written accounts of what the researcher sees, hears, experiences and thinks while collecting and reflecting on data” (Kelly, 2017). In agreement with Kelly, Emerson, et al., (2001) state that not only is the observer the scribe, they are also the explorer who can bring their interpretations of the ‘adventure’ to others: “participant observation involves not only gaining access to and immersing oneself into new social worlds, but also producing written accounts and descriptions that bring versions of these worlds to others.”

To give a true recount of the situation, “it is key that the observer maintains the greatest level of normality possible” (Pickard, 2002). The observations were made through live, interactive,

digital communication platforms and lasted for one hour. They were also recorded for future reference and analysis. The researcher was not on full display during the interventions and so could work in the background, offering fewer distractions to the normality of a Higher Education seminar. The fieldnotes contained details of what was heard, said and seen in the setting. They were a descriptive, not interpretative, account of the phenomenon (Patton, 1990). In writing up the fieldnotes as soon as they had been validated (Denzin, 1978; Mellon, 1990), there was a lower possibility of interpretations becoming confused with the description of what was actually witnessed (Lincoln and Guba, 1985). "Transcribing notes immediately after vacating the field allowed the interpretative notes to be added as memos inside the observation description" (Pickard, 2002).

As a participant observer, there were times when the researcher had to focus more on participating rather than observing, making it difficult to record what was being witnessed at the time. The situation did allow for some notes, but it was accepted that some data collection procedures (observations) had to "allow the researcher to be excused from accessing any additional data they may need" (Erlandson, Harris, Skipper and Allen, 1993. p, 103) to participate. The researcher used voice recordings and made handwritten notes during the observations to record their thoughts. After the intervention ended, the researcher then typed up the handwritten notes and expanded on these whilst the interactions and thoughts were still fresh. The recorded conversations and thoughts using a Dictaphone were then organised and added to the typed notes.

Participants Feedback Forms

Feedback is meant to inform and guide improvement (Hattie & Timperley, 2007). Researchers aim to understand how to use feedback to lead them to "adaptive and growth-orientated action" (Lipnevich, Berg and Smith, 2016). "Feedback from external sources has been deemed crucial in the maintenance of competence" (Telio, et al., 2016). The reliability of the feedback is dependent upon the researcher's methodological decisions, making it essential that not only are the studies carefully designed but that comparability is increased (Brown and Harris, 2018).

In this study, feedback was collected via feedback forms, using Microsoft 365 Forms platform. All student teachers from Northumbria University that had participated in the study

were emailed a link to a feedback form related to an individual session, after each session. The six practising teachers received a video recording link to each of the six sessions and a link to the related feedback form.

Each session form asked the participants two open-ended feedback questions:

1. What did you enjoy about the session?
2. What do you think could be improved?
3. What do you think you've learned?

After the course had been completed, two further questions were added:

4. In stars, (1 being poor and 5 being excellent), how would you rate this course?
5. What was your favourite session? Why?

The qualitative feedback was coded following (Hoon, et al., 2015) system by separating each statement into two criteria, the first being whether it was 'negative,' (N) or 'positive,' (P) or 'adequate' (A) and the second being the depth of the feedback. Hoon's (2015) system determines a level of detail from the statements, if the level of feedback was a basic good or not good, with no farther expansion it was levelled as '1' (Descriptive), if a statement gave an indication of a reason for this choice it was levelled at '2' (Qualified), if a statement included constructive suggestions for change or development it was categorised as a 3 (Constructive). This system was adapted from Newton, Wallace and McKimm (2012).

Feedback category	Basic theme of the statement
P1	This was good.
P2	This was good because…
P3	This was good because…but would be better if…
N1	This was bad.
N2	This was bad because…
N3	This was bad because…but would be better if…
A1	This was adequate.
A2	This was adequate because…
A3	This was adequate because…but would be better if…

Table 3.3, *Classification of feedback statements (Hoon, et al.,2015)*

The interventions were to be recorded and then reviewed by a selection of practising teachers, who were asked the same questions as those given to the student teachers.

3.6 Data Analysis

Qualitative research is about interpretation of data through analysis (Blumer, 1969; Strauss and Corbin, 1998; Denzin and Lincoln, 2003). “The word derives from the prefix 'ana' meaning 'above', and the Greek root 'lysis' meaning 'to break up or dissolve” [Bohm, 1983 p.156]. The process of data analysis in qualitative research involves working with data, organising it, breaking it down, synthesising it, searching for patterns, discovering what is important and what is to be learned, and deciding what you will tell others (Bogdan and Biklen, 1982). There are always concerns when approaching data about the accuracy of interpretation; “is the data being interpreted correctly? Am I being true to the data?” (Corbin & Strauss, 2015). Corbin and Strauss (2015) go on to suggest that as human beings, we interpret our own and other’s actions and this is applied with an emphasis on accuracy when analysing data.

In the process of data analysis, the researcher often begins reviewing literature relevant to their field of study to gain an understanding of what is known about a subject. The researcher is then able to identify gaps in the research and how their own study can contribute to knowledge. There are ongoing discussions about how and when to engage with literature and conduct a review (e.g., Dunne, 2011., Glaser, 2015. and Thornber & Dunne, 2019). Corbin and Strauss (2015) state that “the question that arises is: how can the literature be used to enhance rather than constrain analysis?” Becker (1986) suggests: “use the literature, don’t let it use you,” implying that students should use literature to set a foundation of knowledge and can use this as guidance to developing their own beliefs for their study rather than becoming stifled by the opinions and theories of others and pupating those views. Dey (1993) states: “there is a difference between an open mind and an empty head. To analyse data, we need to use accumulated knowledge and not dispense with it.” From this, researchers should understand that “to carry out inductive data analysis it is necessary to be open to all eventualities and not allow prior theory to drive the analysis” (Pickard, 2002).

Analysis is continuous throughout research as the researcher must constantly be "updating and revising concepts, adding new concepts, identifying new properties and dimensions, and seeing new relationships between concepts" (Corbin and Strauss, 2015). The researcher began the analysis process by generalising patterns and moved on to more in-depth analysis to explore as much meaning, from the data gathered, as possible.

3.6.1 Grounded Theory Analysis

Grounded theory is an inductive methodology that provides systematic guidelines for gathering, synthesising, analysing, and conceptualising qualitative data for the purpose of theory construction (Jorgensen, 2001). This method was the most promising and suitable form of methodology for this research. To compliment the research design of action research, grounded theory was used in conjunction by articulating (a) logical steps for handling data collection and analysis, (b) a means of correcting errors and omissions and of refining analytic ideas, (c) tools for studying basic social and social psychological processes in natural settings, and (d) strategies for creating middle-range theories (Jorgensen, 2001). Through data collection and analysis, the researcher looked for patterns/themes and began to categorise them, leading to analytic writing, developing ideas and finding support in literature to develop theory that is grounded in data.

> *"Grounded theory usually begins with individual cases, incidents or experiences and develop progressively more abstract conceptual categories to synthesis, to explain and to understand your data and to identify patterned relationships within it."*
>
> (Charmaz, 2007).

A constructivist grounded theory approach (Charmaz 1995, 2000, 2007) attends to the data collection closely, under the impression that the researcher needs to search thoroughly to find their subject matter through strong questioning and observational techniques. The questions that a researcher asks of the empirical world should shape the data that they select from it. They should not assume that data exists, awaiting discovery or that a researcher can enter a research scene with preconceived ideas. Researchers should enter the field of study and what they see and hear is determined by their 'prior interpretative frames, biographies, and interests as well as the research context, their relationships with research participants, and modes of generating and recording data' (Jorgensen, 2001). Literature reviews, conversations

and interviews with practising and student teachers, a passion for digital literacy skills and building relationships with both the participants and networking community (Education department at Northumbria University and research individuals/teams with similar interests) helped to expand knowledge and understanding of the research in an attempt to gather full, rich data which will present a more thorough view of the studied topic: "You begin with an area to study, then you build your theoretical analysis on what you discover is relevant in the actual worlds that you study within the area" (Charmaz, 2007).Charmaz goes on to suggest that grounded research "relies on knowledge from the 'inside." The wanting to discover research participants' meanings, studies using grounded theory "start with and develop analyses from the point of view of the experiencing person" (Bigus, 1994) and aim to "capture the worlds of people by describing their thoughts, feelings and actions by relying on portraying the research participants' lives and voices" (Charmaz, 2007).

As mentioned earlier, action research and grounded theory accompany one another in that data collection and analysis proceeds simultaneously. A grounded theory analysis starts with data and remains close to the data. During the initial stages of the collection, grounded theorists code and categorise data during the initial stages of the data collection (Jorgensen, 2001). Levels of abstraction are built directly upon the data and are checked and refined by gathering further data (Glaser, 1978; Glaser and Strauss, 1967; Henwood and Pidgeon, 1992; Strauss, 1987). Prior to the development of grounded theory methods, researchers separated data analysis and the collection phases of the research until it was discovered that this method often resulted in gathering extensive but thin data that contained gaps (Jorgensen, 2001). Following an action research cycle, grounded theory strategies include returning to the field to gather more complete data that covers gaps and answers questions (Jorgensen, 2001), performed in this research by gathering data from initial interviews, delivering, and evaluating the framework and amending upon reflection.

The three major grounded theory strategies are coding, memo-making and theoretical sampling. The initial phase of the analysis is coding, which helps the researcher to study their data in abbreviated terms and distinguish relationship patterns. The theorist looks at the data questioning "what is happening?" and aiming for the research subject to inform the researcher of significant processes occurring in the research setting or situation. Jorgensen (2001) suggests that grounded theory coding includes the following characteristics: (a) a focus on action and process, (b) a practice of line-by-line initial coding, (c) a simultaneous

involvement in coding and further data collection, (d) an emphasis on analytic development rather than description. This study proceeded to code interview transcriptions line-by-line to break the data into themes and to assess which of these themes appeared the most frequently. These codes were then applied when analysing the observations and feedback forms. The intermediate phase, which proceeds coding and is prior to drafting theoretical analysis is memo-writing. During the process of coding and continuous comparison, memos are written to identify possible patterns in and between the codes. The function of memo writing in grounded theory is to organise thinking about how the data fits together and to help in the articulation of patterns and emerging links between codes (Glaser and Strauss 1967). Memo writing has four purposes: first, the ideas expressed raise the data to a conceptual level; second, memos encourage the sorting and reworking of ideas; third, a catalogue of memos is created which serves as a source for writing up theory; and fourth, memos are written to be easily organised (Engward, 2013). The final phase is theoretical sampling which occurs after the grounded theorist has defined and analysed core theoretical categories (Jorgensen, 2001) and aims to collect further data to explore emerging patterns. New data is used to confirm, and to or challenge the emerging patterns as well as identify gaps in the data analysis requiring further exploration (Engward, 2013).

"Coding gives you the tools for interrogating, sorting, and synthesising hundreds of pages of interviews, fieldnotes, documents and other texts" (Charmaz, 2014). In grounded theory analysis, coding is used for close examination and to break the data into components or codes. According to Glaser (1978), Strauss and Corbin (1998) and Charmaz (2014) there are three levels of grounded theory analysis:

Glaser (1978)	Open coding	Selective coding	Theoretical coding
Strauss and Corbin (1998)	Open coding	Axial coding	Selective coding
Charmaz (2014)	Initial coding	Focused coding	Theoretical coding

Table 3.4 *The three main perspectives of grounded theory analysis methods*

This study chose to use Charmaz's (2014) methods of grounded theory analysis as they were designed for use within a constructivist grounded theory study (Atkins 2018). Charmaz (2014) explains that conducting a grounded theory coding involves:

1. Initial coding – a phase involving naming each word, line, or segment of data into a code.
2. Focused coding – a selective phase that uses the most significant or frequent initial codes to sort, synthesise integrate and organise large amounts of data into categories.
3. Theoretical coding – the final phase which aids the researcher to group categories together to make one core category that all the other codes and categories have led towards, showing the relationships between them. This core category represents the thesis of the research.

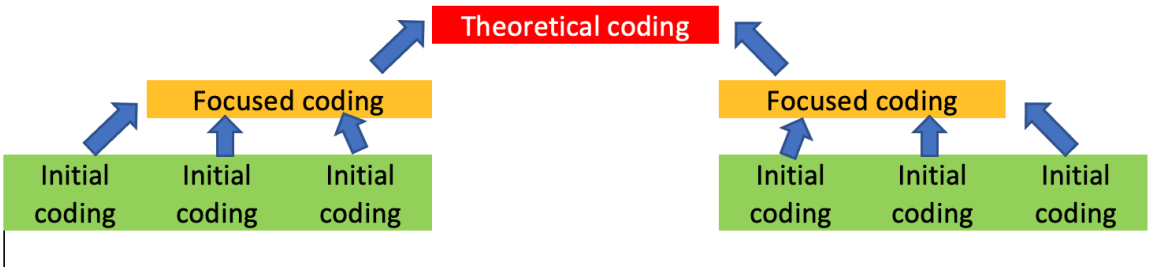


Figure 3.4 *The levels of grounded theory analysis (adapted from Charmaz, 2014).*

This study used an inductive coding approach, deriving codes from the data and allowing the narrative and theory to emerge from the raw data itself.

3.6.2 Using Nvivo

"Over time, some researchers have simply walked away from the more traditional approaches to doing qualitative research" (Corbin and Strauss, 2015). When engaging with the data collected, the researcher decided to use the Computer Assisted Qualitative Data Analysis Software (CAQDAS) Nvivo 12. The software was recommended to the researcher via colleagues and it was decided that it would be more appropriate to use CAQDAS to deal with the volume and richness of the data collected. The researcher and their supervisors felt that this method would help the researcher to "organise the large body of data in a more efficient manner" (Atkins, 2018) thereby making it easier to define and manipulate codes and categories and then add nodes and memos whilst still retaining the original source data (Atkins, 2018). This would be suitable as it was available to the researcher via their institution, Northumbria University and there was a wealth of information available in

literature and online resources for training and becoming accustomed to the software. Before using the software, the researcher attended training and made themselves aware of the terminology used within the software:

Project	The study – the source material (transcripts, surveys, etc.) and your analysis of them.
Sources	The data – transcripts, audio files, video files, pdf resources, memos. These can be internal (imported into NVivo) or external (links to sources, such as webpages, that cannot be imported).
Cases	The research subject – in this context, the research participants.
Nodes	The codes - labels for your data. These can exist as single nodes or a tree node; the category or parent of a group of codes.
Relationships	Links between nodes.
Memos	Notes that can be attached to sources or nodes. Used just like memos written outside of the program.
Classifications	Used to store descriptive information about nodes or sources. These can also be used to sort and filter data.
Attributes	Each classification has its own set of attribute values. For example, the classification *Teacher* may have attributes for *School*, *Subject*, *Role*, etc.
Collections	Groupings of project items that are stored elsewhere within the project, such as memo links (showing which memos are attached to each source).

Table 3.5 *Nvivo terminology* From Atkins, 2018.

The software was used to store, manage, and analyse via "coding, writing, linking, adding demographics, searching for patterns, and reporting or exporting data" (Jackson and Bazeley, 2019). Although a facilitator for the analysis process, "the analysis itself was led by the researcher, guided by the principles of constructivist grounded theory" (Atkins, 2018) as "it relies on creativity and disciplined imagination" (Weick, et al., 1989) plus systematic, accurate, reliable, and iterative approaches (Chandra and Strang, 2019).

CAQDAS has been used as an aid to data analysis in qualitative research in several methodological fields, including grounded theory (Bringer et al., 2004), however there are still concerns as to whether it is an appropriate analytic technique. Glaser, et al. (2007) and Glaser (2003) make arguments about the inability of computers being able to replace human thinking and in response, Friese (2019) states that "no one would expect computer software to perform such wonders". Strauss and Corbin (1996) suggest that the developer of ATLAS/ti made no claim to have produced a program that performs miracles. Muhr (1997) states that it is still the researcher "who will have the ideas and the gifts to do exceptional research."

"There are concerns from some researchers that in using CAQDAS, the researcher becomes distant from their data; computers encourage an overreliance on coding analysis over other techniques; and that the software mechanises the process, making it more quantitative in nature" (Atkins, 2018) and they suggest that true qualitative analysis should be done manually. Salmona and Kaczynski (2016) state "manual data management and analysis may be the best choice for some studies." The choice of whether to analyse manually or electronically depends on the scale of the data methods depends on the scale of the data (Cabrera, 2018). In the context of this study, the researcher had decided to follow Charmaz's (2014) coding techniques prior to choosing to use Nvivo as a support tool. Before making the choice, the researcher had reviewed literature about concerns with this technique and found that "CAQDAS software was created to provide qualitative researchers with both closeness and distance from their data" (Atkins, 2018) and that the complexity of the software would allow the researcher to organise their data in a more efficient and visual manner. "The issue is not with the software itself but with the researcher's ability to use it" (Atkins, 2018).

Many of the features of Nvivo support grounded theory analysis, such as writing memos, creating diagrams and uploading transcripts, recordings and literature to create codes and categories and relationships between them, without affecting the original data (Leech and Onwuegbuzie, 2011). The use of Nvivo will be discussed below.

3.6.2.1 Getting to know the data

"At first, the process of analysis is open and free, much like brainstorming" (Corbin and Strauss, 2015). The researcher was advised that it was important to take the time to get to know the data, to consider meanings from a variety of angles and to be able to make sense of it they must "first "chew" on it, "digest" it and "feel" it" (Corbin and Strauss, 2015). It was also important that the researcher became aware of how their own assumptions may affect their interpretation and understanding of the data gathered.

Data from the interviews was transcribed by the researcher by uploading the audio recordings and using the 'transcribe' function on Microsoft Word Online. The analysis process began during the uploading of the transcriptions of the interviews, fieldnotes and intervention feedback from saved Word documents to Nvivo. The researcher began to compile a database in Nvivo, importing the demographic details of all participants as a tracking method to use for

source comparisons. “Nvivo had the potential to link these sources, thus facilitating quick retrieval and contextualisation of cases” (Bonello and Meehan, 2019). In this study, the participants were ‘cases’ and units of analysis and so a code was created.

The researcher then re-read all documents to gain an understanding of the thoughts, experiences and feelings of the participants through their words and actions. After reviewing the established research questions, memos were drafted to note the researcher’s developing interpretations of the data and to give summaries of the emerging themes and ideas which were identified as nodes in the software.

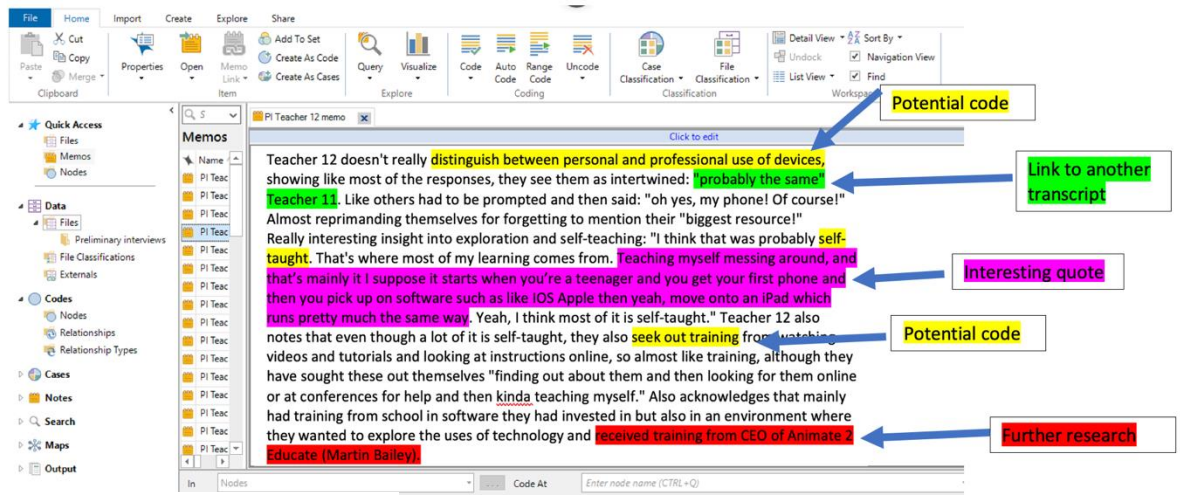


Figure 3.5 *Transcript memo example*

The memos contained key ideas and potential codes, quotes relating to these and links to other transcripts. Using the table created to list the details of the participants, the researcher could also identify patterns within the data linked to genders, ages, teaching experience and teaching year groups (see Table 3.2 *The criteria of participants*). The researcher found this useful as the memos were a reminder of their thoughts at the time which they were then able to reflect on at later stages. “Researchers who apply GT will surely appreciate the possibility to write various memos and create the code tree, supporting a systematic analysis” (Niedbalski. and Ślęzak., 2018).

Alongside memos, the researcher used diagrams to show the relationships between concepts visually: “a diagram, is used as a visual aid to manage and symbolize knowledge, including concepts and their relationships” (Novak, 2004);“diagrams help researchers to keep records

of concepts and their relationships and to systematically explain findings to other researchers" (Corbin and Strauss, 2008); "Concept mapping can help researchers organize and construct knowledge from the gathered data" (Ligita, et al., 2020).

3.6.2.2 Initial coding

> *"Coding is the main analytic process in grounded theory. This means asking analytic questions of the data, categorizing segments of data with a short name (a code), and using these codes to sort and develop an understanding of what is happening in the social situation being studied"*
>
> (Charmaz, 2006, pp. 42–43).

The researcher reread through transcripts and began to break the text into separate units to identify critical segments. These units were then assigned codes from words or phrases the participants had used (in vivo coding), or words or phrases that captured action within the data (process coding), descriptive coding, codes that related to the research questions and objectives and from the foundation categories from the semi-structured interview questions (structured coding) and from the values, beliefs, attitudes and theories. In Nvivo, the researcher created 'nodes' providing "storage areas for referenced texts" (Bazeley, 2007), titled by the given code name to summarise the content of the separated unit. To code the transcripts, the researcher highlighted the unit of text to be coded and then selected from one of three options:

- Code selection at existing nodes – this option allows the user to search existing nodes for a suitable label.
- Code selection at new nodes – this option creates a new node.
- Code in vivo – this option creates a new node using the highlighted text as the label.

(Atkins, 2018).

The researcher was able to use the software to compare nodes and decide if the indicator (words, phrases, statements) would link to existing nodes/labels or if a new one was required.

3.6.2.3 Focused coding and reviewing themes

"Once categories begin to emerge, the second phase of analysis begins" (Atkins, 2018). After the initial round of coding, the researcher began to group the codes into categories. Within each category, codes that were similar or related to each other in topics or general concepts were grouped.

The researcher was able to use Nvivo to view a list of the codes side-by-side and explore where these codes appeared in the data. The researcher copied the list of potential codes into a word document to give a rounded and summarised view of the data, and then viewed the indicators of the codes separately in list-form in Nvivo to see these in more detail:

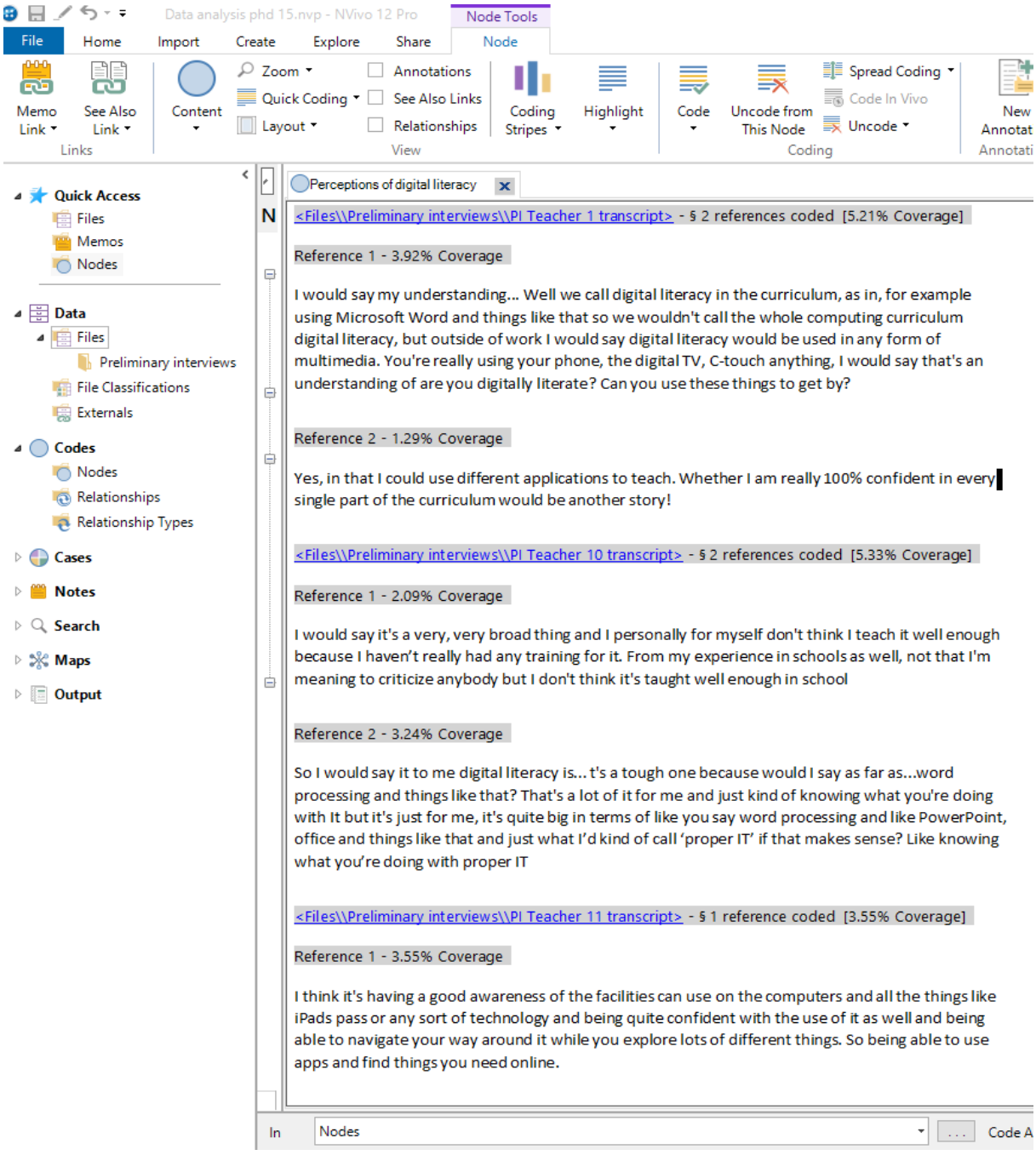


Figure 3.6 *Nvivo Node List*

The selected indicators were then reviewed by the researcher to "ensure its sustainability and to fit the data" (Atkins, 2018) and to continuously look for the more prominent commonalities between codes in the data, Nvivo can list the codes in order of frequency for this purpose. Nvivo was also used to show groupings, or relationships, between these codes, which then formed categories by creating parent nodes.

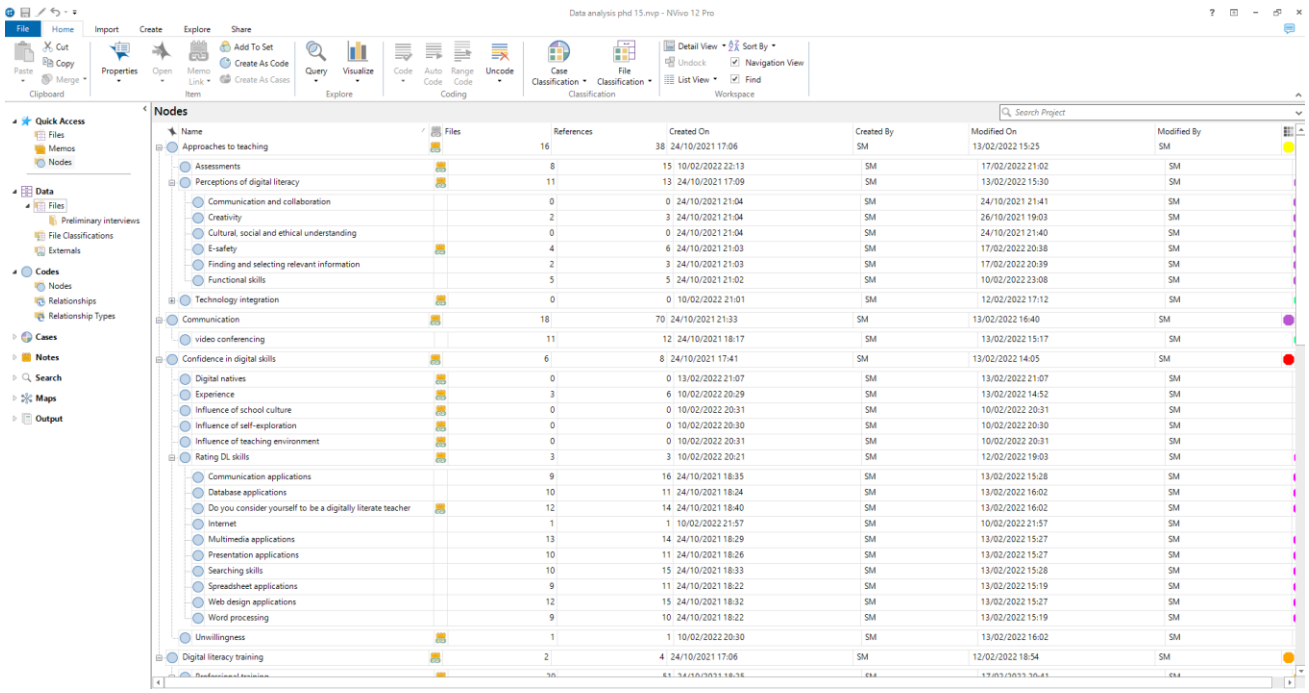


Figure 3.7 *Nvivo Parent and Child Nodes*

Once parent nodes and categories had been formed, the researcher then began to group the categories together to form themes. The researcher further explored the data whilst making connections and then seeking justifications and explanations for these connections (Richie & Spencer, 1994). Memos, diagrams, and maps were used as methods of explanation and to show relationships and overriding themes. This filtering process allowed the researcher to become entirely familiarised with the data, allowing them to "rise above the noise of the data" (Richards, 2009. p.143) , enabling them to "see the bigger picture" (Richards, 2009. p.173) and was able to present coherent findings.

3.6.2.5 Self-Reflection

"Reflexivity is largely practiced in qualitative research, where it is used to legitimate and validate research procedures."

(Mortari, 2015)

It is important that one realises that "we don't separate who we are as a persons from the research and analysis we do" (Corbin and Strauss, 2015). To enhance the rigour and transparency of research, it is essential for a researcher to be self-reflective to ensure the quality of the findings (Primeau, 2003). Reflexivity can extend the researcher's

understanding of the phenomenon studied. The researcher's worldviews, experiences and positions affect all stages of the research process.

Throughout the study, the researcher became a competent and reflective practitioner through their ability to reflect in a deep way (Mortari, 2015) by writing memos and reflecting on how the research was affecting them. They also questioned their research methodology and choice to use Nvivo software, which was justified in the acknowledgement that it improved the thoroughness and quality of the research and analysis which would not have been possible using manual processes for analysis.

3.7. Chapter Summary

This chapter has presented the reasoning for the research design, the identification of the research paradigm and the methodological criteria used to establish the trustworthiness of the findings that have been generated (Atkins, 2018). These choices are presented in the table below:

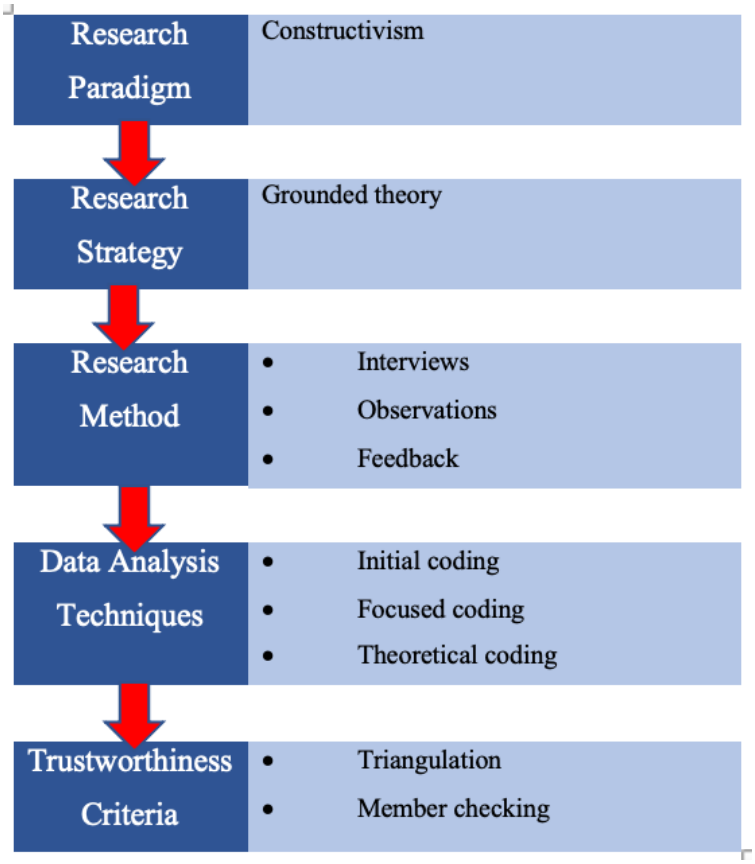


Figure 3.8 *Final research design (adapted from Atkins, 2018).*

With a focus on interpretation, the individual's construction of knowledge and theory building, the constructivist paradigm was chosen in the reasoning that it employs participant voice, to explore the processes involved in the framework design. This also influenced the style of grounded theory chosen for this study, using action research and grounded theory accompany one another in that data collection and analysis proceeds simultaneously.

The data collection approach was designed to adhere to the schedules and needs of the participants. The researcher respectfully approached the practising teachers asking for their participation, displaying gratitude and flexibility by choosing times frames for the interviews to take place and asking participants for their most suitable time. The researcher initially planned for one round of interviews to take place, but due to COVID-19 there was a dramatic change in teaching practice, regarding online teaching, that the researcher proceeded to a further two rounds of interviews (during and after the first lockdown) to gather data that reflected the development of teaching strategy and training regarding DL. The researcher had clearly built strong relationships with the majority of participants, as twenty-eight of the initial practising teachers participating were involved in the next two rounds of interviews.

The researcher then approached Education department leaders from Northumbria University, to ask for permission to deliver the intervention to their students. The University suggested holding the six sessions during a week-long break in placement. All participants proved willing to evaluate the seesions via online feedback forms, resulting in certification in participating in the course.

The data analysis technique employed allowed for Nvivo analysis software to be used, developing the researcher's own research practice. This method of analysis support has been presented with examples of the processes used to develop parent and child nodes, word clouds and node lists.

These choices were influential to the methodological strategies that were used to ensure trustworthiness of the study. The purpose of these strategies was to determine a sampling strategy that would ensure the trustworthiness and representativeness of the data interpretations, and to go on to use these interpretations to aid future researchers in understanding, adapting and potentially replicating the findings and framework.

References

Abutabenjeh, S. and Jaradat, R. (2018). Clarification of research design, research methods, and research methodology: A guide for public administration researchers and practitioners. *Teaching Public Administration*, *36*(3), pp.237-258.

Adler, P.A. and Adler, P. (1987). *Membership roles in field research* (Vol. 6). Sage: Thousand 36Oaks, CA.

Atkins, L. (2018). *Exploring teachers' professional development and digital literacy: a grounded theory study.* Available at: https://dora.dmu.ac.uk/bitstream/handle/2086/17158/Lucy%20Atkins%20Thesis.pdf?sequence=1 . (Date accessed: 12.5.2020)

Bazeley, P. (2007). Qualitative data analysis with NVivo. London, UK: SAGE.

Bickman, L., 1981. Some distinctions between basic and applied approaches. *Applied social psychology annual*.

Bickman, L., & Rog, D. (2009). Applied research design: A practical approach. In L. Bickman & D. Rog (Eds.), Handbook of applied social research methods (2nd ed., pp. 3–43). Thousand Oaks, CA: Sage.

Bigus, O. E., Hadden, S. C. and Glaser, B. G. (1994). "The study of basic social processes". In *More grounded theory methodology: A reader*, Edited by: Glaser, B. G. 38–64. Mill Valley, CA: Sociology Press.

Bingimlas, K.A. (2009). Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. *Eurasia Journal of Mathematics, science and technology education*, *5*(3), pp.235-245

Blumer, Herbert. (1969). *Symbolic interactionism: Perspective and method*. Berkeley: University of California Press.

Bogdan, Robert C. and Biklen, Sari Knopp (1982) Qualitative Research for Education: An Introduction to Theory and Methods, Boston and London: Allyn & Bacon Inc.

Bohm, David (1983) Wholeness and the Implicate Order, London and New York: Ark. Brooks, C. and Warren, W.P. (1967) Understanding Poetry, New York: Holt, RineHart and Wilson, third edition.

Bolander Laksov, K. (2018). 'Lessons learned: towards a framework for integration of theory and practice in academic development.' *International Journal for Academic Development.* London: Routledge.

Bonello, M. and Meehan, B. (2019). Transparency and coherence in a doctoral study case analysis: reflecting on the use of NVivo within a'Framework'approach. *The Qualitative Report*, *24*(3), pp.483-498.

Bringer, J., Johnston, L., & Brackenridge, C. (2004). Maximizing transparency in a doctoral R thesis: The complexities of writing about the use of QSR*NVIVO within a grounded theory study. *Qualitative Research*, 4(2), p, 247–265.

Brown, G. and Harris, L.R., (2018). Methods in feedback research. *Cambridge Handbook of Instructional Feedback*.

Cabrera, G.A. (2018). The use of computer applications in qualitative research: A review. *Asia Pacific Journal of Academic Research in Social Sciences*, *3*, pp.35-42.

Candela, A.G. (2019). Exploring the function of member checking. *The Qualitative Report*, *24*(3), pp.619-628.

Carter, S. and Henderson, L. (2005). Approaches to qualitative data collection in social science. *Handbook of health research methods: Investigation, Measurement And Analysis*, *1*, pp.215-230.

Chandra, Y. and Shang, L. (2019). Computer-Assisted Qualitative Research: An Overview. *Qualitative Research Using R: A Systematic Approach*, pp.21-31.

Charmaz, K. (1995). Grounded theory. In Rethinking methods in psychology. J. A. Smith, R. Harre and L. V. Langenhove. (eds.) London, Sage: 29-49.

Charmaz, K. (2006). Constructing grounded theory: A practical guide through qualitative analysis. London, England: Sage.

Charmaz, K. and Belgrave, L.L. (2007). Grounded theory. *The Blackwell encyclopedia of sociology*.

Charmaz, K. (2014) Constructing Grounded Theory. Second edition. London: Sage.

Charmaz, K. (2020). "With constructivist grounded theory you can't hide": Social justice research and critical inquiry in the public sphere. *Qualitative Inquiry*, *26*(2), pp.165-176.

Choo, C.W. (1996). The knowing organization: How organizations use information to construct meaning, create knowledge and make decisions. *International Journal of Information Management*, *16*(5), pp.329-340.

Clough, P., Nutbrown, C. (2012). *A Student's Guide to Methodology.* Sage Publications.

Cochran-Smith, M., & Lytle, S. (1999). Relationships of knowledge and practice: Teacher learning in communities. *Review of Research in Education*, 24, pp.249-305.

Cohen, L., Manion, L. and Morrison, K. (2011). *Research Methods in Education* (7thedition). London: Routledge.

Cook, T. *Foreword.* Found in: Hedrick, T.E., Bickman, L. and Rog, D.J. (1993). *Applied research design: A practical guide*. Sage Publications.

Corbin, J. and Strauss, A. (2008) Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory. Los Angeles: Sage Publications, Inc.

Corbin, J. and Strauss, A. (2015). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory* (4th ed). Sage Publications.

Creswell, J. W. (1998). Qualitative inquiry and research design: Choosing among five traditions. Thousand Oaks, CA: Sage

Creswell, J. W., & Miller, D. L. (2000). Getting good qualitative data to improve educational practice, *Theory Into Practice, 39*(3), 124-130.

Creswell, J.W. (2003). Research design : qualitative, quantitative, and mixed methods approaches 2nd ed., CA: Sage: Thousand Oaks.

Creswell, J. (2007). *Qualitative inquiry and research design: Choosing among five approaches*. (2nd ed). Sage publications.

Cresswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed method research* (2nd ed.). Thousand Oaks, CA: Sage.

Creswell, J.W. and Poth, C.N., (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

Cronbach, L. J. (1975) Beyond the two disciplines of scientific psychology. *American Psychologist*, 50, pp., 116-127.

Denzin, N. K. (1989). *Interpretive biography*. Newbury Park, CA: Sage.

Denzin, Norman K., and Yvonna S. Lincoln. (2003). Introduction. The discipline and practice of qualitative research. In *Collecting and interpreting qualitative materials*, ed. Norman K. Denzin and Yvonna S. Lincoln, 1–45. Thousand Oaks: SAGE Publications.

Denzin, N., & Lincoln, Y. (Eds.). (2005). Handbook of qualitative research (3rd ed.). Thousand Oaks, CA: Sage.

Dey, I. (1993). Qualitative data analysis: A user-friendly guide for social scientists. London, Routledge.

Dodgson, J. E. (2019). Reflexivity in qualitative research. *Journal of Human Lactation*, *35*(2), pp.220-222.

Draucker, C.B., Martsolf, D.S., Ross, R. and Rusk, T.B. (2007). Theoretical sampling and category development in grounded theory. *Qualitative health research*, *17*(8), pp.1137-1148.

Driscoll, D.L. (2011). Introduction to primary research: Observations, surveys, and interviews. *Writing spaces: Readings on writing*, *2*, pp.153-174.

Dunne, C. (2011). The place of the literature review in grounded theory research. *International journal of social research methodology*, *14*(2), pp.111-124.

Emerson, R.M. (1987). Four ways to improve the craft of fieldwork. *Journal of Contemporary Ethnography*, *16*(1), pp.69-89.

Emerson, R.M., Fretz, R.I. and Shaw, L.L. (1995). Writing ethnographic fieldnotes. Chicago guides to writing, editing. *and publishing. Chicago, IL: University of Chicago Press. Feld, S., & Brenneis, D.(2004). Doing anthropology in sound. American Ethnologist*, *31*(4), pp.461-474.

Emerson, R.M., Fretz, R.I. and Shaw, L.L. (2001). Participant observation and fieldnotes. *Handbook of ethnography*, pp.352-368.

Engward, H. (2013). Understanding grounded theory. *Nursing Standard (through 2013), 28*(7), p.37.

Erlandson, D.A., Harris, E. L., Skipper, B. L. & Allen, S. D. (1993). Doing naturalistic inquiry. A guide to methods. London: Sage.

Fleisher, M. L. (1989). Warehousing violence. London, Sage.

Fleury, J., Sidani, S., Melnyk, B. M., & Morrison-Beedy, D. (2018). Using theory to guide intervention research. *Intervention research: Designing, conducting, analyzing, and funding*, *2*, pp. 55-78.

Flick, U. ed. (2017). *The Sage handbook of qualitative data collection*. Sage.

Fontanella BJB, Ricas J, Turato ER. (2008). Amostragem por saturação em pesquisas qualitativas em saúde: contribuições teóricas. Cad Saúde Pública [online].(Available at: http://www.scielo.br/pdf/csp/v24n1/02.) (date accessed: 11.12.2021).

Fosnot CT. (1996). *Constructivism: Theory, Perspectives, and Practice*. Teachers College Press: New York.

Frels, R.K. and Onwuegbuzie, A.J. (2012). Interviewing the Interpretive Researcher: An Impressionist Tale. *Qualitative Report*, *17*, p.60.

Friese, S., (2019). *Grounded theory analysis and CAQDAS: A happy pairing or remodeling GT to QDA* (pp. 282-313). SAGE Publications: London, UK.

Geertz, C. (1983) *Local knowledge: Further essays in interpretive anthropology.* New York: Basic Books.

Glaser, B. G., Strauss, A.L. (1967). *The discovery of grounded theory: Strategies for qualitative research.* New York: Aldine de Gruyter.

Glaser, B.G. (1978). *Theoretical sensitivity.* California, The Sociology Press.

Glaser, B. G., Holton, J., Strauss, A. L., Legewie, H., Schervier-Legewie, B., & Corbin, J. (2007). *Grounded theory reader*. Zentrum f. Histor. Sozialforschung.

Glaser, B., Bailyn, L., Fernandez, W., Holton, J.A. and Levina, N. (2013). What Grounded Theory Is. *Academy of Management Proceedings* (Vol. 2013, No.1). NY: Academy of Management.

Glesne, C. & Peshkin, A. (1992). Becoming qualitative researchers: An introduction. White Plains, NY: Longman.

Guba, E. G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Communication and Technology Journal, 29*(2), 75-91.

Guba, E. G., & Lincoln, Y. S. (1989) *Fourth generation evaluation*. Thousand Oaks, CA: Sage.

Guba, E.G. (1990). The paradigm dialog. In *Alternative Paradigms Conference, Mar, 1989, Indiana U, School of Education, San Francisco, CA, US*. Sage Publications, Inc.

Guest, G., Namey, E.E. and Mitchell, M.L. (2013). Qualitative research: Defining and designing. *Collecting qualitative data*, pp.1-40.

Gupta, A. and Ferguson, J. (1997). Discipline and practice:'The field'as site, method, and location in anthropology. *Anthropological locations: Boundaries and grounds of a field science*, *100*, pp.1-47

Hammersley, M. (2012) Methodological Paradigms in Educational Research. British Educational Research Association [online] Available from: https://www.bera.ac.uk/researchers-resources/publications/methodological-paradigms-ineducational-research [Date accessed 14/01/2020]

Haraway, D. (2020). Situated knowledges: The science question in feminism and the privilege of partial perspective. In *Feminist theory reader*. pp. 303-310) Routledge.

Harrison, H., Birks, M., Franklin, R., Mills, J. (2017*). Case Study Research: Foundations and Methodological Orientations*. Available at: http://www.qualitative-research.net/index.php/fqs/article/view/2655/4079#gref.Date accessed: 16.5.2019

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*(1), 81-112.

Henwood, K.L. and Pidgeon, N.F. (1992). Qualitative research and psychological theorizing. *British journal of psychology*, *83*(1), pp.97-111.

Hoon, A., Oliver, E., Szpakowska, K., & Newton, P. (2015). Use of the 'Stop, Start, Continue'method is associated with the production of constructive qualitative feedback by students in higher education. *Assessment & Evaluation in Higher Education*, *40*(5), 755-767.

Jackson, K. and Bazeley, P. (2019). *Qualitative data analysis with NVivo*. Sage.

Jorgensen, U. (2001). Grounded theory: Methodology and theory construction. *International encyclopedia of the social & behavioral sciences*, *1*, pp.6396-6399.

Kant, I. (1949) *Prolegomena*, (P. Carus, Ed.). La Salle, 111.: Open Court Publishing Co.

Kappalumakkel, T. (2018) Sohar: *Empowering Teachers and Learners through Action Research.* North Batinah Nursing Institute.

Kelly, R. (2017). The effective use of qualitative methods in establishing best practices in an academic bridge program.

Kivunja, C. and Kuyini, A.B. (2017). Understanding and applying research paradigms in educational contexts. *International Journal of higher education*, *6*(5), pp.26-41.

Koshy, V. (2010). Action Research for Improving Educational Practice. London: Sage.
Krauss, S. E. (2005). Research paradigms and meaning making: A primer. *The Qualitative Report, 10*(4), 758-770.

Kothari, C. R. (2004). Research Methodology. 2nd Ed. New Delhi: New Age International Limited Publishers.

Kuhn, T. (1996) The Structure of Scientific Revolutions. 3rd Edition. Chicago: The University of Chicago Press.

Kuhn, T.S. (1970) The Structure of Scientific Revolutions, 2nd edn, International Encyclopedia of Unified Science, enlarged, first published 1962 (The University of Chicago Press

Kyale, S. (2007). Contradictions of assessment for learning in Institutions of Higher Education. *D. Boud, & N. Falchikov, Rethinking Assessment in Higher Education, Learning for the Longer Term. Nueva York: Routledge*.

Lather, P. (1986). Research as praxis. *Harvard educational review*, *56*(3), pp.257-278.

Lauriala, A. (2013), "Chapter 27: Changes in Research Paradigms and their Impact on Teachers and Teacher Education: A Finnish Case", Craig, C.J., Meijer, P.C. and Broeckmans, J. (Ed.) *From Teacher Thinking to Teachers and Teaching: The Evolution of a Research Community* (*Advances in Research on Teaching, Vol. 19*), Emerald Group Publishing Limited, Bingley, pp. 569-595.

Lave, J., & Kvale, S. (1995). What is anthropological research? An interview with Jean Lave by Steinar Kvale. *Qualitative Studies in Education*, *8*, 219-228.

Leech, N.L. and Onwuegbuzie, A.J. (2011) Beyond Constant Comparison Qualitative Data Analysis: Using NVivo. School Psychology Quarterly, vol.26 (1), pp. 70 – 84.

Li, S., Easterby-Smith, M., & Bartunek, J. (2009). Research methods for organizational learning: The transatlantic gap. *Management Learning*, *40*(4), 439-447.

Ligita, T., Nurjannah, I., Wicking, K., Harvey, N. and Francis, K. (2020). From textual to visual: the use of concept mapping as an analytical tool in a grounded theory study. *Qualitative Research*, p.1468794120965362.

Lincoln, Y. S., & Guba, E. G. (1985) *Naturalistic inquiry*. Thousand Oaks, CA: Sage.

Lincoln, Y. S., & Guba, E. G. (1986) But is it rigorous? Trustworthiness and authenticity in naturalistic evaluation. In *New directions for program evaluation* (Vol. 30, pp. 73-84). San Francisco, CA: Jossey-Bass.

Lingard, L., Albert, M., & Levinson, W. (2008). Grounded theory, mixed methods, and action research. *Bmj*, *337*.

Lipnevich, A. A., Berg, D. A., & Smith, J. K. (2016). Toward a model of student response to feedback. *Handbook of human and social conditions in assessment*, 169-185.

Lofland, J. and Lofland, L.H. (1995). Developing analysis. *Analyzing social setting*, pp.183-203.

Magoon, A.J., (1977). Constructivist approaches in educational research. *Review of educational research*, *47*(4), pp.651-693.

Malterud, K. (2001). Qualitative research: standards, challenges, and guidelines. *The lancet*, *358*(9280), pp. 483-488.

Manning, K. (1997). Authenticity in constructivist inquiry: Methodological considerations without prescription. *Qualitative Inquiry*, *3*(1), 93-116.

Maxwell, J. A. (2005). *Qualitative research design: An interactive approach* (2nd ed.). Thousand Oaks, CA: Sage.

Maykut, P., & Morehouse, R. (1994). The qualitative posture: Indwelling. In P. S. Mayku

Mays, N., & Pope, C. (2000). Assessing quality in qualitative research. *Qualitative research in health care*, *320*, 50-52 .

Mehan, H. (1974). Accomplishing classroom lessons. In A. V. Cicourel, et al., Language use and school performance. New York: Academic Press.

Mills, J., Bonner, A. and Francis, K. (2006). The development of constructivist grounded theory. *International journal of qualitative methods*, *5*(1), pp.25-35.

Mir, R. and Watson, A. (2000). Strategic management and the philosophy of science: The case for a constructivist methodology. *Strategic management journal*, *21*(9), pp.941-953.

Mojtahed, R., Nunes, M.B., Martins, J.T. and Peng, A. (2014). Equipping the Constructivist Researcher: The Combined use of Semi-Structured Interviews and Decision-Making maps. *Electronic Journal of Business Research Methods*, *12*(2), pp.pp87-95.

Mortari, L., (2015). Reflectivity in research practice: An overview of different perspectives. *International Journal of Qualitative Methods*, *14*(5), p.1609406915618045.

Muhr, T. (1997). ATLAS.ti. Visual qualitative data analysis management model building (Version 4.1) [Computer software]. Berlin: Scientific Software Development

Nagel, T. (1986). *The view from nowhere.* New York: Oxford University Press.

Nascimento, L.D.C.N., Souza, T.V.D., Oliveira, I.C.D.S., Moraes, J.R.M.M.D., Aguiar, R.C.B.D. and Silva, L.F.D. (2018). Theoretical saturation in qualitative research: an experience report in interview with schoolchildren. *Revista brasileira de enfermagem*, *71*, pp.228-233.

Niedbalski, J. and Ślęzak, I. (2018). The Main Features of Nvivo Software and the Procedures of the Grounded Theory Methodology: How to Implement Studies Based on GT Using CAQDAS. In *World Conference on Qualitative Research* (pp. 90-101). Springer, Cham.

Nolan M.R., Hanson E., Magnusson L. & Andersson B. (2003) Gauging quality in constructivist research: the Aldre Vast Sjuharad model revisited. Quality in Ageing 4(2), pp.22–27

Novak, J. (2004). Concept maps and how to use them. *Insight 6 (2).* pp.15-16.

O'Keefe, D. J. (1975). Logical Empiricism and the Study of Human Communication. *Communications Monographs.* 42(3), pp. 169-183.

Osborne, J. F. (1996). Beyond constructivism. *Science education*, *80*(1), 53-82.

Palinkas, L.A., Horwitz, S.M., Green, C.A., Wisdom, J.P., Duan, N. and Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and policy in mental health and mental health services research*, *42*(5), pp.533-544.

Parkin, P. (2009) *Managing change in healthcare: Using action research. SAGE Publications Ltd.* Available at: https://sk.sagepub.com/books/managing-change-in-healthcare. Date accessed: 12.6.2019

Patton, M. (1990). Qualitative research and evaluation methods. London, Sage.

Patton, M. (2002). Qualitative research and evaluation methods (3rd ed.). Thousand Oaks, CA: Sage.

Peredaryenko, M.S. and Krauss, S.E., 2013. Calibrating the human instrument: Understanding the interviewing experience of novice qualitative researchers. *The qualitative report*, *18*(43), p.1.

Pickard, A. (2002). *Access to electronic information resources: Their role in the provision of learning opportunities for young people. A constructivist inquiry* (Doctoral dissertation, University of Northumbria).

Pickard, A. (2013). 'Action Research.' *Research Methods in Information, 2nd edition*. Facet Publishing.

Polizzi, G. (2020). Digital literacy and the national curriculum for England: Learning from how the experts engage with and evaluate online content. *Computers & Education*, *152*, p.103859.

Primeau, L.A., 2003. Reflections on self in qualitative research: Stories of family. *American Journal of Occupational Therapy*, *57*(1), pp.9-16.

Reason, P. (1981). Issues of validity in new paradigm research. In P. Reason & J. Rowan (Eds.), *Human Inquiry* (pp. 239-250). New York, NY: Wiley.

Rennie, D. L (1994). Human science and counselling psychology: Closing the gap between research and practice. *Counselling Psychology Quarterly, 7*, 235-250.

Richards, L. (2009). Handling qualitative data: A practical guide (2nd ed.). Thousand Oaks, CA: Sage

Ritchie J, Spencer E. Qualitative data analysis for applied policy research. In, Bryman A, Burgess RG, eds. Analyzing Qualitative Data. London: Routledge; (1994).

Rodwell, M. K. (1998) *Social work constructivist research*. New York, NY: Garland Publishing.

Salmona, M., & Kaczynski, D. (2016). Don't blame the software: Using qualitative data analysis software successfully in doctoral research. In *Forum: Qualitative Social Research* (Vol. 17, No. 3, pp. 42-64). Freie Universität Berlin.

Sánchez-Cruzado, C., Santiago Campión, R. and Sánchez-Compaña, M.T. (2021). Teacher digital literacy: The indisputable challenge after COVID-19. *Sustainability*, *13*(4), p.1858.

Sands, R. G. (2004). Narrative analysis: A feminist approach. In D. K. Padgett (Ed.), *The qualitative research experience* (pp. 48-75). Belmont, CA: Thompson/Brooks/Cole.

Sbaraini, A., Carter, S.M., Evans, R.W. and Blinkhorn, A. (2011). How to do a grounded theory study: a worked example of a study of dental practices. *BMC medical research methodology*, *11*(1), pp.1-10.

Schneider, K. J. (1999). Multiple-case depth research. *Journal of Clinical Psychology*, *55*(12), 1531-1540.

Schwandt, T.A. (1994). Constructivist, interpretivist approaches to human inquiry. *Handbook of qualitative research*, *1*, pp.118-137.

Schwandt, T.A. (1998). Constructivist, interpretivist approaches to human inquiry. In N.K. Denzin& Y.S. Lincoln (Eds.), *The landscape of qualitative research theories and issues.* (pp. 221 -259). Thousand Oaks, CA: Sage.

Sevilla, C. (2007). Research Methods: Philippines: Rex Printing Company, INC.

Shannon, P., & Hambacher, E. (2014). Authenticity in Constructivist Inquiry: Assessing an Elusive Construct. *Qualitative Report*, *19*(52).

Silverman (1997) *Qualitative research: theory, method and practice.* SAGE Publications.

Slettebø, T. (2021). Participant validation: Exploring a contested tool in qualitative research. *Qualitative Social Work*, *20*(5), pp.1223-1238.

Snow, D., Morrill, C. Anderson, L. (2003). Elaborating analytic ethnography: Linking fieldwork and theory. *Ethnography*, *4*(2), pp.181-200.

Spivey, N. N. (1995). Written discourse: A constructivist perspective.

Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, CA: Sage.

Stenhouse, L. (1984). Library access, library use, and user education in academic sixth forms: An autobiographical account. The research process in educational settings: Ten Case Studies. R. G. Burgess. London, Falmer Press.

Strauss, A.L. (1987). *Qualitative analysis for social scientists*. Cambridge university press.

Strauss, Anselm L., and Juliette M. Corbin. (1998). *Basics of qualitative research. Techniques and procedures for developing grounded theory*. 2nd ed. Thousand Oaks: Sage Publications.

Stringer (1999) *Action Research.* Thousand Oaks, California: Sage Publications Ltd.

Stringer (2014) *Action Research, 4th Edition.* Thousand Oaks, California: Sage Publications Ltd.

Tagg, S. K. (1985). Life story interviews and their interpretation. In The research interview: Uses and approaches. M. Brenner, J. Brown and D. Canter. [eds.] New York, Academic Press: 56-78

Telio, S., Regehr, G., and Ajjawi, R. (2016). Feedback and the Educational Alliance: Examining Credibility Judgements and Their Consequences. *Medical Education* 50(9) pp.933-42.

Tessier, S. (2012). From fieldnotes, to transcripts, to tape recordings: Evolution or combination?. *International Journal of Qualitative Methods*, *11*(4), pp.446-460.

Thornberg, R. and Dunne, C. (2019). Literature review in grounded theory. *The Sage handbook of current developments in grounded theory*, pp.206-221.

Tisdall, K., Davis, J and Gallagher, M. (2008). *Researching with Children and Young People: Research Design, Methods and Analysis.* SAGE Publications Ltd.

Urquhart, L, Rees., C., Ker, J. (2004). Making sense of feedback experiences: a multi-school study of medical students' narratives. *Med Educ* 48 (2). pp. 189– 203.

Van Rijnsoever, F.J., 2017. (I can't get no) saturation: a simulation and guidelines for sample sizes in qualitative research. *PloS one*, *12*(7), p.e0181689.

Von Glaserfield E. (1995). A constructivist approach to teaching. *Constructivism in Education*. Erlbaum: Hillsdale, NJ; 3–16.

Wacquant, L., 2002. Scrutinizing the street: Poverty, morality, and the pitfalls of urban ethnography. *American journal of sociology*, *107*(6), pp.1468-1532.

Weick, K. E. (1989). Theory construction as disciplined imagination. *Academy of management review*, *14*(4), 516-531.

Wilson, C. B., & Clissett, P. (2011). Involving older people in research: practical considerations when using the authenticity criteria in constructivist inquiry. *Journal of Advanced Nursing*, *67*(3), pp. 677-686.

Winter, G. (2000). A comparative discussion of the notion of validity in qualitative and quantitative research. *The Qualitative Report*, *4*(3&4).

Yin, R. K. (2014). *Case study research: Design and methods* (5th ed.) Thousand Oaks, CA:

4. Chapter Four: Interview Findings

4.1 Introduction

This chapter consists of the findings from the three rounds of thirty-three individual interviews (Phase 1) with practising primary school teachers, feedback from thirty-five third year Primary Education (BA) students from Northumbria University on the six intervention sessions and evaluations from three practising primary school teachers. The interviews and interventions were classed as separate phases of the study (shown in Methodology: 3.4 Research Model).

The aim of the interviews was to provide 'highly specific information related to the aims of this study" (Patton, 2015), which in this study was a thick description of the thirty-three practising primary school teachers and their context, which was then interpreted by the researcher.

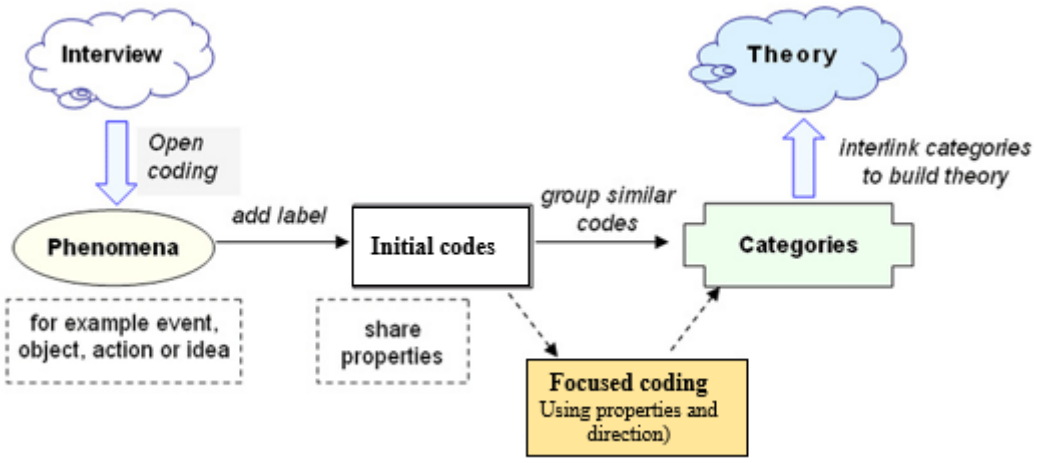


Figure 4.1 *Coding steps in grounded theory (adapted from Strauss and& Corbin, 1998)*

This method of analysis was chosen as a way of discovering a theory and explain this from the data collected. The interviews aimed to answer the second research question:

What are the information skills needs of primary school teachers to support DL in the classroom?

To do so, aimed:

1. To gain an insight into practising PSTs' perceptions and experiences with digital literacy to determine current digital literacy skills levels.

2. To determine the digital literacy developmental skills requirements of primary school teachers.

3. To use the determined developmental skills requirements to create a training curriculum framework to support digital literacy in the classroom.

The interviews provided a perspective on the behaviour of teachers and was useful in practical applications to guide and provide information for designing a training framework and to support further research.

There were three rounds of interviews undertaken during this research. Round 1 was completed prior to the pandemic outbreak and aimed to provide information about the current state of practising teachers' DL skills and their experiences with DL in the classroom. Round 2 took place during the first UK lockdown and aimed to show the changes in teachers' DL skills and experiences impacted by the pandemic and was used in comparison to the first round of interviews. The third round of interviews took place during the reopening of schools after the first lockdown and aimed to highlight a further impact on DL skills and experiences as the situation of teaching practice had changed once more.

4.1.1 Initial coding

With each transcript, a coding key was created by indicators; "based on common responses to the interview questions and repeated use of terms" (Townsend, 2017). The analysis process continued as the ideas, similarities and differences were then grouped together to form categories and subcategories. After the coded categories had been identified through "systematic, line-by-line analysis" (Engler, 2021). An extensive list of the collected indicators from the three rounds of interviews can be seen in *Table 4.1*.

This process entails close examination of the data, breaking it down into parts, making comparisons and questioning (Feeler, 2012). The identified parts of the data collected, and the resulting data from the process of breaking the data down, are defined as 'indicators.' An example of this in the transcripts, is that many teachers identified the abstract concept of technology as an important factor in DL skills. Most teachers talked about virtual platforms and using digital devices, which are important indicators, and much more tangible than the concept of technology. Breaking down the concept of technology into parts enabled the opportunity for discussion. Practising teachers were then asked about the accessibility and availability of technology in their schools, their uses of technology in the classroom and whether they were confident in using technology professionally.

Adapt	Administration	Assessment	Attendance
Behind the screen	broken	Clear guidelines	computing curriculum
Confidence	could be better	creative	cross-curricular
Cyberbullying	data	database	desktops
Digital Strategy for Schools	don't work	Email	engagement
Experience	exploration	Exposure	external training
fake news	flexibility	Functional skills	Funding
Google	ICT	implementation	information
Internet	internet safety	Ipads	Keyboards
laptops	learning from others	links	Microsoft office
new cultures	no interest	Online	online teaching
personal	PowerPoint	Presenting	professional
Reflection	Research	Safeguarding	school support
software	student engagement	teacher engagement	teacher engagement
time limitations	times tables rock stars	tracking	understanding
updating	use of technology	Virtual	virtual reality
Websites	WhatsApp	Word	world wide web
Adapt	Administration	Assessment	Attendance
Behind the screen	broken	Clear guidelines	computing curriculum
Confidence	could be better	creative	cross-curricular
Cyberbullying	data	database	desktops
Digital Strategy for Schools	don't work	Email	engagement

Table 4.1 *List of initial indicators and concepts from the interviews*

The identification of indicators and concepts is an analytic process. This process is supported by the comparing and contrasting of indicators and concepts, which often leads to the re-

grouping of indicators, resulting in more beneficial concepts, the objective of which is to form categories, and ultimately themes (Feeler, 2012).

4.1.1.1 Memo writing

Memo writing is an important part of the intimal coding process, used to encourage reflection through "calling into question the efficacy of the concept and both to reveal a more appropriate concept and to move the researcher toward more abstract and theoretical thinking" (Feeler, 2012). As mentioned in the initial coding analysis, technology was a popular concept, although too generalised to form any theoretical understanding. It was noted that some teachers mentioned technology in both physical and digital forms, and the term was the most relative when giving perceptions of DL. Technology was mentioned in more of a passive state; more about the potential uses of technology rather than the actual implementation of technology into the classroom. Some teachers spoke of the importance of children using technological skills yet never gave them the opportunity to use them during lessons.

Memo: 22. 11.2019

Technology- most think digital literacy is connected to technology- devices, etc. Lots of comments about how important it is yet can't use it because of time, funding, lack of confidence and access to devices. Teacher 1 agrees that they think using technology is a tool for the future yet rarely gets to use it in their lessons because don't have enough resources and they are old so doesn't have time for them in case they break down during lesson. May want to use technology but it's available or scheduled. What do they mean by technology? Simply devices? Or are the extending it into other areas, such as communications, etc? Uses of technology- if there isn't an availability how can it be used in the classroom? Is a better concept functional skills? - being able to use technology effectively. How can it be used effectively without training and practice?

4.1.2 Focused coding

'The purpose of focused coding is to weave together the threads of data that emerged through the initial coding process' (Scott, 2004). The process brings a higher level of abstraction to the analysis in which relationships between the categories are developed (Scott, 2004). The list of initial indicators and concepts from the interviews (shown in *Table 4.1*)

were grouped into categories of terms with similar meanings or had similar relationships. The tree below shows the relationships between the categories and subcategories presented in this study:

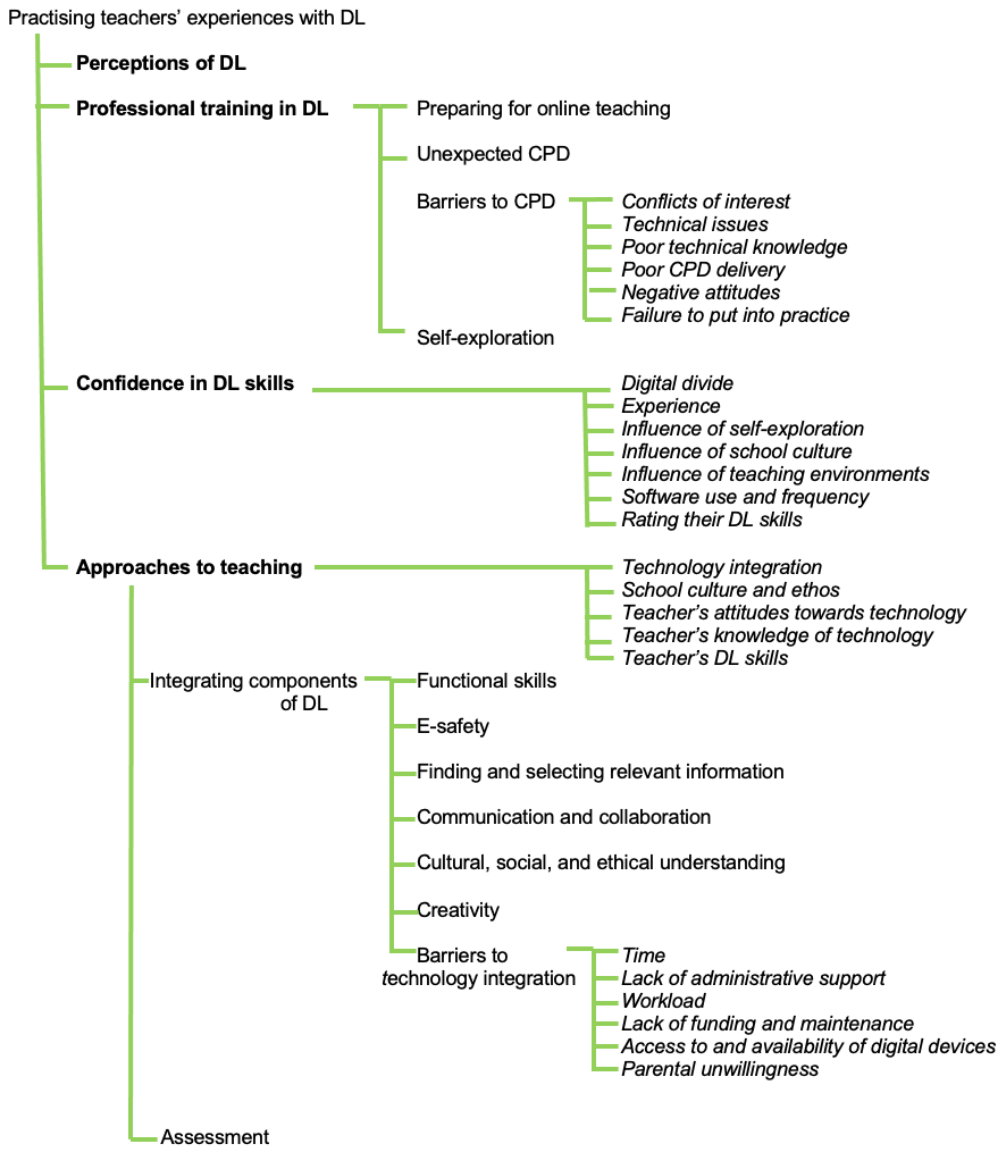


Figure 4.2 *Relationships between the categories and subcategories from teachers' digital literacy skills.*

4.2 Practising teachers' experiences with digital literacy

The interviews showed that the participants appeared to be quite familiar with technology, as they are integrated into their own everyday practices, such as entertainment

(YouTube, Netflix, Gaming), communication (social networking: Instagram, Facebook, Messenger) and even engaging in digital games (e.g. Call of Duty, FIFA) (Tzifopoulos, 2020). In the UK today, using digital learning tools is relatively common and considered to be natural. Although this interaction with technology is common at home, prior to lockdown it was not used much in a school environment (Koutsogiannis, 2007; Koutsogiannis, 2011; Marsh, 2010). It may be suggested that using technology outside of school and the normalisation of it in teachers' and students' daily life may have taught students bad habits and can "deprive them of the privileges they could gain if they used technology in the school class" (Tzifopoulos, 2020). Now, by integrating technology into teaching due to the closure of schools, with more exposure to using technology in an educational context and more formally, students may be guided to use technology more efficiently, effectively and to its full potential. Teachers need to receive professional training in the skillsets children need to be taught, and in which way, so that their habits will come from a formal source so that their skillset will be more applicable to a more formal setting.

4.2.1 Perceptions of digital literacy

In the first round of interviews, teachers were asked to give their own definition of the phrase 'digital literacy,' to give the researcher a foundation of their own understanding. Only one of the participants stated they were "unfamiliar with this phrase" (Teacher 28). Initially, when asking the practising teachers what their understanding of DL was there were a myriad of answers which had commonalties and differences. Just as the definition varies by source, with no agreed definition, scholars often agree that DL encompasses a variety of skills: "I would say it's a very broad thing" (Teacher 10).

A word cloud analysis of the responses from the first round of interviews was used as "a useful way to consider the key themes that arose from the questions asked' (Casselden, 2016). The word cloud is a visual representation of the word frequency, the more common the word, the larger it appears in the image generated and therefore 'illustrates the importance of a theme'(Casselden, 2016).

Figure 4.3 *Word cloud to show key themes arising from teachers' perceptions of digital literacy*

This visual representation of the analysis shows that the most dominant themes were 'ICT' (Information Communication Technology) and 'computers' This may suggest that the most common perception of DL relates most to 'digital' focusing on digital devices and the use of functional skills with these. 31/33 teachers understood that DL means to use technology appropriately and effectively:

"DL is being able to use multimedia; your phone, PC, C-Touch, in that you can use them effectively to teach."

(Teacher 1)

The teachers suggested that digital literacy related to technological efficiency; digital competence and fluency with functional technological skills, placing an emphasis on the meaning of 'digital:'

"I think it's having a good awareness of the facilities you can use on the computers and any sort of technology."

(Teacher 11).

"I would say it's how competent you are using IT."

(Teacher 12).

"It is about being competent with anything involved with the digital world."

(Teacher 24).

"How you learn to and understand work on any digital platform and developing and learning new skills as the digital world changes."

(Teacher 23).

"It is fluency and competency on computers, tablets, the internet and Smartphones."

(Teacher 29).

There were acknowledgements not only of the term 'digital' but also of its relationship to 'literacy:' Teachers discussed their understanding of literacy to meaning knowledge and understanding of information in any context; in this case being digital platforms:

"Digital involves the use of technology and literacy means to read and write, so I understand it to mean reading and writing using technology."

(Teacher 4).

Reflecting on this comment, breaking down the meaning of literacy, one understands that reading involves the understanding of information and writing involves the transfer of information and knowledge.

"It is like any kind of literacy. It is about being able to read and understand things to be able to move to the next level."

(Teacher 5).

As in literature, there were suggestions that the 'next level' involves technology:

"It is about being literate with technology."

(Teacher 8).

"The knowledge and ability to use digital devices now and in the future."

(Teacher 22).

In this further expansion of the meaning of literacy shows the multitude of skills involved, and those teachers whose understanding had centred on functional skills and a greater

emphasis on digital, expanded their own definitions to include being literate with other components of DL:

"It's how competent you are using technology and ICT and being aware of and understanding e-safety."

(Teacher 14).

"It's teaching children key skills that they need to understand ICT skills, like software but also sort of having an awareness of the Internet and how to use the programs responsibly as well."

(Teacher 15).

"It's children's ability to interact with communication aids and digital software to support their learning and development skills in those areas to support learning across the curriculum."

(Teacher 16).

In discussing components, some participants went into the specifics of functional skills:

"DL is basically computing literacy and teaching the students to use technology and using Microsoft Word, etc. Also using any form of multimedia such as phone, digital tv, C-Touch and other technologies effectively."

(Teacher 1).

There was also a heavy emphasis on the importance of e-safety and ensuring children are educated in how to be safe and secure online. Issues of privacy, security and cyberbullying should be acknowledged and mitigated.

"Using digital devices safely to explore the internet and things."

(Teacher 14).

"DL is about using technology effectively. To be able to understand something you need to know how to use it safely."

(Teacher 19).

"Children need to be able to use technology and use it safely and effectively."

(Teacher 26).

Teachers noted that E-safety is also related to being able to find and select relevant information and knowing how to pass on information safely. This teaching needs to be constantly developed to meet the evolution of social platforms and as new security issues arise. Using DL skills provides knowledge and understanding of safety when accessing digitalised information:

"Having the skills to access computers so things like being able to search effectively, being able to use different software and programs to create some kind of work or output. Not so much the computer science side of things but more the general skills that can be applied across different jobs and things like that."

(Teacher 17).

There were discussions about how teachers communicated both personally and professionally using technology in the transfer of information.

"DL for me is a way of communicating through different forms of technology. It is something I do daily on a personal and professional basis."

(Teacher 5).

All teachers spoke about their use of social media, emails, and FaceTime as methods of communication and collaboration and their understanding that their ability to use these platforms had come through training and practice:

"We use Twitter, Facebook and Instagram"

(Teacher 10).

"I'm used to using social media personally, so I know how to use it for school."

(Teacher 7).

However, there were mentions that although their schools used social media and their websites as a method of communication, it was often certain members of staff, such as admin, who were responsible for this.

"We have Twitter and Facebook accounts, but it is up to the school admin to upload stuff on there."

(Teacher 4).

There was an understanding that DL meant being able to communicate with the global community providing the opportunity to make links between school learning and popular culture. The impact of COVID-19 was that teachers had little choice other than to use online communication and collaboration, giving them greater use and experience of social platforms, such as Zoom and Microsoft Teams, etc.

"I never had the need to use any online programs for meetings until COVID-19. Now I know more about how we can communicate online and how good it is."

(Teacher 27).

There were also mentions of a relationship between DL and digital citizenship, as a digital citizen has mastered of the components thereof:

"It's digital citizenship, it is a combination of e-safety (privacy and security and also cyberbullying), communication, finding and using information, understanding digital footprints and identity. It is being literate in the digital community."

(Teacher 6).

These answers show that although the practising teachers placed an emphasis on the relationship between DL and functional skills, there was still an understanding that DL is an umbrella of individual components.

As teachers became more exposed to technology in an educational setting, during and after lockdown, their knowledge of and use of DL skills increased and improved dramatically.

"I now understand that before I'd said: "I didn't know what I didn't know," and that became apparent when schools closed. I do know more now but I've realised I probably don't really know how much more I need to know, it seems like what I know is a small part of such a bigger picture that I'm now aware of."

(Teacher 3).

"The knowledge I had is less significant than I thought."

(Teacher 8)

4.2.2 Professional training in digital literacy

From the initial interviews, it was interesting to find that it was not the less experienced teachers that had received training during their teacher training about the incorporation of digital resources professionally but the more experienced teachers. Those with more teaching experience had received training when there was huge funding placed into state schools when technology was first introduced into schools:

"I was an ICT coordinator at my school in the early 2000s when we received funding to set up an ICT suite and then Durham County Council provided us with a manual about involving technology in teaching."

(Teacher 5).

"We started off with the Promethean boards. We were in a pilot scheme for that when the first came out and we trialled them."

(Teacher 6).

"No, I didn't get any training at uni."

(Teacher 9).

Findings indicated the younger and less experienced teachers felt that their digital training was through exploration, or asking those more experienced teachers for help and advice:

"We didn't get a lot of training from outside, we've kind of just been left to it."

(Teacher 6).

"I haven't had any training but just have a go on different software myself."

(Teacher 7).

"From my experience in school, we haven't been trained well enough, if at all"

(Teacher 9)

"I'd say it's pretty much self-taught."

(Teacher 10).

"I had conversations with staff and asked them about how to use certain things and asked them what kind of things they've used them for."

(Teacher 11).

"Teaching myself messing around, and that's mainly it."

(Teacher 12).

"It was all self-taught. There was nothing specific at all"

(Teacher 26).

As well as, seeking advice from more experienced colleagues they also seek training from watching videos and tutorials and looking at instructions online:

"I taught myself by messing around, and that's mainly it I suppose it starts when you're a teenager and you get your first phone and then you pick up on software such as like IOS Apple then yeah, move onto an iPad which runs pretty much the same way."

(Teacher 12).

Some of the teachers showed initiative in their self-training:

"I find out about them and then looking for them online or at conferences for help and then kinda teaching myself."

(Teacher 12).

The lack of professional training and expectation of self-teaching was more common prior to COVID-19. As technology becomes more prominent, "with COVID, we've had no choice but to become digital" (Teacher 3), one would expect that teachers would receive extensive training in these new teaching methods, but this study showed that practising teachers had received "some basic training" (Teacher 22) during their teacher training but in-depth knowledge and understanding was not readily available, even in digital incorporation modules.

"In lockdown, if I wasn't sure I'd ask my colleagues for advice…I find a lot of useful stuff on YouTube or just searching generally."

(Teacher 11).

"I was shown how to use different software but not really how to apply it in lessons or how to teach children to use it effectively."

(Teacher 27).

Relating to Prensky (2001) theory of 'digital natives;' in that the 'younger generation has grown up with technology, making them more comfortable with digital technology' (Lei, 2009), the teachers deliberated the expectation that teachers possess an understanding of technology without proper training:

"I can use it at home but that doesn't mean you can adapt it to suit your lessons."

(Teacher 3).

"Everyone is expected to know what to do with technology because it's everywhere."

(Teacher 19).

One teacher mentioned that they had entered a school using equipment that was new to them, yet they were expected to learn how to use them by themselves:

"I haven't had any training in using BeeBots but they might have before I joined the school as they're quite old. So perhaps some initial training but no one has had a refresher."

(Teacher 1).

In contrast, there is a misconception that the older generation are less familiar with technology and are referred to as 'digital immigrants' (Prensky, 2001) This misconception was proved in this study, as it was older and more experienced teachers that had received more training, prior to lockdown, when technology was first introduced and became a bigger part of schools and made them feel more digitally confident. Therefore, this study showed that it was these teachers who felt more confident in how to apply technology into their teaching:

"All staff had to have training provided by the County to be able to incorporate the use of technology in the classroom."

(Teacher 4).

There was a heavy focus on the benefits of using technology in education in the hopes of improving school standards. Teacher 6 explained that County Durham distributed an ICT

training manual and basic training sessions to all schools in the district, courtesy of the available budget:

"It was a new strategy, so we were guided with instructions and training, just like we as teachers do, you give the children the knowledge and try to guide them into understanding in the hope they'll go on to be able to do it themselves"

(Teacher 18).

Teachers discussed how there had been a huge gap in training since the introduction of technology into schools and the impact of COVID-19 has placed a greater emphasis that more money needed to be invested into ICT prior to the pandemic:

"We had some input from County, but obviously it's all cost and so there isn't always enough to pay."

(Teacher 6).

Schools were only given notice about the closing of schools two days before and had to find strategies for teaching remotely. There were difficulties with accessibility and membership, and when schools decided that they were going to invest in online learning platforms there were difficulties with staff and students being able to use them effectively when no training had been provided. Therefore, a lack of previous professional training affected teacher's ability to teach using digital platforms:

"We've had to set up instructions on our school website for using Class Dojo because parents and children were really struggling."

(Teacher 19).

"Our Computing Lead sent out emails with instructions and links to search engines and YouTube about how to use Microsoft Teams."

(Teacher 23).

"It was difficult to prepare as we had to arrange for paper homework packs as we didn't have many online platforms at school for home use."

(Teacher 26).

It became apparent that if funding in technology and DL training had been continually developed and available, the crisis of online learning for primary schools may not have been as significant. Many schools tried to rectify this mistake in starting to prepare staff and students for foreseeable closures by signing up for memberships in a variety of software and introducing it into computing lessons and during Continuous Professional Development (CPD):

"I've started training our staff in the use of Google Classroom in case they need to know how to do pre-recorded and live video teaching. When children return, they will also be given lessons."

(Teacher 13).

Learning using digital resources depends on how teachers use them; effectively or not. COVID-19 has emphasised that schools ought not to assume that teaching staff are ready to operate technology and transfer digital skills from the outset (Melhuish & Falloon, 2010) but should actively create adequate opportunities for professional development. Technology integration is determined by the attitude of the teachers and there is often a lack of desire and confidence due to inadequate training, a shortage of technical support, time constraints and the absence of a policy related to the knowledge and understanding of the components of DL:

"We don't have the time to risk using certain technologies because it takes time to get to know how to use them and when to use them."

(Teacher 22).

"I've never really needed to teach using technology and because I haven't been shown how to and don't really like to, I don't."

(Techer 24).

"I struggled loads because I've never really done it and then wham! You've got to. It was not easy and caused us loads of issues as a school too because the Headteacher hadn't really encouraged us before. It meant trying to get training in a very short space of time."

(Teacher 24).

Some teachers discussed how their schools sought out the exploration and accompaniment of technology in their practises, usually when they had invested in certain devices or software. This inspired the confidence to implement the use of these into the classroom. However, there

was an acknowledgement that without generalised training in basic DL skills, there had been a 'gap,' especially before the closure of schools, which led to feelings of uncertainty:

"We've received training from CEO of Animate 2 Educate (Martin Bailey) and that was interesting, looking at green screen and purple mash and stuff like that. It makes you want to use it."

(Teacher 12).

"We mainly had training from school in subscribed software."

(Teacher 12).

"We've had some training in specific software but it's only for that one. It doesn't help if you're not using it because it's too specific and not transferrable. I want the basics too."

(Teacher 19).

COVID-19 has forced schools to train in both basic and specific DL skills, encouraging teachers to develop and adapt their teaching strategies to include DL skills, giving an indication of the understanding and overall needs of primary school teachers in North-East England in terms of developing DL skills.

"We've had to start using Microsoft Teams because my class has had to isolate. I'm learning as I go!"

(Teacher 19).

Teachers appeared to understand what they need to train in, but this 'gap' needed to be identified and rectified by the schools themselves:

"I've had to train myself in using this software whilst I've been teaching from home. There are so many available ways like search engines and YouTube so there isn't really an excuse to not being able to use them in a basic way."

(Teacher 23).

Developing a suitable curriculum and high-quality teacher training programme in DL skills is a priority for the Department for Education (DfE). One of the challenges that the DfE faces is to rethink this curriculum and make amendments to the Teachers' Standards and this requires active engagement from Universities, Senior Management Teams and teachers (Brito,

Rodríguez & Aparicio, 2018). Once training interventions are established, it is the responsibility of teachers to get involved with on-going training and continuous development of these skills. As mentioned, a lot of the more experienced teachers received training during the introduction of 'technology into schools strategy' (1997) introduced by Blair government. However, skills need to be practised and updated and not all schools had accessibility and availability of devices to keep their skills up to date. Before the impact of the pandemic,Teacher 19 explained that although they have received training related to certain devices and software they were not practiced tso were forgotten

"You have you couple of hours on the training, and then it kind of disappears."

(Teacher 19).

This statement suggests although some training had been received, it may not have been enough and as after the training has commenced, it isn't always put into practise as the schools don't always invest in them after the training. Prior to lockdown, Teacher 19 explained after the training sessions there isn't really an opportunity to develop these skills and therefore were not continued and so weren't used to their full potential.

"There's no longevity in them."

(Teacher 19).

There is a hope that after the increased use of online communication and use of devices and software, the training that students and teachers will continue to be practised or those skills will also become dormant:

"We've invested a lot of time and money into training during the lockdown period. As IT lead, it's my responsibility to ensure that some of these skills continue to be used because obviously we aren't going to be using them to the same extent, but we don't want them to go to waste."

(Teacher 13).

4.2.2.1 Preparations for online teaching

During the closure of schools, teachers 3,5,6,11,12,13,16,19,23 and 25 discussed how their prior knowledge, from self-exploration and professional training, had aided them in managing the challenges of online teaching:

"I've always had a confident mindset when exploring with technology because I used it a lot at school myself and that's continued. I think having that meant I adapted to online teaching quickly."

(Teacher 13)

The second round of interviews showed that all the participants' schools were providing online classes. However, only 6/33 participants had received any training, prior to lockdown, that would have prepared them for this unprecedented situation. The study showed that there was a major deficiency in training for online teaching or online platform use for teachers in the North-East of England. Lockdown highlighted this gap, which became more extensive during this period:

"I'd had training on Purple Mash so we knew how to use that before and the pupils did too."

(Teacher 10).

"I'd used Teams for meetings and Zoom personally so I had some skills pre-COVID."

(Teacher 11).

"We did use Class DoJo for homework and to sometimes message parents when we were still in school so that's ok I suppose, but nothing else."

(Teacher 33).

However, for most participants, more training had been received during lockdown, meaning an improvement in DL skills. From this, it may be suggested that relevant policy amendments relating to training in DL skills need to be undertaken.

The participants were asked how they were managing the preparation of materials and assignments for online teaching and all teachers responded that they were being supported by their schools and Senior Leadership Team (SLT):

"We've made sure that all the staff have instructions available or can contact our IT lead or SLT for help with using Purple Mash, Education City and Zoom for their lessons. We have a meeting every week via Zoom to discuss how things are going and staff can share issues or any concerns they have."

(Teacher 5).

14/33 participants stated that they asked their colleagues for help if they had any uncertainties or problems:

"I just speak to some of my senior colleagues."

(Teacher 10).

"we've got a really good Head of IT and I just ask her if I need anything."

(Teacher 23).

"Some of my colleagues had used Class DoJo in their previous schools and so were more familiar with it. If I do need anything I know I can go to them."

(Teacher 32).

Teacher 12 stated that they used search engines for instructions, more specifically looking at instructional videos as opposed to text, highlighting that different people learn in different ways:

"If I wanted to know more, I went to my go-to: YouTube."

(Teacher 12)

Some teachers stated that they had been able to manage with the transition by seeking help from members of their family:

"My husband is pretty good with Zoom and Skype so I just asked him."

(Teacher 4).

"My daughter actually does research in digital education and was able to give me some good advice and I just called her if I needed anything."

(Teacher 18).

"My son's school has been using online platforms for homework for about 3 years now and he showed me different features."

(Teacher 30).

It was also mentioned that some teachers went to their students for advice on using certain software or platforms during their online teaching:

"I just said, does anyone know how I can share my screen? And one of the kids talked me through it."

(Teacher 24).

4.2.2.2 Unexpected Professional Development

There wasn't a break for SLTs, teachers or school administration during lockdown as they were still responsible for delivering educational services and so there was an expectation to develop their professional skills, specifically those relating to technology and digital skills. The UK government responded to this need as "UK education providers helped teachers, parents and students respond to the impact of COVID-19 worldwide" (GOV.UK, 2020c). Teacher 16 commented on how lockdown had provided an opportunity for staff to develop their digital skills and their school aimed to take advantage of the situation. They discussed using the new resources that were being provided by the DfE:

"We can now use things like Oxford Owl, learning resources from Pearson, Twinkl and resources from the British Council and I'm pushing staff to make the most of it."

(Teacher 16).

Lockdown meant that most teachers now had to work from home and were often using online communication platforms, such as Microsoft Teams and Zoom, for staff meetings. As mentioned previously, most participants had not used videoconferencing as a method of communication prior to COVID-19. As there were few options for staff training, most of the participants' schools were using videoconferencing for staff meetings:

"We're using Teams for our weekly meetings now because we can share slides and things for training."

(Teacher 9).

The regular use of online platforms meant the teachers became more familiar with them, helping to develop their digital communication skills. Lockdown provided an opportunity for schools to explore more software and learning platforms as there were few options to deliver teaching and in doing so, teachers developed their digital skills, such as e-safety and using search engines because they became more practiced in them.

Teachers and students were also using online platforms for teaching and learning, and schools often explored a variety of software to find options for lessons, resources, and communication that they were comfortable with:

"We were using Purple Mash but it just wasn't working for us, so we started to use Zoom for lessons and lots of different programs like BBC Bitesize and PhonicsPlay and then went back to Class DoJo for other activities."

(Teacher 30).

The pandemic created an opportunity for teachers to use, attend and study a wider variety of online courses and to look at more research, such as articles in journals, online educational event opportunities: "like ICT for Education" (Teacher 12) and to participate and collaborate in online teacher communities to aid PD. Teacher 19 explained that they were more open to explore social media and online conferences from home for PD because they had more time for them. Teachers who had previously stated that they did not participate in online discussion forums were now using them for ideas for online teaching.

"I had never done this before and so we were all just learning together"

(Teacher 9).

4.2.1.2.1 Barriers to Continuous Professional Development

The data showed that one of the more prominent themes in relation to DL skills was CPD, and more specifically issues with it. Teachers discussed that some of the barriers involved poor delivery of training content: "it wasn't well presented" (Teacher 9), difficulties with engagement: "it was really boring" (Teacher 15) and lack of opportunity to put the skills learned into practice: "you go to training for a couple of hours and then never practise them again. There's no longevity in them" (Teacher 19).

Conflicts of interest

The interviews showed that on some occasions, instances arose causing conflicts between partaking in training or putting training into practice. In the initial interview, teachers explained that conflicts usually arose when trying to prioritise integrating and experimenting with using technology whilst trying to manage the multitude of responsibilities in their role:

> *"I can't tell you how frustrating it is when you're trying to sort out faults with an iPad or ones that are dead, etc. You want to move on, the kids want to get on and before you know it, you've wasted 5 minutes for nothing and your classroom is in chaos."*
>
> (Teacher 11).

This reflects that many teachers were previously concerned in using technology as there was a higher risk of something going wrong with old devices and a lack of training, resulting in loss of control in the classroom and wasting time. Time management was also a concern raised in the data. Teacher 4 talked about the multitude of tasks and responsibilities involved in their role and stated:

> *"I would love to be one of those teachers that was really creative with technology but with planning, marking and behaviour management, I feel like I'm spread too thin to prepare lessons with software I'm not used to and devices that aren't always reliable. A teacher's time isn't very flexible and makes it hard to use technology for that reason. It's a shame."*
>
> (Teacher 4).

The findings from round 1 interviews suggested that unreliability of software and devices, frequently due to funding, had often led SLTs to choose not to fund training for devices and software that would not be used:

"I haven't had much training because we just don't have the funds to be honest. The Headteacher at my school would rather use the money available to pay for technological equipment because a lot of ours has seen better days. She pays for training when it's really needed but we try to get by just having a go ourselves or looking on YouTube."

(Teacher 33).

Another reason why schools often hadn't funded DL training before lockdown was due to the scheduled slots available for training, showing that funding is often an issue for lack of training in this area:

"I'd have really liked to have continued that e-safety course, but the next part of the course took place on Tuesdays and that's when I coach football at school. I tried to look for something similar or to see if it would be done on a different day, but it couldn't."

(Teacher 19).

Some teachers expressed that their SLTs placed a lack of value on DL training and therefore it was difficult to practice:

"I feel like I've got some good ideas about teaching with technology and like being creative. The school I'm in doesn't really focus on that though and aren't really that good at noticing good lesson ideas when they're talked about in our staff meetings."

(Teacher 1).

Some SLT weren't supportive investing in certain technological resources, previously, due to issues of with their budgets and funding:

"Technologies are out of date as soon as you get them really! Our Headteacher is very conscious about spending money on trendy software that might not have been reviewed thoroughly, and once you've paid you can't get a refund."

(Teacher 8).

Conflicts of time, reliability, funding and SLT support affects the opportunity to train using and integrating technology into classrooms.

Technical issues

In round 1, findings indicated that teachers continuously commented on the unreliability of devices, software and network connections being a concern affecting their implementation of technology. Issues with both the devices and network during CPD training often results in a reluctance to practice implementation:

"When things go wrong in training, it puts your staff off. I try to only provide sessions on things that I know they will definitely be able to do in the classroom which can sometimes be disappointing because there it kind of puts a limitation on experimentation."

(Teacher 16).

"The software we were meant to be using kept crashing because the signal was so bad. There were also problems with some of the software that didn't need the internet. I just felt if there're problems when the trainer was there and they couldn't fix it, was hope was there for me? Why would I use it in school when I knew I'd be wasting time that we don't have?"

(Teacher 19).

"It was stressful trying to conduct a lesson with software we weren't familiar with and children having problems with the internet or not being able to do things, but what could we do?"

(Teacher 20).

Teacher 19 explained that they had spent time looking at ideas in discussion forums and YouTube to plan online lessons and had found some creative tools that they thought would have been interesting for their students. They went on to say:

"I thought they will absolutely love this but then there was this dark cloud making me think: do the kids have a reliable enough connection to do this?"

(Teacher 19).

As well as issues with devices and poor connections, teachers had expressed their reluctance to using online software due to safeguarding and security:

"Neither myself nor my students had been properly taught about being secure online, so when we had to go to online learning, we sort of had to train ourselves and the students but it was kind of a quick-fix for something that is a huge concern"

(Teacher 20).

This shows that there had been a reluctance in using technology if it wasn't necessary because of the uncertainty of reliability. As teachers have limited time frames to deliver a large curriculum content, there isn't enough time for unreliability. Hopefully, this is no longer the case as the reliability of technology has improved, both in homes and schools, with newer resources that were funded due to the impact of coronavirus.

Poor technical knowledge

Teachers discussed how their own lacking in technical knowledge and understanding affected their use of technology and their willingness to develop DL skills. Before the pandemic, Teacher 18 had stated:

"Sometimes I'm not even sure where to start or who to ask about it."

(Teacher 18).

In not knowing who to turn to for support, Teacher 18 went on to explain that they did not feel comfortable experimenting with technology. Without a foundation of skills, there can be no development in professional development (PD.) Teacher 24 expanded on this when they noted:

"I'm not a technician"

(Teacher 24).

Teachers explained that they did not feel comfortable taking on a role that they weren't qualified for. The mindset of not being qualified to use technology makes CPD unlikely to

succeed. Now, with a new set of Dl skills, teachers do have a skillset foundation and therefore skills can be improved and developed.

Poor Continuous Professional Development delivery

CPD is like teaching, in that objectives need to be delivered effectively to be understood. However, teachers in this study noted that some of those delivering CPD sessions were often not educators and so lacked the required skills to engage with their audience to achieve the desired outcome.

Teacher 13 explained that as IT lead, they had attended conferences, physically and virtually, where it was a salesperson delivering training and weren't always able to relate their products to Primary educational contexts. In agreement, Teacher 16 (also an IT lead) commented on how disappointing it was when insufficient knowledge or social skills affected appropriate answers from the spokesperson.

"The trainers aren't always able to answer the questions."

(Teacher 16).

This maybe because these spokespersons aren't very experienced with the product or how to apply it into teaching practice. Some teachers expressed that when a trainer doesn't promote confidence, they don't feel confident in using the software themselves:

"it would be a viscous circle really, the trainer doesn't really know, so then you don't really know…how are you supposed to teach the children what you don't know?"

(Teacher 3).

Negative attitudes

As an educator, teachers should be promoting CPD and a life-long learning mindset. Those who don't engage are not only placing a barrier for themselves but also for others. In not making the most of their training, they will not see the benefits of the product, will not understand it and therefore won't be able to implement it or teach it effectively in their classrooms.

Mainly when talking to ICT Leads, there was discussion about how negative attitudes from those partaking in the training affected its success:

"It's difficult when certain members of staff aren't that invested because they clearly don't see the value in the training and don't engage with it."

(Teacher 13).

There are suggestions that some educators are very closed to the idea of integrating tech into lessons as they do not wish to change the way they teach or are fearful of technology and aren't comfortable enough to incorporate it into their lesson when they don't not have access to the necessary support:

"I'm scared to use it in case something goes wrong and you can't fix it."

(Teacher 20).

Before lockdown, teachers expressed more of a reluctance into implementation more in relation to behaviour management skills and concerns about inappropriate behaviour and distractions:

"I know I'm not confident enough to use it and get into a fluster so my class will get distracted while I'm messing on."

(Teacher 24).

In this study, the findings in round 1 showed there hadn't been an unwillingness to change as per se, concerns about implementations was often due to lack of resources and experience in using them. Recent research (Vongkulluksn, et al., 2018; Ertmer and Ottenbreit-Leftwich, 2010) has shown that access alone does not automatically equate to greater or higher quality of technology integration. Teacher beliefs are also important factors of how teachers integrate technology in the classroom and those with more facilitative beliefs were more likely to use technology in their classrooms. Forced to using technology during lockdown, it will be interesting to see attitudes towards the use of technology integration and to see whether attitudes have changed enough to continue its use in a now physical classroom.

Failure to put into practice

If CPD isn't put into practice following a session, participants suggested that it was unlikely that it would have a significant impact upon their practice (Teacher 19). Teachers noted that when they couldn't put CPD learning into practice shortly afterwards, they often forgot how to go about setting up the technology or service and so would then not be able to implement it without further support. This gives the impression that if skills will not be used, there is little chance they will be remembered.

4.2.1.2.2 Self exploration

The research shows that in all three rounds of interviews, many of the teachers explored different software and devices on their own terms to develop their digital skills. Teacher 12 explained that they often looked online and just "have a go on software." This teacher explained their beliefs on that they are of the 'digital native' generation and so are more confident to explore:

"We're surrounded by technology and therefore are more confident with exploring."

(Teacher 12).

"Online teaching made me want to learn more."

(Teacher 14).

"It started at university using PCs and keyboards and then obviously your personal life kind of evolves, and the training that we went on to do teacher training kind of introduced us to iPads and what they're kind of capable of. And in my personal life, I've kind of got smartphones, and I've always kind of had a smartphone. Whether it be Apple or Samsung and so it's kind of I suppose it's been an evolution over time."

(Teacher 19).

It may be suggested that the expectation of being surrounded by technology means one is able to use it effectively and this has affected the need for training in such fields. As a Recently Qualified Teacher (RQT), Teacher 14 did not partake in any digital competence modules during teacher training and received no training in how to integrate technology into

their teaching practice. Teacher 14 received Initial Teacher Training (ITT) only 2 years prior to lockdown and was expected to "get on with things" (Teacher 14).

At a conference of Education Officers in 1988, Baker stated it would be an easy task to develop a technology enabled teaching force as these skills would be developed during ITT and then put into practice once qualified. Although technology was at a different stage in 1988, the concept of introducing student teachers to using DL in their classrooms remains. There is now a realisation that embedding ICT into everyday teaching has been a lot more difficult than first envisaged (Barton and Hayden., 2006) and has been emphasised when teaching online.

The aim of training should be to set a foundation for teachers to be able to build on through exploration and adaptation. In receiving external training as a foundation, teachers can build on this foundation by exploring themselves:

"There were external people coming in and to just basically teach the basics and then let us have a kind of have a go with them and them. They would come back and if there was anything that we wanted to know further, or more specifically then they would go through that with us."

(Teacher 16).

This format encourages exploration through guidance. After having training, teachers often have notes or instructions made available as a 'safety net' of support and reassurance. Teachers 15 and 16 stated that once they had received the training, they were still able to access training resources and instructions:

"It's still ongoing. When we get new software on new apps or new programs to run in school and we can still access training on those."

(Teacher 16).

After the reopening of schools, teachers had received a foundation of training in specific software and had gone on to explore themselves by using training resources and exploring themselves. Teacher 15 explained that their school was still using manual instruction documents in school and Teacher 12 had gone on using instructional YouTube videos as they

had been more accessible during lockdown. This shows that Teacher 15's school had gone back to methods of non-digital self-exploration and Teacher 12 used the tools available with the skills they had learned during lockdown.

Teaching requires an act of continuous learning and a drive for exploration. This striving for knowledge is important in the educational process as it is a mindset and habit for people to acquire to be successful. Teachers are role models and therefore should be teaching students to treat mistakes and challenges as part of the learning process:

"Time constraints often make it difficult to allow mistakes in the classroom."

(Teacher 6).

"There's room for improvement there, I think. I've got the basic skills in it, but I would like to know more."

(Teacher 15).

The process should begin with giving teachers some guidance to then feel confident enough to explore for themselves and to feel and be more creative when using technology. In exploring and participating in online discussion groups, teachers will often be able to get ideas and collaborate with experimentation. Teachers should act as role models for their students and set an example by sharing experiences and exploring technology and software. They might do this in VAK or in learning games, presentations or even for administration work. However, teachers must be willing to do so:

"You know you've got to be aware of what's out there to support the children because this is their life and we need to know what what's available, so we try to give them as many opportunities to experience different things as we can."

(Teacher 16).

"I can do what I need to do, but kind of no more."

(Teacher 20).

4.2.1.3 Confidence in digital literacy skills

'Being able to integrate and use technology for educational purposes involves having a set of generic skills suitable for all situations, both personal and professional, as well as specific teaching-profession skills' (Istfjord and Munthe, 2017). A lack of DL skills often relates to a lack of confidence in digital skills. In her 2018 research, Palomino suggests that 'the root causes of teachers' negative attitudes towards ICT use had stemmed from "shortcomings in training." Prior to lockdown, practising teachers had a choice about their use of technology in the classroom and so sometimes chose to remain ignorant:

"I wouldn't say I'm very confident but that's just because I don't feel like I practice it in my teaching enough. The other class teacher focuses on the tech side and I'm involved in the more practical side of things."

(Teacher 18)

"I'm not really very confident with technology, I only really use the software that I need to like Word and PowerPoint. Our school hasn't done any CPD in any other software so I don't feel the need to explore it"

(Teacher 24).

A lack of confidence in digital skills can "constitute a barrier that prevents these resources from being introduced in a classroom setting" (Brush, Glazewski & Hew 2008; Mueller, Wood, Willoughby, Ross & Specht, 2008).

The digital divide

"The digital divide between so-called 'social inequalities' is very real" (Tzifopoulos, 2020). Throughout the interviews, teachers discussed the limitations on availability and accessibility of digital resources and internet connection at home often affected their DL skills:

"They only use their phones at home and so don't have any experience with using keyboards."

(Teacher 6).

"Some of my children are sharing one device between a family of five and so they don't really know what to do"

(Teacher 26).

The lacking in DL skills due to a lack of opportunity to use devices in the home suggests that for students to develop their DL skills, schools need to be able to provide the digital resources required:

"My Headteacher is really good, we're in a really deprived area and the pupils don't always have access to any devices and so they've invested in iPads, PCs in the IT suite and we've even got Green Screen equipment"

(Teacher 4).

Confidence requires practice and practice requires access to technology. The teachers working in these schools contiuously need to be trained so that they can go on to guide students in using these resources.

Teacher 5 suggests there is a divide between previous generations and this current generation of primary school children. The introduction of a theory of 'digital natives' (Prensky, 2001), where a generation is surrounded by technology and therefore must be able to use it correctly. Practising teachers from the initial interviews suggest this is not the case:

"Yes, they might be able to use social networking and things, you see they can use a touch keyboard, but can they actually use a keyboard to type?"

(Teacher 19).

"The look of confusion I get from some students when they see a desktop is quite funny. They're like why is the monitor not reacting to my touch? Why is this keyboard so big? You expect that they'll adapt because they're used to technology, but they aren't."

(Teacher 21).

This expectation of 'digital natives' is unrealistic. Students need to be guided in basic word processing skills to arm them for employment. Burns and Gottschalk (2020) suggest that children of this generation lack these basic skills because there is an assumption of capability:

"You know you're trying to get a fantastic leaflet that they've designed. They've planned out on paper and taking no time at all, and then they go to try and put it on the screen and then it's like one finger typing and then the punctuation is not there. We've got spaces where there shouldn't be. They can't return, so they can't move down to the next line. Next start new paragraph, they can't central anything. They just don't know all the features. They're surrounded by technology and technologies are constant in their life, but it's only it's more for entertainment rather than productivity."

(Teacher 19).

There were suggestions that children were only natives to the software they frequented, such as computer games, as opposed to Office software. For this reason, teachers felt that children needed to be taught basic Office software skills as they were less familiar with them:

"I think a basic office foundation should be on the curriculum and before you code. Because surely you should, even in keyboard skills otherwise, how are you supposed to be able to code? It just seems obvious, doesn't it? "

(Teacher 19).

Experience

There was a connection between teachers being avid technology users in their personal lives and believing that their experience and practice sets a foundation for technological confidence:

"Even if I hadn't been in Computer Engaged Learning (CEL) courses, I still would probably use a lot of technology just because it's who I am and how I live my life."

(Teacher 19).

"I think I got a lot of confidence in my student teaching. I can effectively plan lessons with technology. But I think it's just about the confidence from student teaching that really made the difference for me."

(Teacher 9).

In practicing the skills learned in placements, RQTs felt more confident when they'd been in their roles for a while, as they'd put theory into practice. However, Teacher 7 felt that they'd

received training during ITT but then were out of practice and so had to reacquaint themselves with the software once qualified.

Teachers stated they had to be reintroduced the tools, especially when changing in year groups and during lockdown. Teachers tend to use different software for different year groups, e.g in Reception lots of progress tracking evidence is from photos and videos of the children doing their activities. Changing their strategies and resources to suit their cohort requires becoming familiarised with the changes made and when less experienced teachers go into year groups where technology is used more, such as EYFS and KS1 for evidence, teachers become more experienced and technological tools become second nature:

"I do it every day. I think I could probably do it with my eyes closed."

(Teacher 14).

It may be suggested that as the teacher becomes more experienced and familiar with the software, they could rate their skills more accurately. In the first round of interviews, teachers had often overestimated their skills until they acknowledged the capacity of the software and realised, they were not using it to its full potential. Even though Teacher 16 is an ICT Lead- is modest in their self-assessment:

"I'd say I was at least intermediate and can get by better than some."

(Teacher 16).

As an ICT lead, this teacher was more exposed to the potential uses of certain software and theyunderstood that they were not using it to its full potential. Therefore, it can be argued that this teacher was more accurate in their self-assessment. Teachers with a greater understanding of the software capacity and can acknowledge the extent to which they use the functions of the software, seek to justify the standard they have placed themselves at:

"Probably again I would say... It's difficult because I do use multimedia when I create the flip charts, so with the software that I know I'm quite good at it. But I don't use lots of wide range of software you know what I mean?"

(Teacher 16).

Influence of self-exploration

"Undoubtedly, young people who have grown up with computers, mobile phones and the internet are not fearful of technology, and they are willing and open to experimentation with new ICT applications and facilities" (Jimoyiannis and Gravani, 2011). In the third round of interviews, teachers were asked how they used the following digital literacy tools in their teaching:

- Multimedia (YouTube)
- Virtual learning environments
- Collaboration tools (google docs, OneDrive, Dropbox,)
- IWBs
- Videoconferencing
- Social media
- Recording tools and software

It was interesting to find that for all the tools listed, the majority stated that they were initially "self-taught" until they received training on selected tools during and post-lockdown. Teachers 12 and 19 stated that tools such as multimedia and social media were used in daily life and so were considered to be self-taught. All the teachers explained that even though they received training in some of the tools listed, this was merely a foundation which was later explored and adapted.

Although the teachers in this study were considered to be intelligent and capable professionals, Teacher 19 explained that through solely exploring technology themselves made them feel that their skills were "incomplete" and that they were uncertain about the quality of their learning.

"I'm not sure of the accuracy and development of the skills I'm using my initiative to explore."

(Teacher 19).

In being unsure whether their initiatives are leading them in appropriate direction, knowing that they "don't know what they don't know" (Teacher 3) has made teachers in this study feel less confident.

"I feel like I could use some guidance."

(Teacher 20).

Teachers 8 and 10 discussed how they felt that in exploring software themselves, they weren't confident that they would be exploring the software to its full potential.

Influence of school culture

Confidence in digital skills is increased through creating an encouraging atmosphere in the school culture, often through support and mentoring from colleagues. Throughout the interviews, Teacher 10 mentioned going to talk to a colleague with experience of ICT software used in school, both for teacher administration and lesson activities and how they found this supportive relationship extremely valuable. The RQTs in the interviews had experiences of encouraging environments during their training. Their experiences with coursework, student modules and fellow students, mentors and teachers in their placements provided a foundation of support and confidence.

"When I was on placement in an Apple School, the SLT really pushed you to use the equipment. Like really encouraged it because they'd obviously spent a lot of money and didn't want it to go to waste."

(Teacher 7).

From the findings, it may be suggested that schools should recognise when certain teachers need training as they struggle to use specific technological features (Teacher 24). Teacher 18 noted that regular training is a requirement that schools should be aware of.

"It would be helpful for teachers to receive regular training as part of school policy."

(Teacher 18).

Influence of teaching environments

Teaching environments contribute to knowledge, through opportunities for training and an increased availability of resources.

"When you have good access to technology and have been shown how to use it properly of course you will use it because you're comfortable."

(Teacher 30).

As mentioned, extra courses can help to create new tools, gain new skills, and increase knowledge. Those teachers working in more technology-rich schools can practice more with technology, also building confidence. The participants in those schools explained that they understood they were lucky to have those resources and were greatly encouraged by their SLT to use technology as frequently as possible.

"It was when I worked in an Apple School. Because it's there, you think: how can I use and make the most of the technology available?"

(Teacher 7).

This statement suggests that if technology is available and promoted in a school, the teachers can be almost forced to explore it.

Software use and frequency

The participants were asked in all three rounds of interviews to identify how frequently they used the following software in their teaching:

- Word processing software
- Emails
- The internet
- Databases
- Spreadsheets
- Graphics

- Multimedia
- Blogging
- Online discussion groups/forums
- Video conferencing
- Computer games and learning apps

When given the opportunity to give additional software that they used in their professional practice, none gave any examples to expand the list.

The participants were given example time frames (daily, weekly, half-termly, termly, annually, etc.) as terms of reference. During all three-rounds of interviews, teachers expressed that they used word processing software daily. However, Teacher 19 expressed that they used forms of processing software, but their school didn't not always provide the preferred software:

"I use Word all the time, daily definitely but I prefer Publisher, but we don't use it in School."

(Teacher 19).

Teachers expressed that they used Word frequently but not to its full potential because they had not been trained to do so. Explaining that even during lockdown when they were sending emails that might have documents attached with worksheets on them, they had to be careful to keep them simple to edit as the children hadn't really been trained to use Word either:

"I do use it all the time but only the bits I need. I know you can do all sorts of things now but it's like when am I going to need to transcribe anything? So I don't!"

(Teacher 7).

The results from the first round of interviews showed that technology was mainly used for administration and planning and teaching tasks and less often for the children to use outside of school for homework. This may suggest that as most schools in this study (27/33) were in deprived to extremely deprived catchment areas (see *Table 3.2,* p. 93) and teachers

understood that not all students had access to digital devices or the internet and so would be unable to do the assigned tasks.

Rating their digital literacy skills

The practising teachers were asked to describe the level they believed they were at in relation to their DL skills, from none, basic, intermediate, and advanced. Some teachers initially expressed that they didn't have a realistic grasp on their skills until they had more knowledge and experience of the potential uses of software which were exposed during the first lockdown:

> *"I thought I knew a lot about using software like PowerPoint Now using presentation software more because of lockdown, I've realised there are so many different options and there's so much to it you can add. I don't know why I would have rated myself as advanced before."*
>
> (Teacher 26).

Table 4.2 presents an overview of the participant's ratings of their own DL skills prior to COVID-19 and *Table 4.3* shows the participant's rating of their own DL skills post lockdown:

	None	**Basic**	**Intermediate**	**Advanced**
Word Processing applications	0%	0%	63.3%	36.7%
Spreadsheet applications	6%	53.3%	36.7%	10%
Database applications	0%	50%	40%	10%
Presentation applications	0%	0%	63.3%	36.7%
Multimedia applications	3.3%	20%	63.3%	13.4%
Web-design applications	13.1%	43.3%	26.6%	0%
Search engine skills	0%	6.6%	66.6%	26.7%
Communication applications	0%	23.3%	50%	26.7%

Table 4.2 *Table to show participant's ratings of their own DL skills prior to COVID-19*

	None	Basic	Intermediate	Advanced
Word Processing applications	0%	0%	73.3%	26.7%
Spreadsheet applications	6%	60%	30%	10%
Database applications	0%	50%	50%	0%
Presentation applications	0%	0%	33.3%	46.7%
Multimedia applications	3.3%	20%	63.3%	13.4%
Web-design applications	13.1%	23.3%	36.6%	0%
Search engine skills	0%	6.6%	66.6%	26.7%
Communication applications	0%	3.3%	60%	36.7%

Table 4.3 *Table to show participant's ratings of their own DL skills post COVID-19*

Sometimes as the teacher becomes more familiar with the software, they were more able to rate their skills more accurately, they had often overestimated their skills until they appreciated the capacity of the software and realised that they were not using it to its full potential. At the beginning of the process, the participant considered their understanding to be at an intermediate level. As they became more familiar with the software and its functionality, they stated that their understanding had been more basic at the outset. This was evident in the discussions post COVID-19, where teachers spoke about how they had previously rated themselves to be higher than what they were, the teachers explained that they hadn't recognised the potential of the software and therefore hadn't understood their ability in relation to it.

There weren't any drastic changes in their understanding of their own skills. In using word processing software more frequently during the pandemic, teachers explained that they had gone on to explore the software and were able to use tools they hadn't realised existed, but now considered their skills to have improved because they were now practising these skills:

"I'm better now because all I could do was get better. I can even use a 'replace' to edit the words and used the 'Dictaphone' tool, but it didn't work that well. Who knew you could do that? Well now I can!"

(Teacher 23).

Even though Teacher 16 was an IT lead, they were modest in their self-assessment, both prior to and post COVID. This may reflect the reality of being more familiarised with the potential of the technology used and therefore more accurate in their assessment. This teacher was more precise at self-assessment as the made solid justifications of the standard they have placed themselves at:

"Probably again I would say... It's difficult because I do use multimedia when I create the flip charts, so with the software that I know I'm quite good at it. But I don't use lots of wide range of software you know what I mean?"

(Teacher 16).

In contrast, Teacher 15 rated their searching skills as advanced but admitted to having no experience with advanced search methods, only using keyword searching. It may be suggested that until told, teachers will not know the extent of their own ignorance.

"Sometimes others don't know what they don't know."

(Teacher 3).

It may be possible that Teacher 15 saw themselves as advanced in terms of searching skills because of their environment: they felt they are better than those around them.

Prior to lockdown, teachers had a lesser knowledge or understanding of information literacy and advanced research methods, and therefore did not know there are better methods for searching. During lockdown, teachers had to familiarise themselves with using search engines, sometimes for training, but still did not explore more advanced search methods:

"I'm using Google but just do key word searches."

(Teacher 8).

Teachers rated themselves more highly post COVID, perhaps because they used search engines more frequently, but many still did not use advanced search methods and therefore were ignorant to the differences between frequency and their standards, showing that their advanced searching skills had not improved.

The researcher would recommend that schools and teachers explore digital skills and become more knowledgeable of the capabilities of certain software to give themselves an accurate rating of these skills.

4.2.1.4 Approaches to teaching

"Technology can make a significant, positive impact on teaching and learning."
(Couse and Chen 2010; Higgins, Xiao, and Katsipataki 2012).

The findings showed that most of the teachers felt that using technology as a support tool in their teaching benefitted their students:

"I can use a variety of methods to help the children with different learning needs all at once, they can have visual effects like videos and imagery, I can use audio like music, I've got software like speech to text for children with dyslexia and I can even put on videos that are going to help the children like get up and dance or I might use them in PE."
(Teacher 6).

"I'm using technology to engage the children like using BeeBots for instructions or setting up interactive tasks on the IWB and showing videos of songs and things like that. They love it."
(Teacher 18).

"I really think technology is beneficial to teaching. What would we have done in lockdown without it?"
(Teacher 19).

Some teachers felt that in using technology in their lessons, they were allowing the children to become familiarised with it and therefore learn digital skills and often will go on to develop these skills through self-exploration:

"I started showing them and quite often now they're showing me"
(Teacher 7).

"I have to be honest I wasn't really using technology a lot in my lessons before schools closed. When I started teaching on Zoom sometimes the children had been exploring and knew what I needed to do,"
(Teacher 11).

Having technology in an educational setting provides an opportunity for some children to experience it in a way they may not at home. This may entail using a wider variety of devices or using software suited for academic purposes as opposed to video games with little educational content or social media:

"They're often on Instagram or snapchat at home and have never even seen the likes of Word."

(Teacher 4).

This suggests that as teachers feel that technology is beneficial to their practice and children's learning, exploring further methods and teaching strategies in training would be extremely useful for practising teachers.

Technology use should be for the sake of learning, not for the sake of technology. Many participants noted that if the technology is not used to increase student learning and understanding, it is no different from the learning without technology, and there is little effect in having technology in the learning environment. "Using technology to support and enhance education. When tech is integrated that means it is a part of the classroom/lesson from the beginning, not just an afterthought" (Emre, 2019). The findings suggest that teachers aim to use the resources available them, such as IWB, to focus on the learning process.

"I use it to help them to engage and catch their interest so they'll remember."

(Teacher 32).

This aims to 'develop their capacity for original thinking' (Wood and Ashfield, 2008) and not to be solely focused on the outcome of knowledge and skills:

"We don't really have the time to just play around for the sake of it. It must be used for the purpose of learning and so we must think about how we can use it to motivate and engage our children."

(Teacher 16).

The implementation of technology in education can be thought of as a method of teaching creatively: "teaching creatively, for example, may include the teacher's use of a wide range of media such as video, animation, graphics and text, with hyperlinks to documents, websites and associated content" (Wood and Ashfield, 2008). In the initial interviews, the researcher questioned the teachers about their use of technology in their teaching practice. All participants stated that they had access to some form of IWB and used them to deliver presentation slides and often for showing multimedia:

"I often put a video of a fire on the IWB when I'm doing story time."

(Teacher 1).

"I use my Promethean to show my presentation slides."

(Teacher 6).

In this statement, Teacher 1 shows a level of creativity which is an important characteristic when implementing technology into teaching: "creative teaching promotes creative learning" (Woods, 1995). Both prior to and during lockdown, Teachers 12 and 13 mentioned receiving training from an independent trainer and lecturer at Durham University, Martin Bailey (Animate 2 Educate). Bailey delivers workshops and speaks at conferences relating to curriculum-based technology integration in Primary Education:

"Martin's training is so good, exciting, and creative. It really made me think outside of the box and just using simple tasks to engage the children. They absolutely loved it."

(Teacher 13).

From this comment, one may interpret that Teacher 13 benefitted from seeing how the creative use of technology can promote creative learning that children thoroughly enjoy. It may be suggested that when teachers are trained by creative trainers and given the opportunity to see and be guided on the creative use of technology, their teaching practice may be improved.

During lockdown, teachers had to switch from face-to-face teaching using presentation slides to teaching via online platforms, such as Google Classroom, Zoom, Microsoft Teams, etc. This meant adapting their lesson plans and resources to digital formats, which for some teachers proved to be more challenging:

"I hated it. I hadn't done it before, and it took a lot of energy to learn how to do it myself during a really stressful time. On top of that, we often had to show the pupils and/or their parents what to do too."

(Teacher 24).

This reflects that as many teachers had not been trained previously, it was difficult to become more proficient in such a short period of time. "A key issue is that online teaching requires a specialised form of pedagogy, which teachers are not familiar with" (Jain, et al., 2021). The first round of interviews showed that most participants considered themselves to have sufficient DL skills, online teaching was still a new experience for them:

"I feel like I'm quite good with technology, but it was still hard for me. It took more preparation and I had to be more attentive in my delivery and just in monitoring the children."

(Teacher 15).

Teacher 19 discussed that not only was the transition difficult for the teachers but also for the students themselves, especially those with Special Educational Needs (SEN):

"It's a lot of change which some students can adapt to easily, but I've got a boy with autism in my class who is used to 1:1 support. It's been a nightmare because it's just too confusing for him and is such a drastic change. He's just been participating in a session a day and we're building on his online time."

(Teacher 9).

Some teachers resorted to sending assignments home and being available to address their needs in other ways, such as on telephone calls, instead of conducting all classes on an online platform:

"We've got a cohort with 80% EAD students from low-income families. Online teaching just isn't practical for them so we're sending things home and having weekly conversations with the students and their parents on the phone."

(Teacher 26).

Had teachers and students received training and practised using technology regularly a sense of familiarity would have formed and made the change less drastic.

Technology integration

The research showed that there were several factors affecting levels of confidence in using technology, which affected teacher's implementation of technology in the classroom. Four main factors affecting teacher's confidence and their implementation of technology emerged from this study:

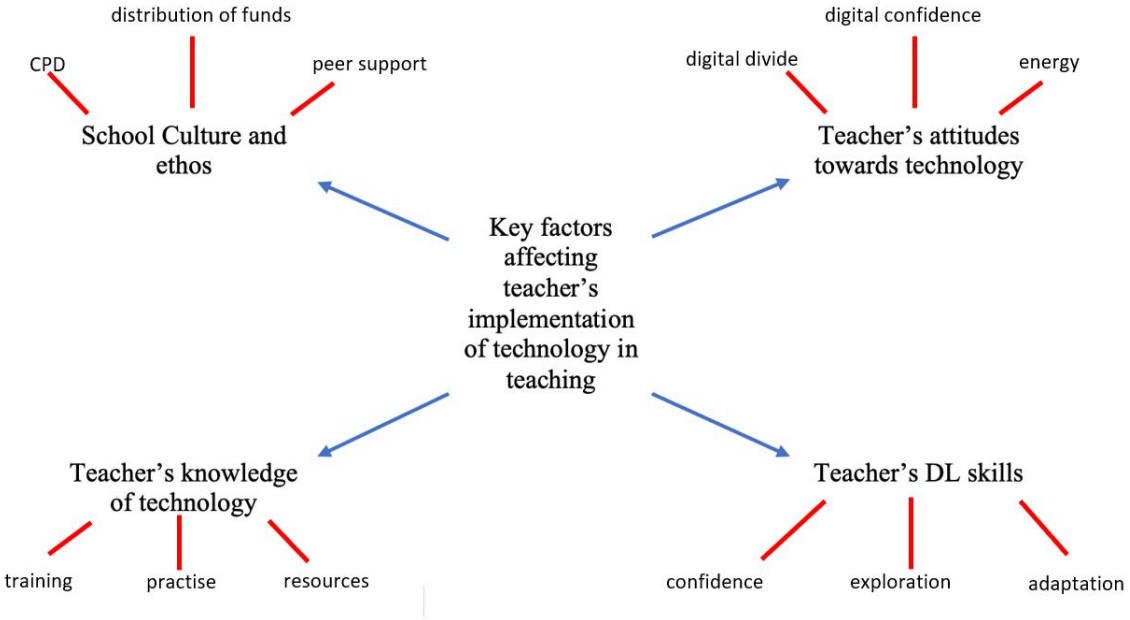


Figure 4.4 *The key factors affecting teacher's implementation of technology in the classroom adapted from Spiteri and Chang Rundgren (2020).*

School culture and ethos

School cultures and the teachers themselves have a relationship impacted by and involving school strategies, the support of leadership, peer mentoring, online learning, curriculum

development, and infrastructure. The findings showed that attitudes, knowledge, and DL skills of teachers were influenced by the culture and attitudes of a school environment.

Teachers whose schools promoted a positive attitude towards the use of technology, through the accessibility of training and digital devices, were often more willing and involved in using technology in their teaching practice.

"Our Headteacher is pretty good with setting aside money for technology in school and so we've got decent resources and software in the classrooms, and she sends us on training for using it properly. When you're a bit surer about it and there's less of a risk about the technology going dead it's fun to use it."

(Teacher 33).

The study supported research that suggests that teachers who had supportive schools, digitally competent SLTs, technical help and maintenance and encouragement are required to integrate technology (Kim and Keller 2011; Omwenga, Nyabero & Okioma 2016; Tezci 2011). Expanding on this, it is possible that if more time is allocated to training, schools show support and encourage the integration of technology and staff collaborate and share ideas, there would be an increase in the use of technology as a support tool in schools and would aid in the development of DL skills.

Teacher's attitudes towards technology

As mentioned earlier in this chapter, teacher's attitudes towards the integration of technology are often related to their confidence in DL skills. Their opinions and self-efficiency are often influenced by their school culture and environment. Teachers indicated that initially during lockdown, they didn't feel confident delivering lessons online but as time progressed, the support and collaboration internally (e.g., during staff meetings and communication) and externally (e.g., digital forums and talking to external schools and teachers) helped to build confidence and improve their attitudes towards self-efficiency:

"We got used to it fairly quickly by working with colleagues and observing or researching successful strategies for online teaching."

(Teacher 13).

This study showed that teacher's attitudes towards implementing technology improved during lockdown, as they were able to observe the use of successful integration and received training with specific and useful instructions that provided knowledge and experience for them to feel more confident. However, some teachers expressed an opposing attitude when technology had proved unreliable or difficult to use:

"There were times when I was put off because the program wasn't working, or I wasn't sure what I was doing and then the kids were distracted"

(Teacher 3).

Generally, teachers' attitudes towards using technology became more positive with greater knowledge and experience, support from their schools and the improvement of their skills.

Teacher's knowledge of technology

A teacher's knowledge and understanding of technology is influenced by their school culture and its encouragement and access to appropriate training. A greater exposure to technology increases the knowledge and understanding of what is available and how it can be used in an educational context. It is down to the attitude of the teachers and the school making technology available for these skills to be learned and practised for "longevity" (teacher 19).

"We've previously put a lot of funding into buying digital devices and resources, but it isn't any good if they're not being used properly."

(Teacher 6).

In reflection, schools continuously need to invest in training their teachers in new technologies to inspire the confidence that will encourage them to use them and to their full potential.

Teacher's digital literacy skills

This study showed that teachers felt that training in DL skills set a foundation where teachers felt confident enough to explore these skills and to go on to adapt them to different contexts to then develop them further.

Initially, teachers DL skills were mainly focused on their uses for presentations, such as embedding multimedia into their slides or creating motivating designs and content and using e-learning apps.

All the participants used the internet and search engines daily although they had little experience in more effective or advanced searching methods:

"Boolean retrieval? I haven't got a clue what you're talking about."

(Teacher 12).

In the initial interviews, it may be noted that when the researcher mentioned alternative and more advanced search methods, none requested that the researcher expanded on their explanation or offered training:

"I do what I need to get by and that's usually using key words and that has worked well so far."

(Teacher 24).

During lockdown, teachers were able to develop their DL skills by using newer devices and online platforms for teaching and communication. The findings showed that teachers who had previously showed a reluctance to using technology in their classrooms were now more willing as their confidence had increased. Lockdown brought about an evolution of technology and a revolution to teaching methods. This suggests that with training and practice teachers become more confident and DL skills develop, increasing a willingness to integrate technology into the classroom.

4.2.1.4.1. Integrating Components of digital literacy

Teachers incorporate useful technology resources such as online programs, programming, or apps into their lessons to benefit student learning in all content areas. The study showed that teachers with more facilitative beliefs are more likely to use technology in their classrooms, as they have a passion and want to explore this. They must have a desire to

increase their knowledge of pedagogical uses of technology in classroom, which became a necessity during lockdown. However, teachers still required a passion for improving their DL skills and reaching their full skillset potential to integrate technology as effectively as posibe into their teaching.

"Myself and my Head had been reluctant to using technology as there wasn't room in the budget for new devices. You can imagine what a nightmare that was when we had no choice when teaching from home!"

(Teacher 24).

The findings also showed that technology was integrated into the administrative side of teaching for communication, planning, assessment, lesson resources and the use of digital equipment to collect evidence of student progression. The UK's entering lockdown increased technology confidence as teachers had no choice but to use it as a teaching platform and practice their DL skills.

"We've always uploaded our planning onto the staff portal and used emails for communication."

(Teacher 25).

Results from the interviews revealed that all teachers experienced practicing the components of DL in their teaching. There were examples of teachers using, often basic, functional skills by setting up digital equipment and using software effectively. Teachers were practising safeguarding and cybersecurity and teaching children to do the same in their lessons, especially during lockdown. There were also examples of using digital communication such as emails, online platforms, texting, and videoconferencing and collaborating with internal and external colleagues.

"The only way to communicate is now online."

(Teacher 11).

Teachers showed some understanding of how to practise respectful behaviour online and showing an understanding of culture and ethics. The most prominent theme was teachers explaining their desire to teach creatively using technology as a strategy for motivation and

engagement. From this research, it may be suggested that teachers showed they had touched upon these components in their practice previously, and often had a "want to know more" (Teacher 14) frame of mind. Further training and exposure of these components in an educational context would have met teachers' DL needs before the pandemic. However, since lockdown, schools have had little choice but to overcome these boundaries as they were left with very few options to communicate with their students other than to integrate technology and DL into their teaching. For effective use, both students and teachers required appropriate training to improve their DL skills.

4.2.1.4.1.1 Functional skills

The interviews showed that teachers were using technology as a method to "transmit, process, store, create, display, share or exchange information by electronic means" (UNESCO, 2007). Prior to lockdown, most of the teachers explained that their experiences with digital communication and the transmission of work was mainly through email, texts or using school storage drives and databases. Due to the change in circumstances (pandemic), teachers explained communication and transmission mainly became digitalised, and the needs to embrace a wider range of platforms meant that teachers were also now using videoconferencing to communicate and share files via 'chat,' e-learning platforms to send memos to parents, and discussion groups to share ideas. This shows that their initial functional skills of simply being able to use basic networking had expanded through exposure and practice.

> *"We've always used a school portal and sent emails to colleagues, but now children have access to another class portal to send their work and I'm also emailing them and their parents."*
>
> (Teacher 23).

In the initial interviews, all teachers discussed how they were using word processing skills, such as using PowerPoint for presentations and Word for documents and resources. Teachers discussed how they were using Microsoft Word not only as a learning resource but also teaching the children how to use Word through cross-curricular teaching:

"I got them to use Word- trying to get a fantastic leaflet that they've designed."

(Teacher 19).

Teacher 19 went on to explain that although the children could design the leaflet on paper, they were unable to transfer the design into Word. This suggests that children don't often have the experience of using word processing skills at home and so school is the only environment that creates an opportunity to learn and develop these functional skills. To allow for children to experience using these skills means that teachers require an attitude where they will know how to facilitate learning with technology and building on digital functional skills.

All three rounds of interviews showed that the level of skills and the attitudes to using digital skills in their teaching practice varied amongst the participants:

"I think that my ICT skills would be quite good and I'd like to use digital equipment in my lessons but we just don't have it in school."

(Teacher 7).

"I'm keen to explore technology but being in Year 6 means the kids don't have as much of a need to use things like games. I think I try to teach them more how to use technology rather than using it for like just a learning tool."

(Teacher 19).

"I wouldn't say I was very confident with using technology, so I don't."

(Teacher 24).

These statements prove that participants had basic functional skills but there is a need for better digital resources in schools and appropriate training to build them in schools.

The DfE in England needs to recognise that for more advanced functional skills to be achieved, they need to adopt a curriculum which identifies which functional skills and competencies are required, including understanding skills relevant to the use of different hardware and software, to meet computing standards. Research suggests that teachers not only are teachers required to educate themselves in DL skills, they are also responsible for making their students "capable of using technology in productive ways" (Lund, et al., 2014).

4.2.1.4.1.2 E-safety

As more schools in the UK are using digital technologies and the internet, there has been a huge focus on e-safety, cybersecurity, and safeguarding procedures and schools are now doing more research and training into e-safety and digital footprints:

"It's our responsibility to teach the children how to stay safe online. They need to know about things like fake news, digital footprints and scams but teachers need to know about them too."

(Teacher 13).

Schools are very aware that data protection and safeguarding procedures need to be put into practice. Teacher 22 discussed how their school follows regulations and has training in e-safety and safeguarding every two years:

"Training's got to be up to date and that does include e-safety. But we also in school promote and teach e-safety, so there's a lot of information about that and we must sign as part of our professional contract like that we say that we don't use like phones and how we manage data and sensitive information. We also had GDPR training when that all came in about managing sensitive information."

(Teacher 22).

The research showed that some of the participants' schools were taking strict measures for data protection. Schools were using secure drives for safeguarding and as a measure to avoid the exposure of sensitive data:

"Everyone in my school was given an encrypted USB to use."

(Teacher 14).

"We've got several layers of drives in place in school. We've got a common drive for the children to use. We've got a teachers drive which doesn't have any kind of GDPR sensitive information and then we've got a secure drive which is only for teachers to use and so no office staff can access the secure drive because that has sensitive information"

(Teacher 19).

"We were given a personal iPad and use 'CPOMS' for storing data and photographs of the children It's like for safeguarding and things. So it's like a safe place where you have to log information and in the classroom."

(Teacher 22).

Teachers are well-aware of the risks when sensitive data is exposed. Many teachers stated that they had vulnerable children in attendance and so safeguarding is essential. It might be suggested that explicit training into safeguarding and investing in secure storage software is a necessity that all schools should practice.

There is evidence in the literature that e-safety is a major concern and should be a priority. Therefore, not only should teachers be trained in components of e-safety but parents and children too. As schools deliver online security instructions and e-safety procedures, such as "using certain search engines that we know are safe" (Teacher 8), it is valuable if parents are teaching the same messages at home. Some schools were providing training opportunities in e-safety for this reason:

"We have hosted e-safety training sessions for parents."

(Teacher 19).

However, they later noted that there was poor attendance due to scheduling conflicts. It might be suggested that schools promote online training sessions and include their e-safety and safeguarding policies on their website so that parents will be able to access information about this issue.

"We've received internal training of what to use and what to look for."

(Teacher 8).

This teacher went on to state:

"At school we use the same search engines and obviously everything is filtered for by cyber safety programs and things like that and ask that parents do the same."

(Teacher 8).

There are multiple components to e-safety. In using the internet, students and teachers are sharing information and need to be aware that not everything online is private. Sometimes there is uncertainty about who is providing information and a lack of awareness of who can access information:

"We all have a digital footprint."

(Teacher 6).

"You don't know who's watching anymore."

(Teacher 19).

During the second round of interviews, teachers explained how both themselves and their students were using the internet more and so there was a greater need for e-safety training. As teachers try to explain the risks of the internet, they need to be up to date about what software students are accessing and how to stay safe when using it:

"There is so much involved in e-safety. The more things you do online the more aware you become about safety. It can be worrying."

(Teacher 4).

"Kids use social media where there can be some unkind things said, they're into gaming where they might talk to strangers and new apps are always coming up and you just don't know how risky they might be."

(Teacher 30).

For this reason, teachers and students need to be taught critical evaluation skills when uploading any personal information or communicating online.

There was also a heavy emphasis on the importance of e-safety and ensuring children are educated in how to be safe and secure online. Issues of privacy, security and cyberbullying should be acknowledged and mitigated.

"Using digital devices safely to explore the internet and things."

(Teacher 14).

"DL is about using technology effectively. To be able to understand something you need to know how to use it safely."

(Teacher 19).

"Children need to be able to use technology and use it safely and effectively."

(Teacher 26).

E-safety is also related to being able to find and select relevant information and knowing how to pass on information safely. This training needs to be constantly developed to meet the evolution of social platforms and as new security issues arise. Using DL skills provides knowledge and understanding of safety when accessing digitalised information.

"Having the skills to access computers so things like being able to search effectively, being able to use different software and programs to create some kind of work or output. Not so much the computer science side of things but more the general skills that can be applied across different jobs and things like that"

(Teacher 17).

4.2.1.4.1.3 Finding and selecting relevant information

The findings showed that even prior to COVID-19, teachers all used the internet on a daily basis: "it's just constant" (Teacher 19). The availability of search engines to access a vast amount of information means that if questions are asked and there is curiosity or any uncertainty, a search can be made and often the required answers can be found:

"If I'm not too sure about it, my TA will be looking up something on the iPad just so we can instantly correct ourselves or correct the children."

(Teacher 19).

"It's instant information."

(Teacher 12).

In being able to access search engines on devices in the classroom, it means that teachers do not need to leave their classrooms, or send a child or TA, to go to the library to find information in the books available there:

"You know you don't have to go to books you don't have to go away and yeah just use a search engine and come back, you've got everything balanced."

(Teacher 19).

Teachers using search engines constantly in front of their students should create an atmosphere that supports the children in independently accessing information online, using appropriate research methods such as 'key word searches.' However, even though most of the teachers felt comfortable using search engines most did not know how to search effectively:

"Boolean logic? I haven't got a clue what you're talking about… (researcher explains the method) … no, I've never tried to filter searches that way"

(Teacher 12).

For security, schools often place filters and restrictions on their servers or use child-friendly search engines as a security measure:

"If they use iPads then all the addresses will be set up prior to the lesson so they can only go on certain websites that I've vetted."

(Teacher 19).

Some schools have experienced finding inappropriate content after searching online:

"Anything can come up really."

(Teacher 19).

"I was covering a topic on animals and had searched for sloth and the results showed images with different implications of the word."

(Teacher 22).

"I've even had one of my children come home and said they've been searching something and a rude word came up and that was in the middle of a session. So I had to go and report that to their school."

(Teacher 25).

The likelihood of this happening at home are greater due to a more frequent exposure to the internet and using search engines for educational purposes.

It is oftenmore effective to teach children e-safety as opposed to setting restrictions or applying too many filters as they need to know what to do if they do come across inappropriate content in search results. To prepare children for a variety of search results, some schools try to teach children at their school how to narrow search terms or to make their key word searches more specific:

"If they're looking for a sloth, we'll put sloth animal. You know, to make sure they're very specific and what they're asking the Internet to give them back."

(Teacher 19).

There were suggestions that as well as teachers and students, it is important for parents to understand how to use a search engine effectively and how to incorporate e-safety in their digital resources at home:

"We try to put workshops on for parents as well throughout the year and we show them how to put filters on at home fillers on phones and iPads and PCs and laptops. We want them to become more confident."

(Teacher 19).

Teacher 5 stated that it is important to educate parents in internet safety whilst using search engines because it is often overlooked once restraints have been set, they state: "banning and blocking is not the answer" as "this approach does not acknowledge that children could access the internet elsewhere or may intentionally bypass systems without parent's knowledge" (Avery & Assiter, 2018). Often parents need to be reminded that blocks and filters are never 100% protective. Rather than placing restrictions which may heighten children's curiosity and evoke the opposite outcome where children override restrictions, it is important that there are open discussions about safe searching and to approach an adult if there are any concerns.

"It is more important that we show the kids how to be risk aware."

(Teacher 15).

The aim is to empower children to make safer and sensible choices when online.

4.2.1.4.1.4 Communication and collaboration

Lockdown forced schools to replace face-to-face communication with colleagues, parents, and students with digital alternatives:

"We now use the school website to communicate with parents and Teams and emails for staff."

(Teacher 23).

Before the closure of schools, 31/33 teachers had little or no experience of using videoconferencing as a communication method, this changed significantly for the participants using it whilst schools were closed. Teacher 14 stated that prior to COVID-19, their first method of communication would be face-to-face with colleagues rather than using a digital communication method like emails, videoconferencing, and social networks like WhatsApp. However, during lockdown, teachers had little choice other than to communicate with both colleagues, students, and parents via videoconferencing and digital platforms:

"I'd never experienced videoconferencing before but now I feel like it's all I ever do."

(Teacher 24).

The initial interviews showed that staff would usually participate in team meetings and CPD sessions on a weekly basis, most usually in a physical staff room. As the pandemic hit, the need for communication between staff became even more vital as policies and guidelines were changing at such a rapid pace (Middleton, et al., 2020). The study shows that during lockdown, most schools were using Microsoft Teams and Zoom to hold videoconferencing calls to discuss current work, new guidelines and plans to reopen. This was a very new method of communication, as mentioned previously, prior to COVID-19 most schools had never participated in a video conference call.

"We don't use videoconferencing."

(Teacher 26).

To maintain relationships and morale, communication amongst colleagues was essential. During lockdown and the reopening of schools, most schools communicated professionally via email, telephone, or video conferencing to stay safe both physically and mentally. The findings showed that each participant's school used social media, texts, and WhatsApp to communicate informally with their staff:

"Our school had a WhatsApp group between colleagues to discuss school issues and another for them to discuss issues outside of school."

(Teacher 14).

This was done to promote the boundaries between work and home life as this had been crossed as the home had also become the workplace. Those that had had a home-work balance no longer did as those whom they would see socially or physically daily, all had to be contacted online. Prior to lockdown, most teachers would have drawn a line between friends and colleagues through methods of communication:

"I went from meeting my friends to texting them or calling them. I went from seeing my close colleagues daily in school to emailing or videoconferencing with them, which before I would only have done with externals."

(Teacher 11).

As digital communication was not a priority prior to COVID-19, and teachers in schools using social networks, blogs and online platforms, etc. were often "not involved in this" (Teacher 17). The participants explained that their schools were using their websites as a method of communication with parents and the outside community, but often the teachers themselves were not involved in the web design or uploading content. Therefore, even as a necessity, teachers were not being trained in or had any experience with these digital platforms:

"There's certain staff members that do that."

(Teacher 15).

Similarly, in the initial interviews, Teacher 18 explained that they weren't really involved in discussion groups or the texting and communication with parents:

"The Headteacher texts and communicated digitally with the parents if necessary for professional purposes. If I need to communicate with them, I will speak to them at the school gate."

(Teacher 18).

The shift from physical communication to entirely digital communication meant that schools had to invest in training support staff, parents and students in this dramatic change, which required time, patience, explanations, and the required equipment.

The findings revealed that prior to lockdown, most teachers without greater responsibilities preferred to use face-to-face methods of communication for advice and discussions. Teacher 15 (an RQT) stated that they did not use online discussion groups for professional purposes. Teacher 11, who had been teaching for 6 years, explained that although they have an educational Twitter profile, they did not participate in the sharing of their own ideas, experiences or give advice.

However, the findings showed that teachers in more senior roles would use digital communication as they had to reach a broader range and number of contacts. Teacher 16 (IT lead) stated that they used online discussion groups to liaise with other contacts and offer advice. This is in direct contrast with many teachers as not only did they use them, but they also contributed. Teacher 17 explained that they used their personal Facebook account to keep in touch with former colleagues, teachers from other schools and educational leaders relating to their own subject fields, such as English Leads, etc. As a Deputy head, Teacher 17 had greater responsibilities and so also used WhatsApp for communication with current colleagues.

Those teachers with greater experience, such as Teacher 17 using emails as an internal and external communication method, are constantly using technology to communicate therefore more confident:

"I'd say intermediate to advanced. I'm always sending texts, Facetiming with friends and family, sending emails. I've used discussion forums in the past but as I said before not so much now."

(Teacher 23).

Prior to lockdown, results showed that teachers often used digital communication to communicate with people they wouldn't see regularly. Those teachers who were in Academies, partnerships and Trusts often communicated with externals and had training together, both physically and virtually:

"We sort of have staff training with them and staff meetings and we'll do those together. Sometimes on site and other times using things like Skype."

(Teacher 15).

There was an option before lockdown to communicate either physically or virtually or both. For teachers in more senior roles, communication was often a mixture of physical and virtual communication as they had to communicate with parents and colleagues internally and other contacts externally. Teacher 19 expressed a mistrust towards solely using digital communication methods due to reliability and miscommunication through tome:

"Your initial phases are through the email, but then obviously things I find things can get lost in translation at times. Sometimes you can't tell people's tone because their punctuation isn't so good! And so I prefer to meet people in the old-fashioned way."

(Teacher 19).

Lockdown took the choice to communicate physically away and made digital communication essential and therefore removed the attitude of unwillingness to using technology professionally.

Social networking

This research showed that prior to the pandemic, some schools used Facebook, Twitter and Instagram accounts (Teachers 3; 7; 8; 9; 11; 12; 13; 20; 27;30; 32). However, 14/33 schools did not use social media as a communication platform:

"It's not used,"

(Teachers 2; 28)

"We don't use any. The Headteacher doesn't agree with them,"

(Teachers 4 and 18)

Teacher 4 explained that their school chose not to use social media as it had several vulnerable children in its cohort and so were restricted in using social media.

During lockdown, schools had no choice but to explore social media and networking platforms as a method of communication. In not activating these prior to lockdown, many schools were faced with opening accounts on Facebook, WhatsApp, Twitter and other platforms such as Class DoJo or school websites and having to educate staff, students and parents on how to use them properly. Instead of familiarising students with their online communication platforms, such as emails or direct messaging, staff had to provide these details during lockdown. It was necessary for all children to have access to an online communication platform linked to their school to ensure that schools could communicate with children outside of school:

"We've had to make sure every student and parent have their login details to check work and messages."

(Teacher 19).

4.2.1.4.1.5 Cultural, social, and ethical understanding

The interviews showed that teachers in this study had a very limited understanding of appropriate behaviour regarding cultural, social, and ethical situations. Teachers mainly

touched upon access to different cultures and social experiences when discussing digital communication:

"We did videoconference with a school in France and then children asked them questions, in French, about themselves and what educations in France is like."

(Teacher 8).

There were mentions of digital responsibilities and how children need to act responsibly and behave respectfully online:

"We're trying to teach them how to be safe and responsible online. We've talked about digital footprints and things like cyberbullying."

(Teacher 6).

"My pupils in Year 6 are using things like social media a lot at home. We've had discussions about the differences between what's real and what's behind a screen. You want them to know that if you wouldn't say it to someone's face don't say it through a computer."

(Teacher 19).

"I'm trying to get children to think about how they might speak to people online. It was a really good cross-curricular opportunity where we were talking about how punctuation affects tone. We were working from home so I got them to send a partner an email and students had to tell their partners how they would have interpreted the message"

(Teacher 20).

The findings show that teachers have a need for a greater understanding of cultural, social and ethical situations online. It might be suggested that training in netiquette, virtual and physical communication and behaviour, digital responsibility, and respect online should be offered to both teachers and students, particularly due to the current climate in education.

4.2.1.4.1.6 Creativity

Teachers in this study acknowledged that they used technology as a creative tool to help motivate and engage children in the classroom. Seeing and experiencing are the best ways to learn and understand, for example, using certain software students can even get on a

spaceship virtually in the classroom thanks to the integration of technology in education. The results showed that teachers felt having technology in the process of learning increased the students' interest in the lesson, and therefore, technology motivated the students to engage more.

"I've explored greenscreen and the kids were pretending to be driving in a car or faced with some kind of monster and they loved it for their stories and things."

(Teacher 12).

"It arouses them!"

(Teacher 19).

Some teachers felt that students with SEN or EFL learned better when they could see things that they cannot in absence of technology:

"Sometimes using videos and things really helps motivate a girl with SEN in my class, it almost clicks in a part of her brain the helps her to engage and then gain a better understanding."

(Teacher 15).

There is certain software available which can aid teachers in delivering their computing curriculum and have lesson plans to support and these comply with General Data Protection Regulation (GDPR) for security and safeguarding purposes:

"Code.org complies with GDPR as long as we want to use the children first names in it."

(Teacher 19).

Some software uses popular multimedia and characters to motivate the children into completing tasks and allows the children to meet the curriculum standards required:

"Those that are usually not necessarily academically inclined, they're helping their peers who are higher abilities, or it gives a different kind of child a platform to do well which gives them confidence."

(Teacher 12).

"It uses things like Angry Birds and stuff to kind of grab the kids attention and then the kids code and they can build games and solve puzzles. So it's almost like a video game, but they have to be able to code the game to be able to complete the task"

(Teacher 19).

"I mean, it really turns them on and I've had children in an hour less and do like 10 different parts in the lesson, because they're so excited and the children that are like text savy and motivated."

(Teacher 19).

A lack of motivation and engagement affected behaviour management which meant teachers have had to provide lessons that would excite the children. Teachers had experienced a lot of pressure in trying to engage more with the students and to motivate them to working online, which had resulted in working longer hours to prepare.

"It's extremely difficult to manage behaviour and engagement in a KS1 classroom anyway. So myself and my TA spend hours brainstorming ideas, more hours preparing the lessons and then I go onto the screen armed with my puppets, signs, stars and that, all singing and dancing and by the end of my teaching time I've got a sore throat and I'm knackered! In the classroom you might do that for a while and then give them 'learn through play' activities but we haven't been able to do that. You often see parents having to bring their children back after they've wandered off. It's a bit much for us all."

(Teacher 14).

4.2.1.4.1.7 Online Education

The pandemic lockdown exposed the urgent need for all teachers to be able to use digital technologies effectively for online teaching and learning (Perifanou, 2021). Initially, the teachers in this study felt confident in using technology for simple tasks, such as presentation applications for slides and word processing applications for planning, but after lockdown hit all teachers admitted:

"My skills weren't up to scratch. I wasn't prepared to teach online."

(Teacher 20).

Even though initially unprepared, schools started using online learning platforms to teach their students. The second round of interviews revealed that many schools were providing learning strategies through online platforms and online learning programs:

"We now use Zoom to deliver lessons and send work via email or using the e-learning portals we've recently subscribed to."

(Teacher 1).

After schools reopened, some decided to continue using those online platforms, in an attempt to maintain those practices:

"We still use some of subscriptions like Times Tables Rockstars and Purple Mash for homework and home communication."

(Teacher 20).

'Delivering online home-based education that is as close to school-based learning is complex' Teachers explained that their schools had subscribed to and were using online platforms, such as Purple Mash, Class DoJo and Education City and reading apps like Oxford Owl which offer an online library for reading skills to support children reading at home.

"Children are usually expected to read one book per week and answer questions in a reading journal to show their understanding."

(Teacher 32).

Teacher 32 went on to explain that often parents didn't understand the importance of repetition and recall, consolidating learning and so allow their children to read all the books in a level once, rather than multiple times, as repetition helps to consolidate learning:

"Parents are keen to move them to a higher level even when they are not ready to."

(Teacher 5).

For this reason, Teacher 5 explained that they had to get in touch with students and parents via emails, telephone calls and on their school website to emphasising the importance of

repetition and recall, supporting the idea that parents and children should re-read books to answer questions on them.

In the second round of interviews, teachers expressed that there were difficulties with the continuity of teaching strategies. For example, in Mathematics, where there are many different learning methods, parents expressed their anxiety about using the learning strategies that are curriculum-approved or in line with those taught in schools (Middleton, et al., 2020). The findings showed that many teachers felt that parents were uncertain of their understanding in areas of the curriculum, that perhaps did not exist or were taught differently when they were at school and felt that digital learning was not as reliable as in classroom learning:

"I've been contacted by some parents who are struggling because they know that the way they were taught isn't the same was as is being taught to their children. They feel like they need you there."

(Teacher 19).

Teacher 25 explained that some parents felt unfamiliar with phonics and grammar and so struggled explain or instruct their children. All participants gave details about the support structures their schools had put in place to support the children and their parents. Teachers explained that their schools were providing details of the objectives and learning strategies and providing access to free planning/resources from sites such as Twinkl and PhonicsPlay and again drawing on educational software such as Purple Mash and Class DoJo which provide lesson plans, teaching videos, games and resources by year group, subject and ability, making it easier for children to access curriculum approved resources and be independent in their learning (Middleton, et al. 2020).

The findings from lockdown interviews showed that only 14/33 participants were using video conferencing with their students to deliver lessons. There were issues with children logging onto the shared platforms at the same time and receive equality of learning opportunities:

"It's been an absolute nightmare with trying to log on and then the system crashing and getting all these messages about the kids losing connection."

(Teacher 12).

Teacher 12 explained that because of this problem, schools were providing whole class resources and activity suggestions:

"We've been sending resources home and putting information and activity suggestions up on our school website."

(Teacher 12).

Many of the teachers explained that online platforms provided planning timetables for activities in Mathematics, English and other topic areas. Some schools already used online platforms making them familiar and easier for the children to use. Some schools decided to expand their subscriptions to other platforms:

"We've invested in subscriptions to Education City, gotten a premium package for Oxford Owl and have reopened our subscription for Class Dojo."

(Teacher 5).

In opening subscriptions for online learning platforms, parents and children expressed their difficulties in understanding how to use new programs to their full potential. In response to these concerns, many schools uploaded instructional videos on to their websites and provided links to other informational videos, e.g. YouTube, to help with this.

Some teachers expressed that they found behaviour management harder when teaching online:

"You can't see their faces or know whether they are paying attention or truly engaging."

(Teacher 3).

"We had to make it policy that they children wore clothes for their lessons. Some of the children were wearing their pyjamas and then they're not in the right mindset to learn. There isn't that barrier, you know?"

(Teacher 11).

"They were pretty good overall, l but I did have a couple of students carrying on and not paying attention, you know doing things they wouldn't have dared if they were physically in the classroom with you."

(Teacher 19).

The findings showed that in the initial interviews most teachers felt that their DL skills could "be better." This set a notion for online teaching practice, as some teachers felt unprepared and that their standard of teaching would be at a lower level than it would be in a face-to-face lesson. When students returned to school, their baseline levels had decreased in some cases. Teachers in this study expressed concerns that it was their lack of familiarity and confidence when teaching online, particularly at the beginning of lockdown, that had affected their own standards of teaching and as a result students weren't reaching the desired standards. Many teachers explained that teaching online had lowered their teaching efficiency, as there were issues with the pace of the lessons as teachers couldn't find certain functions on the software being used and sometimes attendance and control of behaviour were affected as their decrease in confidence also lowered their perception of authority.

"I felt that I didn't know what I was doing as it was all so new, I use technology at home but obviously I've never had to use it to the extent we do now. I feel like the kids picked up on this and I don't know if it's true, but I felt that with some of them knowing more than I did my level of expertise was lower."

(Teacher 1).

"It was difficult to manage behaviour at times because the children had more control, they could get up and walk around, wear what they wanted and not always pay attention because you couldn't keep your eye on them behind a screen like you would in a classroom."

(Teacher 1).

"I couldn't get through a lesson as fast as I usually would because it was all new. I had to look for things which wasted time. I felt that we couldn't always achieve as much because there was a lot of stopping and starting at the beginning. We had to get through the content with little time for reflection."

(Teacher 1).

At the end of the second round of interviews, the researcher asked:

"What do you wish you'd known?"

(Reseacher, Interviews, round 2).

The participants agreed that they all felt that they'd have like to have had more training in DL skills prior to lockdown, but stated that it was only when they began teaching virtually, that they could identify what those needs were:

"It was only when I was using Teams that I realised I couldn't use it properly. I wished we'd had training so I couldn't have used it earlier for better communication with externals and to do activities like speaking to children from other schools with my class."

(Teacher 11).

"I wish I'd explored using technology more creatively so that I could have had fun tasks in my lessons."

(Teacher 20).

"I'd have liked to have known how to search more effectively because I was constantly looking for advice, ideas, and resources. It sometimes took ages to find what I wanted."

(Teacher 23).

"You know how little I used technology in my lessons before so it probably would have been a good idea to have spent time training and practicing so I wasn't in the situation I ended up in. For the first week, my lessons were utter chaos. I didn't know how to share my screen or resources, and I didn't know how to sign in to staff meetings."

(Teacher 24).

"I'd have liked to have known how to search more effectively because I was constantly looking for advice, ideas, and resources. It sometimes took ages to find what I wanted."

(Teacher 26).

"We have a lot of vulnerable children in school. E-safety is a big issue, not only for cybersecurity, being safe with what you share. I think if we'd had more training in the aspects of e-safety and mental health, I might have been more prepared for dealing with things like cyberbullying, how to make them recognise fake news."

(Teacher 28).

4.2.1.4.1.8 Barriers to technology integration

Time

To integrate technology across subjects is something that takes time for teachers. The findings showed that teachers, in this study, felt that time restrictions are a huge barrier to

developing DL skills and using technology in educational practice. With little time to deliver the NC, teachers are often unwilling to take risks with technology as they cannot afford to waste time if something goes wrong.

"It's all about kind of you having the time to go through everything and see what works for your school, which unfortunately you've got other pressures in terms of English and Maths, especially in Year 6 to cope with. Technology has to take a step back; it can't always be relied on and therefore can't always be prioritised."

(Teacher 19).

"We've got so much to cover and have the pressure of SATs. I can't trust technology and so I feel it isn't worth risking time to have it as a support tool if I don't need to."

(Teacher 24).

Lack of administrative support

Another barrier to technology integration was sometimes administrators' openness to technology integration. Technology-rich schools provide opportunities to learn more tools and explore digital skills with guidance, not just going to be using a mobile phone but get typing experience using a keyboard, and using Microsoft office, as children were less likely to use these at home, etc.

Workload

In discussing workloads, the teachers in this study discussed the huge pressures they faced, regarding workloads. They stated that their workload now consisted of non-teaching, or delivery tasks, including marking, planning and data management. Teachers 5,6,12,17,18 and19 all discussed the large amounts of time they now spent in order to meet and perform to extremely determined standards, on average working 12 hours per day,

"I arrive at school at 6:30 to prepare for my day; setting up my presentations and equipment for the lesson, adapting my planning, sometimes marking, briefing my TA and having breakfast there. Then I tend to leave at 6ish, once I've spoken to my colleagues, parents, done as much marking as I can, making notes on my plans and tidying up with my TA."

(Teacher, 10).

In the findings, teachers indicated that limitations of time and their teaching context affected their capabilities and priorities, regarding all subjects but particularly Computing. Not working in a supportive environment of technology use, such as not having equipment or training, and struggling with confidence due to their lack of practising teaching technology effectively meant a negative attitude towards technology integration has arisen for some teachers. Teachers are under huge amounts of pressure to get through large amounts of marking to determine the needs of their students and adapt their lessons to suit these needs. For this reason, teachers must prioritise what the children need to be taught, and as mentioned, core-subjects (English, Maths and Science) are most often the upmost priority. In combination with time limitations, teachers are often delivering to large classes of mixed abilities without any assistance. The findings indicated that teachers could not spend time assisting children struggling with their device or software, which would distract them from delivering the lesson.

"The pressure we are under to deliver is really strenuous. There's so little room in the curriculum to recap over things. After marking 30 books every night and then seeing gaps in learning, it's ensuring they understand what's been taught in core-subjects that has to take priority."

(Teacher 9).

After lockdown, teachers discussed their new experiences with, and training in teaching with technology. Findings showed that teachers felt they had developed and improved their DL skills with practice and training. However, there were concerns that after returning to school, assessments had shown gaps in learning and so teachers once again had to focus on core-subject content, and therefore practicing of and training in technology integration would once again take a backseat. Some schools were worried that they needed to remain prepared for another lockdown and so were ensuring that DL skills were improved and practiced.

"As ICT Lead, I'm working to make sure staff are continuing to be trained in ICT skills. I'm offering training in using Google.docs and in the software we have invested in. We have all these new devices, and we aren't as worried they're going to fail, so I want to make sure we use them!"

(Teacher 13).

"I'm worried about if we're going to be ale to keep using and having training in teaching with technology, or are going to go back to the way it was?"

(Teacher 15).

Access to, availability and reliability of digital resources

"We are living in a digital world with technology transforming the way we live our lives, both at home and in the workplace" (Hinds. DfE, 2019) this research has shown that the practising teachers had used digital devices both personally and professionally, affecting pedagogical methods both inside and outside of the classroom.

"I use the apps on my iPad at home, just to mess about so I kind of get to know what to do when I show the kids in the classroom."

(Teacher 19).

"I love playing about online, you get some great ideas for lessons."

(Teacher 27).

There are theories that teachers' personal uses of digital devices can affect and develop their functional skills and their creativity in the classroom: "with the use of technology the home can become an extension of the classroom" (Sawmiller, 2010). The use of digital devices creates a familiarity with DL and this feeds into professional work (Cunningham, Kerr, McEune, Smith & Harris, 2003).

In considering the ways teachers use technology, this research showed that on a personal level, technology was used for entertainment purposes, online shopping, work, games, and communication. It appeared that teachers used their mobile phones, laptops, or iPads "daily" (Teacher 1); "oh everyday" (Teacher 12) and "all the time… so daily" (Teacher 25), creating a sense of comfort and familiarity with technology and making it second nature. This level of comfort with technology on a personal level has fed into how participants in this study use devices professionally:

"Well you know we're surrounded by phones, laptops, PCs, etc. It's become a second nature using them and that has filtered into my teaching really."

(Teacher 16).

The interviews revealed that mobile phones were central to their digital experience personally, but that desktops, laptops, and Interactive Whiteboards (IWB) were central professionally. These devices have helped to change the way that they experience the world and how information is processed. Most participants acknowledged using search engines to answer any of their queries, both personally and professionally, but only 26.6% classed themselves as having intermediate to advanced skills and 66.6% felt that their search engine skills were intermediate. They admitted that they were able 'to find what they were looking for' by using key word searches and filters but none had any experience with advanced web search engine skills such as phrase searching or Boolean retrieval:

"I mean I can use keyword searches and sometimes must rethink my search words when I don't find the information I want. That's as far as I get though! I'm not really in the know about using these capitalised ands or ors!"

(Teacher13).

When asked about the impact of the internet and search engines in their professional capacity, only one teacher stated that they did not use search engines as a default option to source information. All other participants said that the internet had a major impact on how they were able to access information, content, resources, and material for their teaching.

When first asked about sharing ideas and resources or communicating with other schools, colleagues, and parents, it was found that only 7/30 teachers had ever participated, to a limited extent, in video conferencing and 10/30 schools did not have any social media accounts making online communication difficult. COVID-19 forced all thirty-three participants and their schools to use online communication methods:

"We have a school WhatsApp group and started using Zoom for staff meetings but now we use Microsoft Teams"

(Teacher 3).

Since it is compulsory for all schools to have a website (legislation.gov.uk, 2012 and 2016), it has provided a platform to communicate with parents and externals and to provide easy access to information to meet government regulation requirements (legislation.gov.uk, 2012

and 2016). COVID-19 required schools to increase their use of digital communication tools including social networking platforms (e.g. WhatsApp), video conferencing, email and e-learning platforms. Findings showed that some teachers used their personal social networking accounts to participate in discussion groups related to teaching practice both before and during the pandemic. This study also highlighted that communication with parents and the home use of digital devices varied between wealthier and poorer areas, depending on their accessibility of technology and motivation:

"We've struggled with attendance because we're in a deprived catchment area where the children are in bigger families and are having to share their devices. It makes it difficult to access the work and their parents struggle to give them all the attention they need."

(Teacher 25).

There were discussions about practicing DL skills in the classroom with the available devices, such as using class sets of iPads and laptops. Prior to lockdown, teachers found this difficult as they often needed charging and were slow as they were old. This made it time consuming and frustrating and so the devices were often abandoned. There was recognition that not all children had access to digital devices during lockdown and they struggled to keep up with their schoolwork. To try to meet the need for digital devices, some schools attempted to loan vulnerable children school iPads and laptops.

"We've given out some of our iPads to some of the families that were having problems; lots of them could only use phones and it's so hard to work that way because the screen size is too small and sometimes the app format doesn't work on phones."

(Teacher 13).

Teacher 5 stated that their school had struggled to support some vulnerable families because the devices they had in school were old and weren't reliable, they went on to say:

"The government announced a scheme to provide digital devices for disadvantaged and vulnerable children but that was months into the lockdown so children hadn't really had the access to the work they needed before that. Even though we have a high proportion of pupil premium children, they still didn't all meet the criteria and still had to go without."

(Teacher 5).

Lack of funding and maintenance

Teacher 19 discussed the availability of devices in their own school and how it is often linked to the decisions that are made based on funding. Their school provider, prior to the pandemic, was their local council, but they were aware that some schools were unsatisfied with the availability, reliability and maintenance of the distributed resources and had opted to outsource their maintenance provider as opposed to using those given by their council:

"You pay quite a bit for council to run your software when actually if you outsource it, it can be cheaper at times and can be more frequent as well"

(Teacher 19).

Teachers have described that councils often only supply maintenance on a limited basis, such as fortnightly and this often isn't enough support and therefore the reliability of the software and devices declines and cannot be integrated:

"I mean it's not really reliable because they don't always have enough time to get around to fixing everything and then we can't use them."

(Teacher 6).

This reflects that a lack in maintenance results in a lack of availability in technological resources, creating a barrier to integrating technology into the classroom. At the time of the third round of interviews, schools had not been reopened for long enough to determine what state the supply of maintenance would be.

To provide online teaching during the pandemic, schools had to look for funding to ensure access to devices, the internet and reliable electricity, particularly for students in extremely deprived areas:

"We have a lot of children from low-income families, and we sent out a survey to make sure that the children had what they needed, like computers, the internet and sometimes enough electricity to last as they wouldn't usually have used as much when the kids were at school"

(Teacher 25).

During lockdown, the DfE provided a 'Get help with technology for remote education' funding strategy:

"It's meant to help with the ordering of equipment like laptops, iPads, etc., we're also using it to help get our current devices repaired so they can be sent home."

(Teacher 5).

Teachers 5 and 16 expressed that although this fund appeared to be helpful to those in need, there were great difficulties when trying to access it, as "the process has many hurdles" (Teacher 16) and therefore funding was still an issue.

Parental unwillingness

Teachers in this study expressed that they had some parents in their classes, particularly before lockdown, that were reluctant to having their children using technology at home:

"I'm a parent and I restrict the amount of time my kids can spend on their iPads, even when it's e-learning apps."

(Teacher 25).

Working in Reception, Teacher 14 explained that they often used learning games and activities on their IWB and children had access to classroom iPads during free play. They stated that their classroom environment often mirrored the views of parents:

"We have a good balance with technology and physical activities. Technology can be beneficial as a support tool but it's still really important for children to develop social skills"

(Teacher 14).

Some parents show a reluctance to their children using technology as they feel it may interfere with their attention span, socialising and building their own characteristics. Teacher 18 discussed how they had spoken to parents during parents' evenings where they expressed concerns about allowing their children to go on iPads for entertainment rather than learning:

"These parents were experiencing guilt and feeling lazy for allowing their 4-year-old to watch videos on an iPad. I've just explained that iPads can be used as a learning tool but children also need breaks in learning or to make things more exciting. We're often using technology for motivation and engagement so that learning is fun."

(Teacher 18).

Parents main concern about children using technology was issues with security and e-safety. Teacher 17 discussed how some parents didn't want their children online because of risks with inappropriate content on search engines, issues with fake news and cyberbullying and 'catfish' scenarios, where people pretend to be someone or something they aren't. This could not be escaped once schools were closed as the main teaching strategy was to use online software and technology and therefore children were exposed to these risks. It may be suggested that if children are taught how to balance their time spent on technology and are exposed to risks online and shown how to deal with them, children will be able to make sensible choices whilst using technology.

With few attempts to overcome these barriers, there is little hope of appropriately educating the next generation in required skills for the future, such as digital communication and staying safe online, effective searching skills for personal and professional needs and how to be respectful to the diversity of persons present on the world wide web (www). However, since lockdown, schools have had no choice but to try to overcome these boundaries as there was no choice but to integrate them into teaching. For effective use, both students and teachers required appropriate training to improve their DL skills.

4.2.1.4.4 Assessment

Digital learning software is now used as a support tool by some schools to increase children's knowledge and understanding and practice different skills and tasks. Teacher 17's school had invested in 'Reading plus,' 'Accelerated Reader' and 'MyON' software, prior to the pandemic outbreak. They stated that their SLT aimed to use it to aid the children with SATS at the end of KS2.

"The children now at the end of KS2 and previous years, the paper was about 1800 words and they obviously then have to read all of those words and answer questions on it. Now this year there are 2300, so the fact that Reading Plus supported children with speed reading obviously is very good for that."

(Teacher 17).

In using this digital software, Teacher 17 believed that it would help to accelerate the children's reading pace, allowing them to cover more text in a shorter time frame and so will be able to spend more time on the comprehension questions. E-learning software often keeps a record of the children's activities which can then be kept by teachers for assessment evidence.

It is a frequent practice for primary schools to use a database to store data tracking information to monitor progress. In terms of assessment, Both Teachers 16 and 17's school used a database to store tracking data. Their school uses a software called 'iTrack' as opposed to spreadsheets. They suggested they had considered bringing back the use of spreadsheets for Foundation Subject assessment tracking but stated that they were not accustomed to using them currently.

The pandemic was a particularly difficult time to accurately monitor/evaluate children's progress. Some programs, such as Purple Mash, store data on completed tasks and allowed teachers to see what work the children are doing but there is no proof that it is the children themselves that are completing the tasks. Some schools asked children to upload their work via email, such as taking photographs of written work and practical activities and teachers would then be able to observe and respond to these. Schools couldn't place an emphasis on monitoring and assessment as it is dependent on time, engagement, and willingness. The findings showed that some SLT decided that it would be better to reduce monitoring and to try to improve communication with parents to discuss work and wellbeing, as well as offering advice. Teacher 5 mentioned that correspondence depends on the parents and schools have noticed that most of their children and parents were motivated and engaging well:

"It's been tough, but I feel that because we've bought into a lot of online learning software and resources the children and their parents are engaging well."

(Teacher 5).

Teacher 6 noted that they had found those who weren't engaging are those parents who are not usually as involved with the schools and their children's education. These families have been contacted more frequently via phone calls, texts, and emails (teachers 7,9,11,13,19,25,26). The pandemic made it difficult for parents who are working full time or have larger families to find the time to both do the work and then report back to staff.

"Lockdown has made assessments, monitoring and being able to see where the children were at really hard. Parents just can't keep track; we must remember they aren't teachers"
(Teacher 26).

The third round of interviews showed that as there were inequalities in the availability of digital devices, access to digital learning tools and support at home, when the children returned to school.

"We basically had a minimum of assessment data from the lockdown period. We had to do tests when they got home and identify what needed to be done."
(Teacher 4).

4.3 Determining the framework

Using findings from the review of literature and the interviews, a CPD course was designed to give a better understanding of digital literacy skills and to develop these skills so that they can be incorporated into teaching practice.

It consists of six, one-hour training sessions including activities, and focuses on different components of digital literacy skills These being: functional skills, e-safety, finding and selecting relevant information, communication and collaboration, cultural, social, and ethical understanding and using these skills creatively.

An overview of each session was offered:

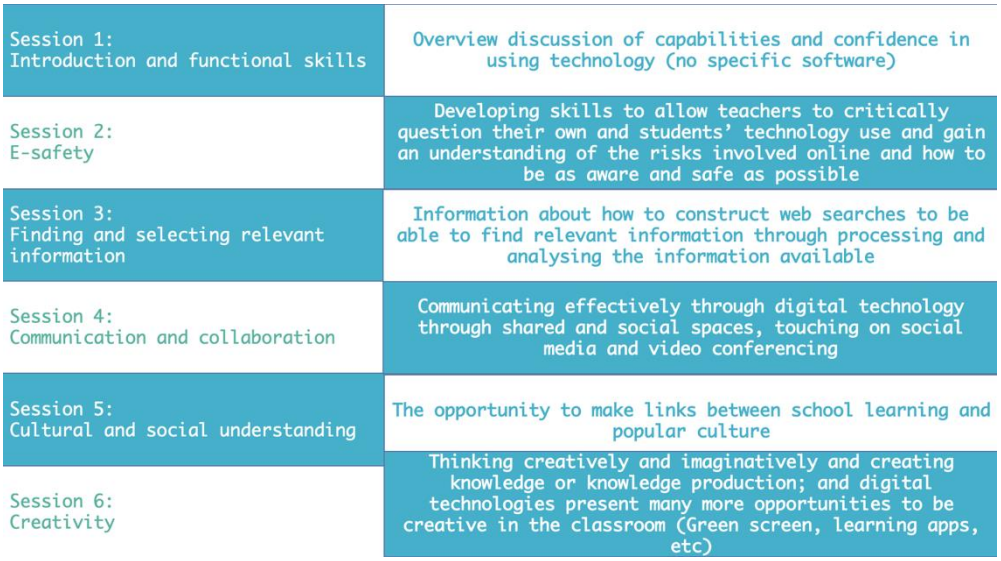


Figure 4.5 *An overview of the individual sessions in the digital literacy skills for primary educational contexts framework.*

The main aim of this programme was to make teachers feel comfortable exploring different digital devices and software to become confident enough to use them in their teaching practice.

Schedule:

Session	Title	Objectives	Activities
1.	**Introduction and functional skills**	• To understand the meaning of digital literacy in an educational context. • To understand how to build confidence and develop an understanding of exploration and adaptation to using software to find different tools and techniques. • To explore and develop technological functional skills.	• To indicate initial perceptions of the term digital literacy and create a word cloud to see patterns in thoughts. • To discuss some of the challenges teachers have faced during lockdown and what solutions have been found. • To test your own typing skills. • Searching for and using other relevant and available training resources.

2.	**E-safety**	• To look at statutory guidance and legislative framework on online safety. • To understand the risks children may encounter online, including harmful content online and cyberbullying • To look at useful resources and lesson ideas and YAPPY • To be able to access advice and support for children and parents in using the internet safely. • To consider how online behaviour affects professional reputations	• To discuss your own experiences with social media • To discuss social media and about at how it benefits us socially, professionally, and academically • To discuss online safety for students and identify the risks of students using social media • To look at how to build a positive online reputation
3.	**Finding and selecting relevant information**	• To consider using the web as a research tool • To understand issues of evaluation and copyright • To understand how to identify reliable sources. • To gain an understanding of research methods such as key word searching, Boolean retrieval, truncation and wildcard. • To view different approaches to teaching information literacy.	• To discuss what should be considered when asking students to find and filter information.
4.	**Communication and collaboration**	• To explore online communication platforms. • To consider effective formats to communicate and collaborate online. • To develop an understanding of communication methods for sharing files, using videos and conversations, internally and externally • To consider how to use digital communities to exchange ideas, share and exchange resources and collaboratively to develop digital resources. • To view different approaches to teaching about online communication and collaboration. • To consider how to use	• To discuss own personal and professional experiences of online communication and collaboration. • To share ideas about online communication lessons. • To share ideas about methods to communicate digitally with learners and how they can interact with each other. • .To discuss own experiences with remote learning platforms.

		learning activities that encourage learners to collaborate and communicate using digital technologies.	
5.	**Cultural, social, and ethical understanding**	• To look at the legal and illegal implecations of technology and content use. • To understand that digital culture is the internet and it provides a medium between other cultures and social interaction • To understand digital rights and responsibilities • To encourage appropriate online behaviour with the appreciation of cultural limitations and boundaries.	• To discuss experiences of virtual reality. • To discuss rules of netiquette and designing a poster to explain this term. • To discuss the ethical, legal and environmental concerns of digital culture
6.	**Creativity**	• To experience methods to use a range of digital resources and technologies to create a relevant, rich and effective digital learning environment.	• To look at and evaluate examples of creative use of technology in the classroom. • To discuss ideas and experiences of lessons that incorporate e-learning or using digital tools for creative presentations.

Table 4.4 *Table to show schedule and objectives of the digital literacy skills for primary educational contexts framework*

Session details:

1. Introduction and functional skills

We will define digital literacy and discover how it relates to your teaching practise. We will look at the different components of digital literacy and how each can be incorporated into your teaching practise. We will go on to look at using technology and developing functional skills through exploration, confidence, and adaptation.

2. E-safety

We will look at some of the risks children face when using the internet, such as harmful content and cyberbullying. We will look into internet safety for students and incorporating e-safety into your own lessons by encouraging children to think about age restrictions, making friends online, sharing personal information (YAPPY: not sharing Your name, Address, Phone number, Password and Your plans and birthday), their online reputation and digital

footprint, questioning the reliability of sources and fake news, accounts, passwords and usernames, manners and talking behind a screen and mental health and wellbeing. We will also think about how your personal online behaviour can affect your professional reputation.

3. Finding and selecting relevant information

We will look at how to use a search engine efficiently by using specific keywords and terms and other techniques. You will go on to look at different search engines and how to evaluate websites for reliable information. We will also discuss plagiarism and copyright.

4. Communication and collaboration

We will look at what tools can be used to communicate and share information online and discuss experiences of the software used personally and professionally. You will be introduced to communication methods for sharing files, using videos and conversations, internally and externally. We will look at methods to communicate digitally with learners and how they can interact with each other, online profiles and how to make the most of and contribute in discussion forums. Finally, we will consider how to use learning activities that encourage learners to collaborate and communicate using digital technologies.

5. Cultural, social, and ethical understanding

We will be exploring the cultural, social and ethical dimensions of digital media and networking and considering ways to encourage appropriate online behaviour with the appreciation of cultural limitations and boundaries.

6. Creativity

We will be looking at how to use different digital resources and technologies in planning and in the classroom. We will explore different uses of technology for teaching and learning, in forums, videos and other platforms. You will evaluate these examples and collect ideas for your own creative use.

The purpose of this framework is to develop teachers' knowledge and understanding of DL skills, to feel confident enough to implement these skills into their teaching practice and to then guide their students into developing their own DL skills.

4.4 Chapter Summary

In this chapter, the findings from the research have been presented, focusing on those categories most prominent in the data. Key themes arising from the interviews data paint a picture that teachers have some understanding of and experience of DL skills. However, prior to lockdown, teachers were constrained by availability and accessibility of resources, time restraints, lack of training and the constraints of existing responsibilities. Post-lockdown, a greater availability to devices and resources and greater experience of and training of using technology in teaching, created a higher DL skillset and an improvement in teachers' confidence in implementing DL into their teaching strategies. Teachers still expressed a need to receive professional training in the skillsets children need to be taught, and in what way, so that their habits will come from a formal source so that their skillset will be more applicable to a more formal setting.

However, although digital literacy skills had improved because of the higher frequency of using technology in teaching, teachers were concerned that their own standard of teaching was not as efficient as it was before, which affected students' learning.

The interviews indicated that participants had diverse experiences with technology in their teaching practice and training, both before and after lockdown. The more experienced teachers had received more extensive training during the introduction of technology into schools and the digital strategy for school around the millennium. The findings showed that many teachers and children used technology at home but weren't as familiar with using technology in educational settings once they had returned to school.

It may be suggested that practising teachers understood that DL refenced technology and the use of digital devices and resources. The data shows that teachers in this study understood that DL consists of a multitude of components, referencing functional skills, e-safety, digital communication, and information literacy (IL), but did not mention an understanding of cultural, social, and ethical respect online or how to use technology creatively in their teaching practice. When asked how they felt about their DL practice, some stated that they "wanted to know more." This implies that teachers need to be made aware of all components of DL, gain an understanding of their concepts and then be able to implement their skills into

their teaching and to be able to impart valid and verified information regarding DL to their students. To impart verified knowledge, teachers need to understand verifiable concepts of DL skills in a primary educational setting through CPD as dl skills need constantly updating as technology evolves.

The participants indicated that there had been more training in DL when technology had first been introduced into schools, but few had received training prior to lockdown due to the expectation of them being 'digital natives.' The teachers explained that although they were surrounded by technology, they had not been efficiently trained to use in appropriately in their teaching practice before going into lockdown. Due to a lack of training, teachers and schools were unprepared to teach using technology when schools in England closed in March 2020 due to the pandemic. This caused emergency CPD in DL skills to be introduced and this should be updated regularly as teaching strategies and technology evolve. This provided an opportunity for, and a requirement in training in DL skills. However, once returning to school, some teachers expressed concerns that they may no longer continue to practice their new-found skills and so would forget them. Though some schools were continuing to receive training and practicing DL skills in preparation for another lockdown and to embrace in the foundation being set for CPD.

The pandemic also highlighted a shortage in availability and accessibility to digital devices and software which affected the use of them in the classroom. More government funding was given to schools to increase their supply of digital devices and software during the closure of schools, and now the practising of DL skills should be easier as there are fewer risks with newer devices and teachers are more confident after being appropriately trained in implementing technology into their teaching.

The data indicates that the practice of DL skills in education was not as active as it could be due to teachers being untrained in the necessary standards of DL skills, causing a reluctance to explore with technology due to a lack of confidence. The data also showed that all participants had touched upon teaching with some components of DL, such as functional skills, e-safety, digital communication, and collaboration, cultural, social. and ethical understanding, and creative use of technology. However, specified training of these components should be given to meet the desires to "know more." Teachers explained that

with the updating of technology integration and development of DL skills, they were now "beginning to know more."

Although the data showed that these participants had some experience with using databases, spreadsheets and specialist software for assessment, participants were not confident or had the time to explore these tools to their full potential. More specified training and investment in software could move schools away from paper tracking sheets and into a more efficient future.

As well as, a lack of training, time constraints, a lack of administrative support, and the availability and funding of digital resources were all barriers to the implementation of technology in schools. With few attempts to overcome these barriers, prior to lockdown there was little hope of appropriately educating the next generation in required skills for the future, such as digital communication and staying safe online, effective searching skills for personal and professional needs and how to be respectful to the diversity of persons present on the world wide web (www). However, since lockdown, schools have had little choice but to overcome these boundaries as there was little choice but to integrate them into teaching. For effective use, both students and teachers required appropriate training to improve their DL skills.

The data gathered from the interviews was assessed to identify what DL skills practising teachers had, and what they felt their training needs were. The researcher combined the findings, the Computing curriculum standards and DL skills identified in Hague and Payton's (2010) *components of digital literacy* model to create a curriculum to train teachers in critical DL skills: functional skills, e-safety, finding and selecting relevant information, communication and collaboration, cultural, social, and ethical understanding, and creativity. Findings from both the literature and interviews were used to influence a criteria to determine the objectives of each session.

The purpose of this framework is to develop teachers' knowledge and understanding of DL skills, to feel confident enough to implement these skills into their teaching practice and to then guide their students into developing their own DL skills.

References

Avery, R. & Assiter, A. (2018) Engaging families in online safety: guidance for education settings. *The Education People.*

Barton, R., Haydon, T. (2006). Trainee teachers' views on what helps them to use information and communication technology effectively in their subject teaching. Journal of computer assisted leaning, 22, pp, 257-272.
Brito, R.M., Rodríguez, C. and Aparicio, J.L. (2018). Sustainability in teaching: An evaluation of university teachers and students. *Sustainability*, *10*(2), p.439.

Brush, T., Glazewski, K.D. and Hew, K.F. (2008. Development of an instrument to measure preservice teachers' technology skills, technology beliefs, and technology barriers. *Computers in the Schools*, *25*(1-2), pp.112-125.

Burns, T., & Gottschalk, F. (2020). Education in the Digital Age: Healthy and Happy Children. Educational Research and Innovation. *OECD Publishing*.

Casselden, B. (2016). *A delicate balancing act: An investigation of volunteer use and stakeholder perspectives in public libraries*. University of Northumbria at Newcastle (United Kingdom).

Couse, Leslie J., and Dora W. Chen. (2010). "A Tablet Computer for Young Children? Exploring Its Viability for Early Childhood Education." Journal of Research on Technology in Education 43 (1):75-98.

Cunningham, M., Kerr, K., McEune, R., Smith, P., & Harris, S. (2003). Laptops for Teachers: An evaluation of the first year of the initiative. ICT in School Research and Evaluation Series No 19. Becta/DfES.

Engler, S., 2021. Grounded theory. In *The Routledge handbook of research methods in the study of religion* (pp. 300-313). Routledge.

Emre, D.İ.N.C. (2019). Prospective teachers' perceptions of barriers to technology integration in education. *Contemporary Educational Technology*, *10*(4), pp.381-398.

Ertmer, P.A. and Ottenbreit-Leftwich, A.T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of research on Technology in Education*, *42*(3), pp.255-284.

Feeler, W. (2012). *Being there: A grounded-theory study of student perceptions of instructor presence in online classes*. The University of Nebraska-Lincoln.

GOV.UK (2020a). "Get help with technology for remote education." *Department for Education.* (Available at: https://www.gov.uk/guidance/get-help-with-technology-for-remote-education). (Date accessed: 12.6.2020)

GOV.UK. (2020b) "Training and support for remote and face-to-face education." (Available at: https://get-help-with-tech.education.gov.uk/EdTech-demonstrator-programme). (Date accessed: 30.9.2020)

GOV.UK. (2020c). "UK education providers helped teachers, parents and students respond to the impact of COVID-19 worldwide." UK: Foreign & Commonwealth Office. (Available at: https://www.gov.uk/government/news/uk-education-providers-are-helping-teachers-parents-and-students-respond-to-the-impact-of-covid-19-worldwide). (Date accessed: 1.6.2020)

Higgins, Steven, Z Xiao, and Maria Katsipataki. (2012). "The impact of digital technology on learning: A summary for the education endowment foundation." Durham, UK: Education Endowment Foundation and Durham University.

Hinds, D. (2019). Realising the potential of technology in education: A strategy for education providers and the technology industry.

Isenfjord, E., Munthe, E. (2017) Educating digitally competent teachers: A study of integration of professional digital competence in teacher Education. *Teacher and Teaching Education.* 67 pp. 37-45c
Jain, S., Lall, M. and Singh, A., 2021. Teachers' voices on the impact of covid-19 on school education: Are ed-tech companies really the panacea?. *Contemporary Education Dialogue*, *18*(1), pp.58-89.

Jain, S., Lall, M. and Singh, A. (2021). Teachers' voices on the impact of covid-19 on school education: Are ed-tech companies really the panacea?. *Contemporary Education Dialogue*, *18*(1), pp.58-89.

Jimoyiannis, A. and Gravani, M. (2011). Exploring adult DL using learners' and educators' perceptions and experiences: The case of the second chance schools in Greece. *Journal of Educational Technology & Society*, *14*(1), pp.217-227.

Kim, C., & Keller, J. (2011). Towards technology integration: The impact of motivational and volitional email messages. *Educational Technology Research and Development*,*59*(1), 91–111.

Koutsogiannis, D. (2007). A political multi-layered approach to researching children's DL practices. Language and Education, 21(3), 216-231.

Koutsogiannis, D. (2011). Adolescents' DL practices and (language) education. Thessaloniki: Greek Language Center [In Greek].

Lei, J. (2009). Digital natives as preservice teachers: What technology preparation is needed?. *Journal of Computing in teacher Education*, *25*(3), pp.87-97.

Legislation.gov.uk. (2012 and 2016), The School Publications (England) (Amendments) Regulations, (Available at: https://www.legislation.gov.uk/uksi/2016/451/introduction/made) (Date accessed: 31.3.2010).

Lund, A., Furberg, A., Bakken, J., & Engelien, K. (2014). What does professional digital competence mean in teacher education? *Nordic Journal of Digital Literacy, 9*(4), 281–299

Marsh, J. (2010). The relationship between home and school literacy practices. In: D. Wyse, R. Andrews & J. Hoffman (eds.), The Routledge international handbook of English, language and literacy teaching, pp. 305-316

Melhuish, K. and Falloon, G. (2010). Looking to the future: M-learning with the iPad.

Middleton, S., Emembolu, I., Strachan, R,. Davenport, C,. Keogh, S,. Pickard, A,. Sanderson, J Bradnum, J., Anderson, E. (2020). 'The Impact of Coronavirus on primary schools in North East England. Challenges and Solutions.' Digital Learning Lab/NUSTEM, Northumbria University, UK. (Available at: https://committees.parliament.uk/writtenevidence/5920/pdf/). (Date accessed: 31.8.2020)

Omwenga, E., Nyabero, C., & Okioma. (2016). Assessing the influence of the PTTC Principal's competency in ICT on the teachers' integration of ICT in teaching Science in PTTCs in Kenya. *Journal of Education and Practice*, 6(35), pp. 142-148.

Palomino, M.D.C.P. (2018). Information and communication technologies and inclusive teaching: Perceptions and attitudes of future early childhood and primary education teachers. *Problems of education in the 21st century*, *76*(3), pp.380-392.

Patton, M. Q. (2015). Qualitative research & evaluation methods (4th ed.). Thousand Oaks, CA: Sage.

Perifanou, M., Economides, A. and Tzafilkou, K., 2021. Teachers' digital skills readiness during COVID-19 pandemic.

Prensky, M. (2001). Digital Natives, Digital Immigrants. On the Horizon, 9(5): 1–6

Sawmiller, A. (2010). Classroom blogging: What is the role in science learning?. *The Clearing House*, *83*(2), pp.44-48.

Scott, K. W. (2004). Relating the categories in grounded theory analysis: Using a conditional relationship guide and reflexive coding matrix. The Qualitative Report, 9(1), 112-126.

Spiteri, M. and Chang Rundgren, S.N. (2020). Literature review on the factors affecting primary teachers' use of digital technology. *Technology, Knowledge and Learning*, *25*(1), pp.115-128.

Strauss, A. and Corbin, J. (1998). Basics of qualitative research techniques.

Tezci, Erdogan. (2011). Turkish Primary School Teachers' Perceptions of School Culture regarding ICT Integration. *Educational Technology Research and Development*, 59 (3), pp. 429–443.

Townsend, M.B. (2017). *iPads in K-12 schools: A grounded theory study of value* (Doctoral dissertation, University of Phoenix).

Tzifopoulos, M. (2020). In the shadow of Coronavirus: Distance education and DL skills in Greece. *International Journal of Social Science and Technology*, *5*(2), pp.1-14.

Vongkulluksn, V.W., Xie, K. and Bowman, M.A., (2018). The role of value on teachers' internalization of external barriers and externalization of personal beliefs for classroom technology integration. *Computers & Education*, *118*, pp.70-81.

Woods, P. (1995). Creative teachers in primary schools. Buckingham: Open University Press.

Wood, R. and Ashfield, J. (2008). The use of the interactive whiteboard for creative teaching and learning in literacy and mathematics: a case study. *British journal of educational technology*, *39*(1), pp.84-96.

5. Chapter Five: Intervention Findings

5.1 Introduction

The digital literacy (DL) course (see *appendices 6-17*) was designed based upon Hague and Payton's (2010) *The components of digital literacy* framework, evidence and gaps found in the relevant literature and the needs of teachers found in the findings from the interviews. Once the framework had been designed, it was delivered to thirty-five Primary Education Bachelors' (BA) students from Northumbria University, virtually via Blackboard Collaborate, in April 2021.

The intervention aimed to answer the third research question:

How can training and support needed by primary school teachers be provided to give greater knowledge and understanding in digital literacy skills?

This question, regarding the training and support required to developing DL skills, was supplemented by asking the participants sub-questions about their understanding of the term DL, their enjoyment in each of the individual component training sessions, their perceived learning after each session and what experiences they feel could be improved.

As the interviews had identified the gaps in teachers' DL skills, the interventions contained individual sessions addressing needs relating to the individual components of DL. The interventions aimed:

1. To gain an understanding of teachers' relationships with DL in the classroom
2. To evaluate the curriculum and address suggested amendments

The course was designed into six sessions:

1. Introduction to digital literacy and functional skills
2. E-safety
3. Finding and selecting relevant information

4. Communication and collaboration
5. Cultural, social, and ethical understanding
6. Creativity

Each session had a set of objectives and activities designed to set a foundation for digital literacy skills. The results from the activities showed the knowledge and understanding of the teachers' skills and experiences, and this data could be used to influence further rounds of interventions.

The BA students participated in the session and then reviewed them via Microsoft Forms after the session was complete. The students were asked:

6. What did you enjoy about the session?
7. What do you think could be improved?
8. What do you think you've learned?

And on the final session were asked questions 1 and 2, as well as:

9. In stars, (1 being poor and 5 being excellent), how would you rate this course?
10. What was your favourite session? Why?

The sessions were recorded and uploaded onto YouTube, where four practising teachers:

- Deputy Headteacher (Deputy Head).
- Teacher with 30+ years of experience (Experienced teacher).
- Key Stage 1 Information Technology Lead (KS1 ICT Lead).
- Key Stage 2 Information Technology Lead (KS2 ICT Lead).

were asked to review them, answering:

1. What do you think the strengths of the session were?
2. What do you think could be improved?
3. Do you have any suggestions for improvement?

This chapter details the evolution of the training framework, as it was developed from the findings of the literature and interviews and unfolded from the data collected through feedback from both student and practising primary school teachers, coding, and generating substantive theory and themes. It discusses each session individually and the themes which emerged from the discussions between participants in the study.

5.2 Data Collection and emerging themes

Initially, the interventions were designed to be delivered to focus groups of primary school teachers in four schools over hourly sessions, over a six-week time frame. However, due to the outbreak of COVID-19 and the closure of schools in England in March 2021, practising teachers had to prioritise the delivery of their lessons over participation in the course. The researcher was able to contact colleagues in the Education Department at Northumbria University, Newcastle, and was given permission to deliver the course to final-year Primary Education (BA) students, who were no longer able to go to their placement schools due to the pandemic. The six sessions were delivered over five days:

Day	**Session:**	
Monday	1. Introduction and Functional skills	
Tuesday	2. E-safety	
Wednesday	3. Finding and selecting relevant information	
Thursday	4. Communication and collaboration	5. Cultural, social, and ethical understanding
Friday	6. Creativity	

Table 5.1 *The day and session schedule*

The students were contacted via email and understood that they were voluntarily participating in the course and would receive a certificate once they had given feedback for all six sessions. The students were reminded of this at the beginning of each session and were given the choice to opt out at any point. The students were not asked to sign any consent forms as they were given this choice. At the end of each session, the students were given a link to individual session 'My Forms,' where they answered the feedback questions. They logged in via their student identification (ID) to confirm their participation to receive their certificate, but this was not shown in their feedback answers.

Initially, seven practising teachers, who had participated in the interviews were asked to participate in the feedback, but some did not respond to emails or were unable to commit due to the pressures of COVID-19. Four participating teachers were able to partake, whose names were anonymised to the teacher number they had been given during the interviews. The four practising teachers were given a link to the recorded sessions and a link to 'My Forms,' separate to that of the students, for each session.

5.2.1 Initial coding

As with the interview analysis, indicators (word, phrases, statements) were collected from the feedback, discussions, and activities:

breakout groups	Interactive	opinions	typing test	activities
challenges	Solutions	experiences	discussions	engagement
practical ideas	classroom examples	lesson ideas	impact of covid-19	interesting
collaboration	Communication	delivery of lessons	easy to follow	informative
instructive	software choices	online teaching	efficiency	balance of information and discussion
theory & practice	Involvement	availability	online risks	child applicable
clear speaking	visual aids	approachable	available resources	behaviour management
audio / microphone	applicable ideas	teaching strategies	opening discussions	expertise
helpful displays	great structure	practical demonstrations	clear steps	good recordings
cross-curricular	more suggestions	explore individually	group sizes	preparation
technical issues	Responding	face-to-face	notes on slides	quality of videos

Table 5.2 *List of initial indicators and concepts from the interviews*

5.2.3 Focused coding

Following from the categories discovered during the initial analysis phase, relationships between the categories emerged. The tree below shows the relationships between the categories which emerged from the study:

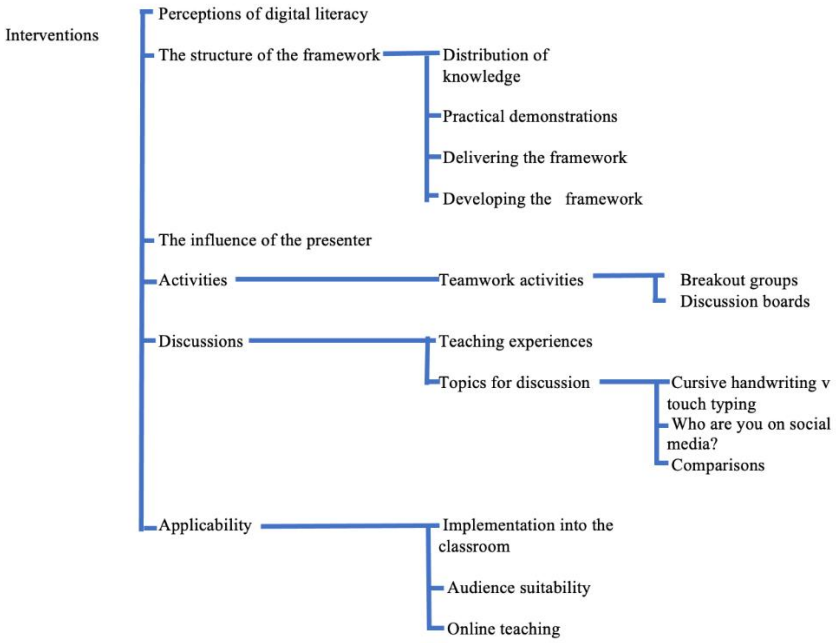


Figure 5.1 *Relationships between the categories and subcategories from student and practising teachers' feedback from the digital literacy framework training interventions.*

5.3 Results

5.3.1 Perceptions of digital literacy

In the introduction of the first session, the students were asked to give their own definition of the phrase 'digital literacy.' This was done as a method for comparison:

(a) Between the practising and student teachers
(b) Between the student's perceptions prior and post interventions

The researcher used a polling website called 'Vevox.app,' where the students could enter a statement or words and phrases that they associated with the term. The following slide gave

them instructions as to how to access the website and the researcher was able to turn the responses into a word cloud for the students to see common themes themselves, which were then discussed in the session:

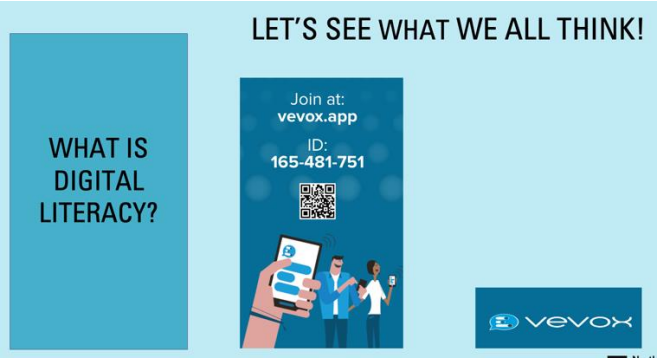


Figure 5.2 *Slide from Session 1, to show instructions to enter poll on perceptions of DL*

Figure 5.3 *Word cloud to show key themes of students' perceptions of DL*

It was interesting to find that the most prominent theme amongst the students was "online," some students explaining that they were not only refencing using the internet but *using the internet for teaching.* As these interventions took place when schools had reopened during the worldwide pandemic, students had either seen or experienced teaching using online platforms. It may be suggested that as teaching had taken place virtually via online platforms, students had an up-to-date understanding that there are elements of communication and digital resources involved in digital literacy skills. "Different platforms" and 'interaction" relates to online communication and collaboration, touching upon another component of DL.

Although technology was another important focus, unlike the practising teachers, the students' association between DL and technology did not dominate their perception of the phrase. There were mentions of "computers" and "electronic" and the students went a step further by showing an understanding of the uses of technology in the classroom: "electronics skills," "online learning" and "includes use of technology in school." There was also mentioning of 'children' and when asked, some of the students explained that the use of technology in the classroom focused of children's learning. The student went on to say that they believed DL meant that children would know how to use technology themselves by using it at school. The students show that they understand that DL not only relates to technology but the uses of and skills involved with technology in an educational setting. One student spoke to the group, explaining that they felt that the use of technology involved having the skills to use software for planning, making resources and knowing how to use learning apps. This comment shows that this student understood that in using technology, teachers needed to have functional skills.

In their responses, students were showing an understanding that DL involves different components of digital skills. The students had not only broken down their understanding of DL into having functional skills but were also commenting on using these skills safely: "e-safety." The researcher asked some of the students why they thought 'e-safety' was related to DL. Being more exposed to using online teaching methods, teachers have been made more aware of the risks online. Students in this study had understood that DL involves having skills to use technology and the internet safely.

> "*It's sort of like we've said about it being online teaching and the internet, I think if the internet is in involved in DL, then you always need to explain ways to using it safely*." (Student).

Although the students had been able to relate DL and to some of its components: "online" and "media" (communication and collaboration), "electronics skills" (functional skills), "e-safety" (e-safety) and "information" (searching skills), they did not mention specifics of digital responsibility or respectfulness online, and although some students mentioned that they thought DL meant teaching literacy skills through digital platforms, none went into detail about using technology creatively. This suggests that the student teachers understood DL skills, to an extent, but had this understanding was basic as they made no mention of the

relationships to other components, such as communication, collaboration, cultural understanding or using technology creatively. A recommendation would be that student and practising teachers are given more training and resources in independent components of DL to gain a better understanding of the skills they need to use technology effectively.

.3.2 The structure of the framework

The framework was structured to give student teachers information about DL skills to go on to understand and develop them into their profession.

"It's good to know what digital literacy actually is."

(Student).

"I enjoyed how it opened my eyes."

(Student).

"I liked how the framework was broken into different parts of digital literacy; there are many parts to digital literacy!."

(Experienced teacher).

The feedback from both student and practising teachers accounted for the structure of the delivered sessions. They discussed an overview of the course, the objectives, the activities, and the organisation of the individual sessions.

The introduction to the intervention framework appeared to be well received and understood by most participants.

"This was a great opener and gave a clear insight into what will be discussed in later sessions."

(Student).

"The PowerPoint was very clear and easy to navigate through."

(Student).

"I enjoyed being introduced to the topic and felt that the objectives and activities for the course were concise and easy to understand."

(Student).

"I liked how you explained what digital literacy is and then broke it down into sections (which I noticed are your objectives for each session too) which is perfect."

(Experienced teacher).

"The course was set out well with very clear objectives."

(KS2 ICT Lead).

However, KS1 ICT Lead noted that although the objectives were clearly presented in the first session, they weren't referenced throughout the sessions. There was an objective that referenced to statutory guidance in session 2 which was not discussed in detail by the researcher.

"To look at statutory guidance and legislative framework on online safety."

(Session 2 objective)

The teacher explained:

"*I don't recall hearing a great deal of information on this area during the presentation, it was only mentioned briefly."*

(KS1 ICT Lead).

The researcher noted that this is an important factor for Teaching Standards and more information relating to the objective would be useful and should be considered for future interventions.

"*The use of slides and giving examples to the groups to highlight your expectations was great."*

(KS2 ICT Lead).

Although the researcher had explained that this was a generalised course to suit a variety of skillsets and primary school (PS) year groups, there were certain comments about how the sessions might be more suited to specific contexts of year groups:

"I think a little more information towards Early Years Foundation Stage(EYFS) would be good."

(Experienced teacher).

"Better if aimed to EYFS."

(Student).

One student stated that they felt the order of the sessions should be amended. In their opinion, they would have liked to have participated in the 'finding and selecting relevant information' session (session 3) earlier in the course. They even mentioned that they would have found it useful as a separate session to be given earlier in their university course to aid them in their dissertation.

"The session would have been much more useful at the start of the course, even better if we could have had it before we started our dissertations."

(Student).

The researcher feels that the start of the course needed to introduce the concept of DL and then go on to discuss how to use technology safely and this would affect how students would use a search engine safely and effectively. They feel that the order of the course creates a connection between the components, leading from an explanation to then showing a relationship between which component affects another. This course was a 'one-off' action research study to evaluate the DL training framework created by the researcher. The student may recommend that an individual session about research methods and finding and selecting relevant information would be useful for their degree.

5.3.2.1 Distribution of knowledge

The researcher planned the sessions to have a balance of information and interaction as a method of delivering the information through instruction and then embedding the knowledge and understanding through activities which required them to think in more detail. The participants' feedback showed that they enjoyed the delivery of the information:

"I think I could use some of this information whilst training my own staff."

(Deputy Head).

"I found the content useful as it helped to broaden my understanding and knowledge."

(Experienced teacher).

"I like how you gave advice to pass on."

(KS2 ICT Lead).

There were mentions of continuing learning through further training and taking the skills learned in the course and passing on this knowledge to their colleagues and pupils:

"This presentation gave me some great ideas that I can discuss as part of a senior management team."

(Deputy Head).

"There were great reminders and suggestions, like netiquette and getting the children to do a poster to learn."

(KS2 ICT Lead).

The researcher used pedagogical knowledge from their teaching experience to break the sessions into a four-part process:

Figure 5.4 *The four-part learning process*

Where they presented information and theory about a topic, set an activity related to the topic, instigated a discussion based on the activity and then recapped on the information and theory that had been presented, often by questioning the students. Feedback showed that the students responded well to this format:

"I like how we learned about e-safety, then we did the activity on Padlet, and we talked about it and gave our opinions and experiences."

(Student).

"There was lots of little pointers and reminders today of things we need to cover with children, as we so easily forget the obvious things. It was good to go into breakout groups and discuss lesson ideas and to come back to get suggestions for these."

(Student).

"You seemed to know a lot about DL so I think discussing your own experience and giving more advice would be great."

(Student).

The feedback showed that both student and practising teachers were satisfied with the set objectives, instruction and presentation of information and the preparation of resources and materials.

"Your sessions were well-planned, and you presented your information clearly. The structure of the sessions allowed for the embedding of the information in the activities and discussions."

(Experienced teacher.)

5.3.2.2 Practical demonstrations

"Practical demonstrations and lesson ideas are really beneficial for future practice."

(Student).

In relation to the distribution of knowledge, the researcher attempted to embed understanding through practical demonstrations to suit different learning styles. Presentation slides, videos, discussion points, and examples of more physical activities were used to show how to use different resources to suit the learning styles of both the student teachers and classroom students.

"*There were lots of good practical examples and apps that we could use with children in the classroom."*

(Student).

"I think demonstrating software would benefit both practising and student teachers because as a teacher, you become familiar with the software you use regularly, and most practitioners would naturally adapt."

(KS1 ICT Lead).

"You might give a more concrete example of how you or other teachers have / could adapt programs they have seen or used."

(KS1 ICT Lead).

The researcher gave a more informative than interactive session when discussing finding and selecting relevant information. They used a step-by-step guide and demonstrated using a search engine to show the students how to use certain search strategies whilst using a search engine. The purpose was for the researcher to structure and deliver complicated content for the students to understand and learn from it.

Slide 1:

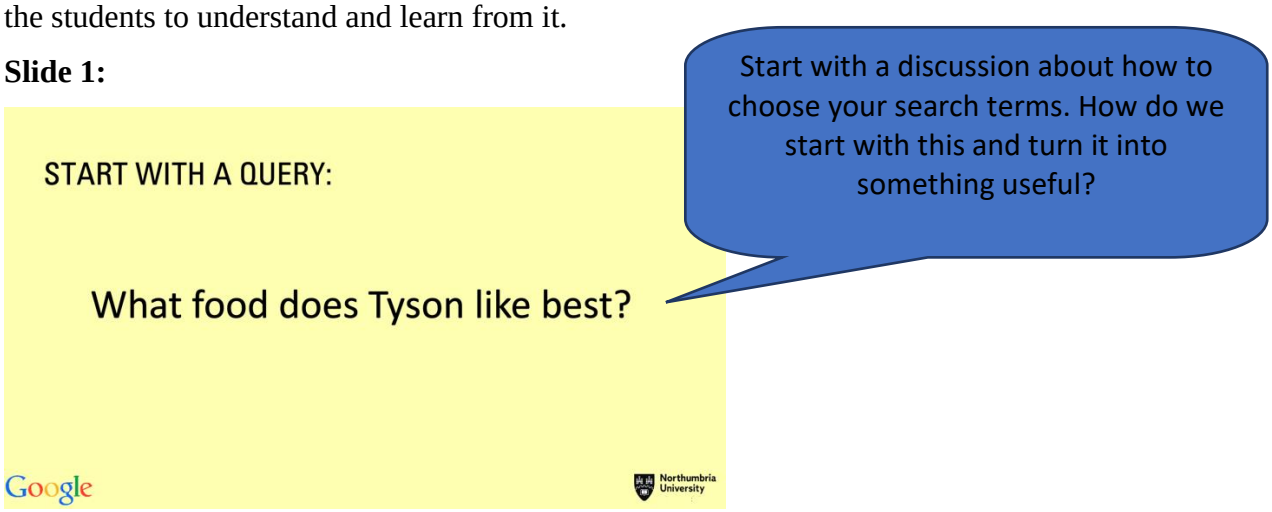


Figure 5.5 *Slide 1 from Intervention Session 3: Finding and selecting irrelevant information*

Slide 2:

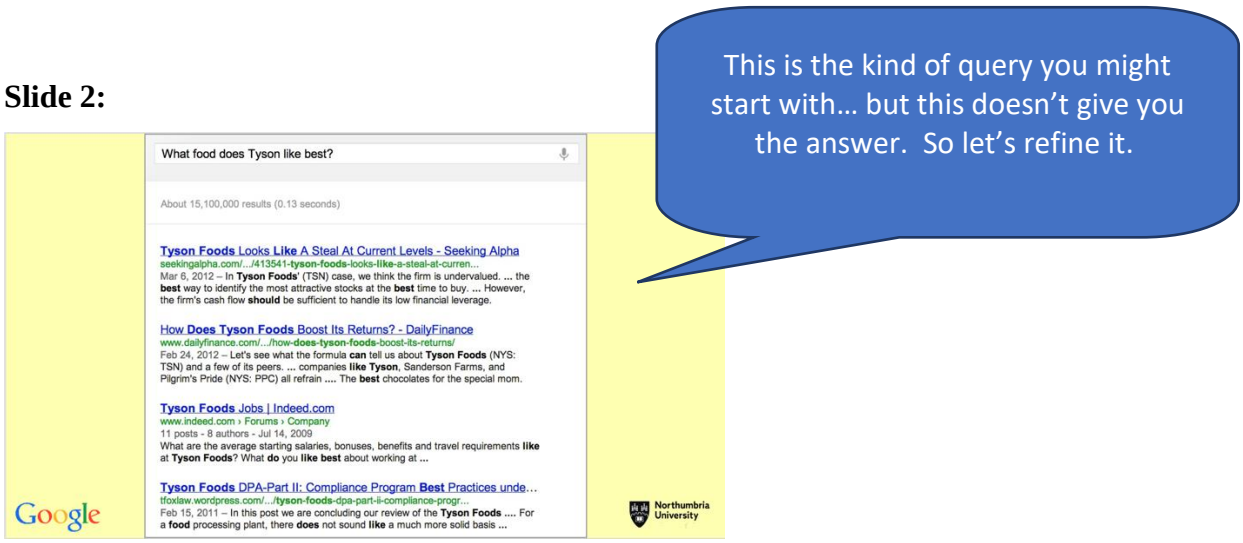


Figure 5.6 *Slide 2 from Intervention Session 3: Finding and selecting irrelevant information*

Slide 3:

Figure 5.7 *Slide 3 from Intervention Session 3: Finding and selecting irrelevant information*

Slide 4:

Figure 5.8 *Slide 4 from Intervention Session 3: Finding and selecting irrelevant information*

Slide 5:

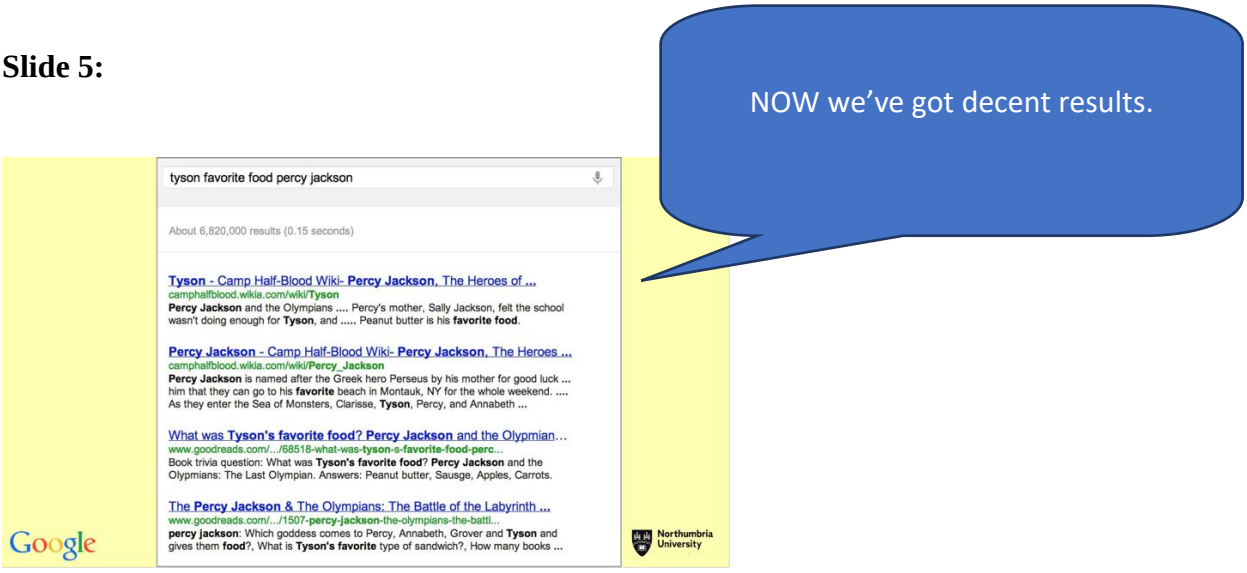


Figure 5.9 *Slide 5 from Intervention Session 3: Finding and selecting irrelevant information*

Slide 6:

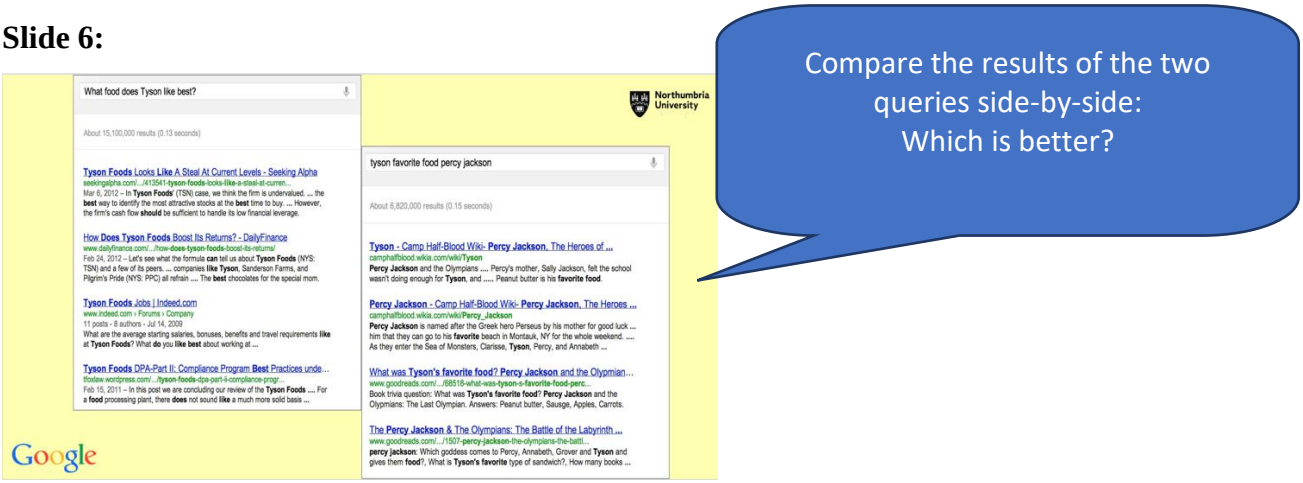


Figure 5.10 *Slide 6 from Intervention Session 3: Finding and selecting irrelevant information*

The feedback from the students and practising teachers suggested that this demonstration was successful:

"*The example of Percy Jackson gave a really good visual explanation of finding relevant information.*"

(Student).

"I like how visual and simple the image on the slide on focused searching was. It was straightforward and interesting to see."

(Student).

"*Your Tyson search was good. It was a clear demonstration of filtering key words and the discussion was also really useful.*"

(KS2 ICT Lead).

However, some students still felt that more interactive activities should be included as a lot of information had been discussed and needed to be embedded through a four-part process (information > activity > discussion > recap).

"I know you said it's hard to get interactive conversation through this subject, but could there be some form of interaction included? It was difficult to take in all the information by just listening."

(Student).

"You could possibly have an interactive whiteboard where you can ask a question and we can write our thoughts. I know this session was hard to make it as interactive as others though!"

(Student).

Although the researcher demonstrated using a search engine effectively, students felt it would have been a good idea to allow them to practice it themselves and then feedback to the researcher after. The researcher had not included this in their session initially as they predicted that not all students would be honest or do the task as they would if she was to monitor them in the classroom.

"Perhaps an opportunity to practise these methods during the session."

(Student).

From the feedback of later sessions, it appears that participants felt that practical demonstrations are more easily placed in face-to-face courses and so they understood some of the limitations of practical demonstrations and practicing themselves.

There was also an understanding that there couldn't be in-depth practical demonstrations and use examples of specific software because this was a basic course which is more generalised as technology and software are constantly evolving and therefore require more time for a practical demonstration.

"*The difficulties are that things change so often and also different schools access different programs / software. There just wasn't enough time to cover it all in one session."*

(KS1 ICT Lead).

5.3.2.3 Delivering the framework

There were some technical issues during the sessions, which caused disruptions and to some may have fed an unwillingness to using technology due to its unreliability. However, there was an understanding from the students and practising teachers that this was a minor fault that did not cause lasting problems:

"There were some issues with technology, but I know you couldn't really do much about it."

(Student).

"The only issue was the technology, however that did not affect the session too much."

(Student).

"A couple of technology difficulties but nothing major."

(Student).

"There were a couple of timing issues where it seemed that different sections of recorded content slightly over lapped although this didn't really cause an issue."

(KS1 ICT Lead).

The researcher attempted to minimise technical issues by sending links in the chat for students to access the videos themselves, but students did not feel this was useful as the students weren't in sync and the researcher could only give their thoughts much later than some students had watched it.

"The video was hard to watch as it wasn't played on the screen due to previous technical issues."

(Student).

The researcher was later able to embed large video content into their presentations rather than attempting to show YouTube videos on their screen.

As this is training framework, in session six the researcher mainly focused on delivering information and lesson suggestions as the student teachers had had little experience in placements and hadn't had the opportunity to observe or practice creative lessons using technology. The researcher wanted to set a foundation of ideas and then ended the session asking for the students to discuss their own experience in the subject or how they felt about the researcher's suggestions.

"I loved how many creative lesson ideas there were in this presentation! It was exciting to discover so many creative ways to use technology in your teaching."

(Student).

"There were some fabulous suggestions in this session, I hadn't been aware of the creativity that can come from computers! I'm not sure I could have contributed."

(Deputy Head).

The researcher also aimed to create a positive atmosphere that the students would be able to model when delivering their own training or lessons on the subject. They wanted to deliver sessions that were motivating, easy to understand and follow, and easy to imitate:

"I enjoyed how you brought people into the discussions with your questions and gave examples of how to do this with children."

(Student).

"You made students think about their answers just like any good teacher."

(KS1 ICT Lead).

"Your questions for the students were good and I thought it was brilliant that you went further by giving examples of questions they could ask their own students."

(KS2 ICT Lead).

"It motivated me to look at different apps and their uses in my own setting. It's an area I'm not too familiar with and felt it good that the researcher spent more time with information than interaction."

(Experienced teacher).

In using different resources and learning styles (Visual, Audio, Kinaesthetic (VAK)) the researcher aimed to motivate the students and help them to understand more by using preferred learning aids and creatively presenting the information:

"I found the google search video particularly interesting as I had no idea how they worked!"

(Student).

"I enjoyed the range of resources used, like Padlet, discussions, and videos that you used. I've found them engaging and useful"

(Student).

Some participants suggested that the presentation of the slides did not always meet their learning requirements. As the researcher had to cater to a variety of learning styles and therefore had to use different arrangements to cater to these needs, and so tried to spread

these arrangements throughout the presentation. In catering to a variety learning needs, every slide had to suit a variety of learning style preferences and therefore not specified solely for theirs.

"Ideally, the session would have been conducted in person, as I enjoy more practical demonstrations and interactive elements to learn."

(Student).

"I prefer there to be more text on the slide to embed what is being said."

(Student).

"I'm a very visual person so I'd have liked more videos and perhaps some photographs."

(Student).

"It would be good for there to be more notes beneath the slides so that you can refer to them when we look at the slides later."

(Student).

"I prefer to stick to one presentation with the lecturer rather than having to go elsewhere, like YouTube."

(Student).

One student noted in session 5 that they would prefer some more visual content to suit their learning needs. They suggested that on slide 5 there were bullet points listed all at once and suggested that the researcher introduced each bullet point individually and then discuss it before moving on to the next.

"I get a bit distracted when there are more than a couple bullet points displaying on a slide at the same time."

(Student).

The researcher feels that they originally placed all the bullet points on the slide for students to note them down more readily. After reading this feedback, it would be suitable for the researcher to change it so that each bullet point comes individually, and students will still be able to note them down but also annotate them more easily.

This may be altered if the framework were to be adapted in its development in order to be developed to suit more specified needs, as opposed to being more basic and generalised.

5.3.3 The influence of the presenter

"I really enjoy listening to you and elaborating on people's suggestions when we put ideas into Padlet, as you explain them really well and put our ideas into context, I like that you spend a good 5 minutes on the task and hold a discussion, even if it is just yourself speaking, as it deepens my understanding rather than just skimming past a few ideas which students have typed into Padlet."

(Student).

One of the most prominent themes within the feedback was the presentation and delivery of the framework. The influence of the presenter is important for an engaging and successful delivery. In virtual platforms, the students wanted to feel a connection to the presenter, and to relate to them personally and through the course material.

"I feel really comfortable with the researcher and she's very precise with the information she gives us."

(Student).

"It's good that she shares what she's done as a teacher herself because it shows a reality to what we're talking about."

(Student).

Reupert, et al. (2009) uses the term 'instructor presence' to refer to an instructor/presenter being salient and visible to learners in either virtual or face-to-face settings. The researcher hoped to use their voice as a representative of their personality and expertise and the presentation slides to share their interpretation and views of what was being discussed.

"I like how positive you sound and how involved you are. It would be great if we could see you whilst the slides are on because I bet you'd be smiling!"

(Student).

"The slides were very simple, but you used videos and images to start a discussion."

(Student).

Participants discussed how they felt comfortable with the delivery of the sessions because they were "easy to follow," "had a clear structure" and the presenter "spoke clearly." The participants felt that the training had been more interesting due to the influence and presence of the presenter.

"I found the PowerPoint easy to follow and like how interested you're in what about you're talking about. You're a good communicator."

(Student).

"*I think the interactions between the researcher and students was very good, and the sessions flowed really well."*

(Deputy Head).

"*You delivered it calmly and confidently, managing to use your knowledge of the topic to make links to answers that were given to allow the rest of the group to understand the relevance of the comments of others. "*

(KS1 ICT Lead).

"I thought talking about and showing confidence was a great thing. It's good to address fears and let people know that we are all not masters of everything we do, we all have to learn and start somewhere."

(KS2 ICT Lead).

It is important that the presenter forms a relationship with the participants to make them feel comfortable to join in with discussions and ask the presenter questions. The presenter should have knowledgeable expertise on the subject to be able to answer questions, express their thoughts and give feedback so that they can guide the students and aid them in their understanding. The practising teachers commented of the bond they had noticed between the researcher and students during the sessions on the recordings.

"I enjoyed the ideas given about how we should be acting online as it made me think of and understand things I hadn't before."

(Student).

"*I found it very interesting and informative, there appeared to be lots of engagement and useful discussion during the session and again you were able to provide immediate feedback on ideas, expanding on them and linking them back to your objectives."*

(KS1 ICT Lead).

The researcher wanted to show their experience in DL skills, as it was important to show a level of expertise theoretically and practically by showing their own knowledge, understanding and experience in the topic:

"You showed your experience and research by discussing the pros and cons of different platforms."

(Deputy Head).

"Giving personal examples of experiences, such as your Jack and the Beanstalk lesson and your trip to Iceland made it easier to understand."

(KS2 ICT Lead).

Overall, the feedback showed that the researcher had presented a clear and well-structured course where students felt confident in the researcher's expertise and comfortable to interact with the researcher and their peers.

5.3.4 Activities

"I liked how there were activities at the start, it drew you in from the very beginning."

(Student).

The researcher included activities to help break up the session, as a large amount of information was being discussed. As mentioned, the researcher used a four-part process in their delivery. The activities were included to encourage the students to become active in the session, like how they would act in a seminar. There were a range of activities included in the sessions, such as using online discussion boards, breakout groups, entering information via Google.docs, discussions, to encourage them to think on their own, to listen to the views of others and then to use this information as to form more comprehensive opinions. The

activities were used to motivate and interest, improve knowledge understanding, build on morale and respect for others, and to encourage freedom of expression.

"There were great collaborative activities where we shared our own views, listen to those of our peers and discussed experiences."

(Student).

Feedback showed that most activities were well received, although there were some comments about amending certain timings, chosen groupings and the format of activities.

5.3.4.1 Using teamwork activities

The researcher chose to explore using breakout groups to encourage collaborative efforts, entertaining the possibilities to:

- Discuss and tackle more complex issues that they may individually
- Share more diverse ideas and experiences
- Delegate roles and responsibilities
- Combine knowledge and skills
- Give and receive feedback
- Develop own voice and perspectives in relation to their peers

Students enjoyed "listening to other people's experiences of DL" and "finding out more from the information, activities and the discussions."

Examples of teamwork activities included in the sessions are described below.

5.3.4.1.1 Student connection via breakout groups

In the first session, the researcher discussed how teaching methods had adapted during lockdown and the shift to online teaching. Participants were assigned into breakout groups and asked to discuss some of the challenges teachers had faced and to suggest solutions to these problems. The researcher gave an example to a challenge and a suggested solution:

Challenges	Solutions
How do teachers provide parents with key information now that children can't bring home a physical letter?	Parents at schools across the country have been advised that daily updates will be posted on the school website and social media channels

Figure 5.11 *Image of Slide 11. Covid-19: How have teaching methods had to adapt during lockdown? Activity in Session 1: Introduction and Functional skills*

As a starting point, the researcher suggested that some challenges that they may want to put into practice were delivering lessons, monitoring progress and attendance. The students were given access to Google.docs and were able to edit individual tables on a document to add their group's discussion points.

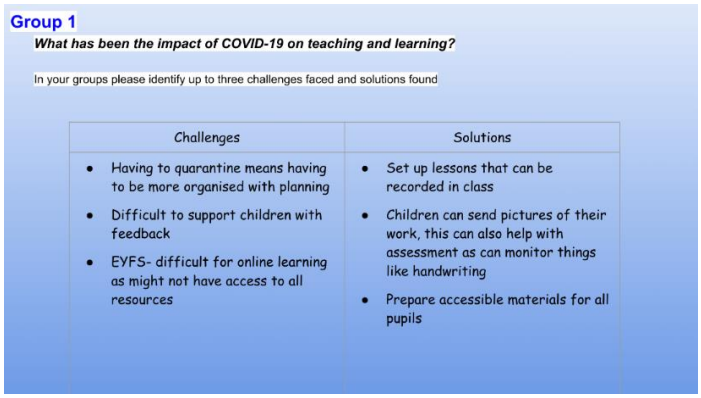


Figure 5.12 *Group 1 challenges and solutions for teaching methods during lockdown*

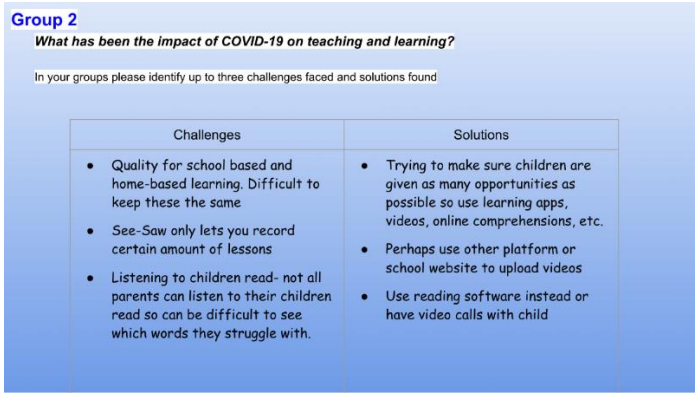


Figure 5.13 *Group 2 challenges and solutions for teaching methods during lockdown*

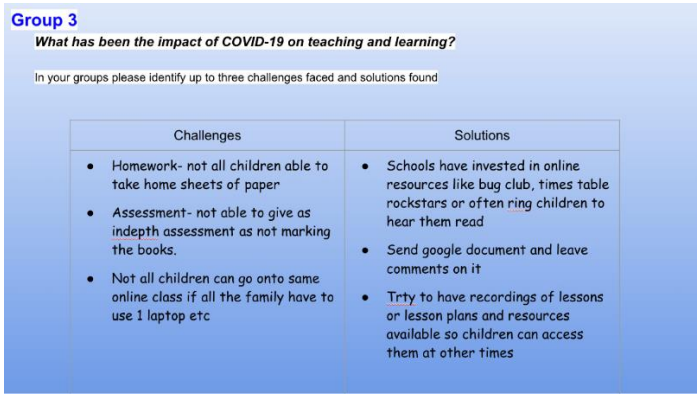


Figure 5.14 *Group 3 challenges and solutions for teaching methods during lockdown*

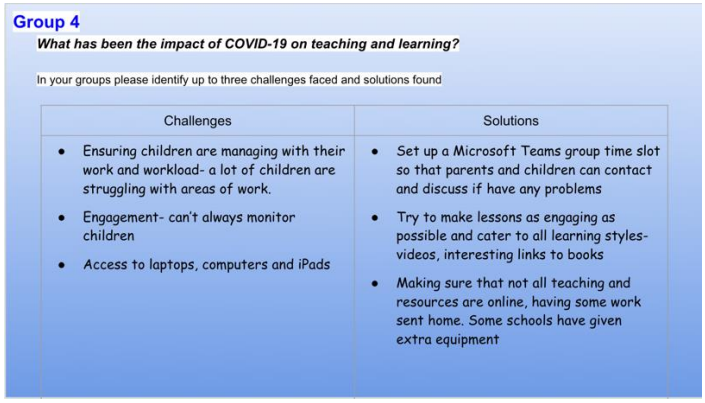


Figure 5.15 *Group 4 challenges and solutions for teaching methods during lockdown*

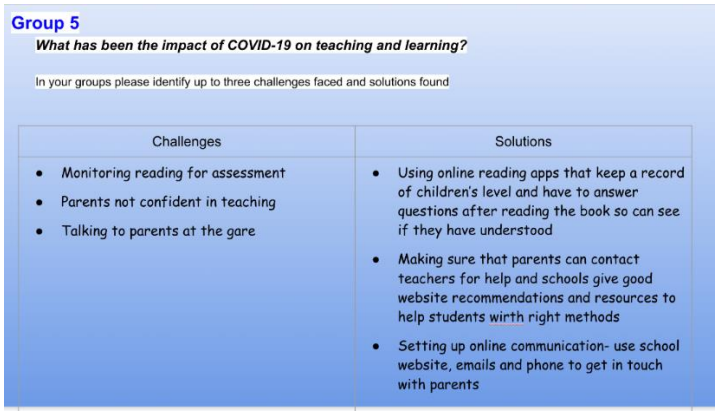


Figure 5.16 *Group 5 challenges and solutions for teaching methods during lockdown*

All groups noted that preparation for online learning would be a key factor to successful delivery. To prepare, one must plan. Group 1 noted that as remote learning was a new approach, teachers would need to plan their lessons to suit this new format:

"We could set up lessons that can be recorded in class."

(Group 1).

They went on to discuss how recording during lockdown had also prepared teachers for recording once they had returned to school. As many staff, children and families were still having to quarantine if they, or a close acquaintance, had contracted virus, some teachers were still recording some of their lessons in class so that they could be accessed at home. Students noted that remote learning had made schools investigate using online platforms for issues like homework:

"Schools have invested in online resources like bug club, times table rock stars"

(Group 3).

Just as in the interviews, the student teachers were aware that the accessibility and reliability of technological devices and the internet were an issue for online learning. There were suggestions that teachers would be able to solve this challenge by preparing the lesson setup and having backups in case technology failed.

"Prepare accessible materials for all pupils."

(Group 1)

The researcher opened this to all students by asking:

How do you make all materials accessible?

Students responded by saying that some resources would need to be sent home or they could send via email or on school platforms. The researcher went on to discuss how teachers need to have 'back ups' to make sure that children can always access some sort of learning resources by having multiple online resources that can be accessed by a variety of devices, suggesting that most should be suitable for mobile phones as this would be the most accessible and available device for students. There were considerations about the availability and accessibility of devices and therefore could cause difficulties for teaching and learning.

"Not all children can go on to some online classes if all the family have to use 1 laptop."

(Group 3)

This statement relates to the notion that teachers need to consider the barriers to learning whilst planning their lesson delivery. Group 3 suggested that schools and teachers should try to have recordings and resources for lessons available so that they can access them when necessary. There were comments that there would be differences in the quality of remote versus in-school learning and so it would be essential that students be given as much support with accessing and using technology for learning.

"Schools should be trying to make sure children are given as many opportunities as possible to use learning apps, videos and online comprehensions, etc."

(Group 2).

Assessment and monitoring were another prominent challenge that was mentioned by the student groups. Group 1 noted that remote teaching removed the 'rapid response' feedback that teachers would usually have when walking around the classroom and checking on children's work, they discussed solving this issue by sending photos of the children's work for the teacher to monitor the work being produced at home.

"Children can send pictures of their work; this can also help with assessment as can monitor things like handwriting."

(Group 1).

In having their students send photographs of their work, provided the teachers with evidence for assessment and would allow them to monitor their progress more accurately. In the 'chat' feature, some students commented that participation and attendance also might contribute to assessment accuracy. As teachers couldn't mark during lessons physically, Group 3 suggested that work should be done on word processing software and the document should be uploaded on to an online drive, such as Google.docs, and the teachers could then comment on the work and the children could then make amendments easily. Although a good suggestion, it should be noted that not all teachers and students have experience in this and therefore may need some training.

There were suggestions that using online tools, such as reading apps, could also be used for assessment purposes. Reading apps often offer comprehension questions for children to answer, "to check that they have understood" (Group 5) and just as with using a comment

tool, teachers can often use these apps to view the answers the children have given and comment on their work. Often a comprehension task, using a digital format is more interesting than simply writing down the answers in a question in a book. To encourage engagement and students producing work to be monitored, there needs to be interest established and support given using effective communication methods.

"In trying to make lessons as engaging as possible and catering to all learning styles." (Group 4).

By using videos and providing links to interesting resources would mean that children were more likely to participate in the tasks and therefore more likely to learn. With multiple options to communicate, such as Microsoft Teams, may mean monitoring progress and filling in learning gaps more achievable.

"Microsoft Teams group time slot so that parents and children can contact and discuss." (Group 4).

Although these were all helpful suggestions, it should be noted that the practising teachers mentioned that online evaluations were sometimes difficult due to device availability, willingness, and network connectivity. Many schools have not given training in how to use the platforms they have provided for assessment purposes and so for this to be done in the future, teachers should have access to online assessment profiles and be trained in using them efficiently.

In the feedback about the discussion about the challenges and solutions to online teaching, 29/35 students stated that they particularly enjoyed the opportunity to interact with their peers in this activity.

"It was very informative listening to other people's ideas."

"I liked interacting with my peers."

"It was good because in the breakout groups people could use their own experiences to help us decide on the challenges and solutions."

Even though one of the most enjoyed activities was the interaction through breakout groups, it was also the area that received the most feedback as an area for improvement. The students seemed to find that this activity was allocated more time than was necessary:

"I think we spent too long in our groups."

(Student).

"Sometimes breakout groups aren't always the best for discussions, as some students do not speak. Then time is just wasted."

(Student).

This exercise was done to investigate the knowledge and understanding student teachers had of the challenges of online teaching. In asking them to determine solutions to these challenges, in breakout groups and then discuss these with the wider student body, the researcher hoped to broaden their view of the challenges of online teaching and would help to prepare them for practical application.

5.3.4.1.2 Discussion boards

The researcher used discussion boards to provide an opportunity for the students to communicate in a virtual environment. The students'feedback showed that many of them preferred using discussion boards as opposed to breakout groups and open discussions in the 'main room' in Blackboard Collaborate.

"I liked how ideas presented and joining in and sharing ideas and thoughts of benefits and risks on Padlet"

(Student).

"I liked the interactive element through Padlet as it allowed myself to see others ideas anonymously."

(Student).

"I can see that the students enjoyed using the discussion boards like Padlet and Jamboard because there were so many responses. I think it was easier for you to look at all the notes and then comment. It meant more time for more views to be shown."

(KS2 ICT Lead).

The feedback showed that some student and practising teachers were unfamiliar with the discussion boards used in the sessions and enjoyed that this provided further training for online teaching and an opportunity for an informal discussion amongst peers.

"I've not used Padlet before, but I really liked it because it's so easy to use and had that "new toy" type of advantage."

(Student).

"I can see the appeal of these discussion boards and would be particularly good for online lessons in KS2."

(KS2 ICT Lead).

5.3.5 Discussions

In discussions, the researcher aimed to create an inclusive environment with opportunities for diversity and reflection. All the students gave perspectives that brought about discussion and debate. The researcher included activities that would allow the students to introduce theories and points for discussion and reflection. The aim was to share experiences and opinions for the students to gain knowledge and form an understanding of the points being made.

"I tend to get new ideas and develop my own understandings of the topic in question through peer discussions."

(Student).

The students were respectful and considerate whilst others were contributing to the discussion point and holistically, the group was confident in sharing their experiences, views, and uncertainties. There were also offerings of different perspectives and possible solutions.

"It was nice to hear everyone's experiences about teaching challenges and ideas about solutions."

(Student).

"There was interesting information and the students seemed enthusiastic in giving their views"

(Deputy Head).

"The breakout groups were great and allowed discussion and an opportunity to discuss any issues that people had encountered. I also liked that you asked them for solutions to the problems too."

(KS2 ICT Lead).

Discussions are often good to help build a foundation of knowledge and ideas that teachers can go on to use in their own practice. Feedback showed that the students found the discussions useful for the sharing of experience, advice and ideas with the possibility of implementation.

"*The format of the session promoted professional discussion and sharing of ideas."*

(KS1 ICT Lead).

"There were great ideas for strategies that came from the discussions."

(Deputy Head).

There were conflicts between participants preferences between online and face-to-face delivery. The researcher understands that although their only option at this time was to deliver the sessions online, there are now options to deliver the sessions physically, which may be recorded to be viewed at other times. Depending on the school, cohort and personality future courses could be delivered to suit their preferences:

"I prefer face-to-face lectures but understand that isn't possible now. I liked the way you still tried to involve us in the discussions online. When you record lectures from the hall you have the best of both."

(Student).

"Using the chat facility was successful as it could be anonymous, and I think a lot more students felt they could bring forward their ideas and experiences."

(Deputy Head).

The researcher considered the balancing between the wanting of participants to speak and allowing more dominant participants to dominate the discussions. This was difficult in a virtual lecture theatre as the researcher was dependent on the students participating in discussions as a whole group and then in breakout rooms. When delivering face-to-face interventions, an instructor can read the body language in the room and anticipate those who feel confident to talk, easily organise who is allocated to speak, prompt those students who appear less confident and knowing who is physically and mentally present. The virtual platform sometimes made it difficult to evoke discussions.

"Sometimes in the breakout groups people don't speak and we don't have any authority to make them."

(Student).

One student suggested that students often feel more confident to discuss things when they are comfortable with others in their group and can prompt one another as they feel comfortable. They felt that they should be given the opportunity to form discussion groups of a certain number prior to the session.

"No-one really spoke in my breakout groups, maybe allowing us to organise our own groups offline blackboard."

(Student).

To motivate discussion, the research included activities, the chat group and nominated group speakers to try a give a voice to the students in more anonymous ways. Some students felt more confident in speaking using chat forums or on discussion boards as opposed to speaking via microphone.

"I liked using Jamboard and Padlet because it was easier to see more people's thoughts and ideas and also made it more anonymous."

(Student).

It is good to have a balance between writing and speaking, as mentioned above, having options for the students to discuss by writing on forums allowed for views to be seen. The researcher factored in the balance between a sense of security through writing anonymously and speaking to groups via microphone. As this is a skill that students will need to have in their teaching. For this reason, the researcher included a variety of methods to stimulate discussion.

5.3.5.1 Teaching experiences

The students most enjoyed the element of discussing their own teaching experiences or those of people close to them with their peers. The students have a common passion: to become effective teachers, and to do so it is often beneficial to be involved in discussions related to this topic by collecting knowledge on the best applications for practice:

"I enjoyed listening to everyone's experience on teaching methods that they have seen being adapted in schools."

(Student).

"It's good to know what works and what doesn't."

(Student).

The researcher encouraged the discussions about teaching experiences by asking follow-up questions and giving examples of their own teaching experience. Their aim was for students to follow and to add reactions to ideas to build on comments.

"It was good when you asked questions about the student's experience and then told us about your own."

(Student).

"I like how now people are more comfortable with back-and-forth conversations by giving their own experience and opinions now."

(Student).

The students had a shared interest: *teaching*. The researcher encouraged discussions for the students to build relationships. In sharing their teaching experiences, the students can draw on successes and disappointments during teaching practice and learn from their peers. In discussing teaching experiences, the students brought forward diverse views and practice.

"I enjoyed hearing about the researcher's and others' ideas on how to teach e-safety in schools."

(Student).

"I enjoyed looking at people's opinions relating to it."

(Student).

In session 2, the students were able to draw on their own observations of e-safety lessons in e-privacy, cyberbullying, and the risks of social media when thinking of activities liking to the topic. One student noted that they had set their lower KS2 students to doing an online multiple-choice quiz on e-safety:

"We decided on using multiple choice questions as a foundation for different contexts and situations that would also help children with "what not to do" and these would evoke discussion and justification points."

(Student).

The student noted that it was interesting for the 'boys' who had been using interactive games, like 'Fortnite,' to see what information a username might reveal, e.g. fore/surnames, date of birth (DOB), hobbies, etc. After the discussion, the children were given the task to come up with their own e-safety rules.

The aim of the lesson is always to get the children to think for themselves, whether it is through peer discussions or other situations. One student discussed using a grouping activity, where the children were given statements linked to e-safety and had to match them to the correct category and then moving on to them coming up with either their own statements, their own categories, or both. The researcher discussed the ideas with the students and then advised that it's especially important that teachers remain up-to-date and stay current if discussing scenarios or topics with their students, e.g., discussing current news events, emphasising the reality of the topic and situation.

5.3.5.2 Topics for discussion

5.3.5.2.1 Cursive handwriting versus touch typing

A typing test activity was included in session 1 as the English national curriculum (NC) places a high importance on handwriting. The English NC specifies that "pupils should revise and practise correct letter formation frequently" (DfE, 2014). The researcher asked the students for their views on whether the cursive hardwiring standard for KS1 should be replaced with a touch-typing instead. The researcher stated:

"We're now asking children to produce written work using technology and software programs like Word.

- *Do you think it's important that we teach children how to use a keyboard properly? […]*
- *Do you think it's more important for children to have a high standard of cursive handwriting or can type quickly and accurately?*
- *Why?"*

(Researcher, Session 1)

In asking this openly to the group, it provided an opportunity for students to interact with others and hopefully prepare them to be confident during discussions. It was interesting for the students to discuss the future of the NC and to justify these opinions with their peers. The student responses mainly agreed with that although they thought that handwriting was a necessary basic skill that all children should be taught, they didn't think that cursive hardwiring should still be a requirement for KS1 in the NC. The students went on to discuss that as children are having to use word processing software, they thought it would be more beneficial if children were taught how to type on a keyboard.

"I mean in primary schools, children need to be taught how to write using pens and pencils, but they also need to know how to use a keyboard because most of them would just use their phone screen to tough type, and that isn't the same."

(Student).

Some of the students commented that their own touch-typing skills were much better than their handwriting skills:

"I'm so used to texting that I'm a much faster texter than a writer."

(Student).

This statement reflects that if children can type faster than they write, the additional time may enable them to spend time focusing on their thoughts to then be able to write, check and edit, which would improve their standard of writing. However, this statement related to touch-typing which is very different to that of using a keyboard.

Students suggested that if children practice their keyboard typing skills, it will become second nature to them, and they will then be able to focus more on their subject thought process rather than on using the keyboard itself. This would then speed up their responses to the task. Some participants felt that improving children's typing skills might make them more efficient in multitasking, as they might be able to read and type at the same time:

"I think the more you practice, the better you get. I can now read and type at the same time because I'm always doing it at uni. I think it would be the same in schools."

(Student).

The researcher and participants concluded that the key to being digitally literate is by maintaining DL skills by embedding them into their teaching. It might be suggested that both practising, and student teachers could use online discussion forums, blogs and DfE for suggestions about how to maintain functional skills by using digital literacy in their lessons.

It may be suggested that to develop any kind of technological skill, such as typing, it should be practised as frequently as possible and so teachers should be looking for opportunities to incorporate this in their lessons. One student had noted that they had been on a placement and

"In Reception they were teaching letter recognition using a keyboard. It almost made it a game. Then they did a print-out of a 2D keyboard and the children had to colour in the key for the letters of their name and then pretend to type."

(Student).

This gives an example of a cross-curricular teaching method, where the teaching was combining the subjects of English and Computing to engage the children. To try and show that teachers can make typing a fun activity, which may later be using across other subject areas, the researcher gave a practical example by asking the participants to partake in a typing skills test. The feedback showed that the students thoroughly enjoyed this quick activity and sharing their results and so it would be engaging for future interventions.

5.3.5.2.2 Who are you on social media?

The researcher commented how all the participants were witnesses to how some, if not most, children now share huge quantities of their lives on social media to online followers and 'digital friends.' They were interested to find what the students' experiences were with social media and what they felt the benefits and risks of social media were. The students were asked to post comments on a Padlet board about the social, professional, academic, and communicative benefits of social media are. From that, they were asked what risks they could identify from having an online presence. The students were given three minutes to respond on the board before discussion. The results from the board are shown below:

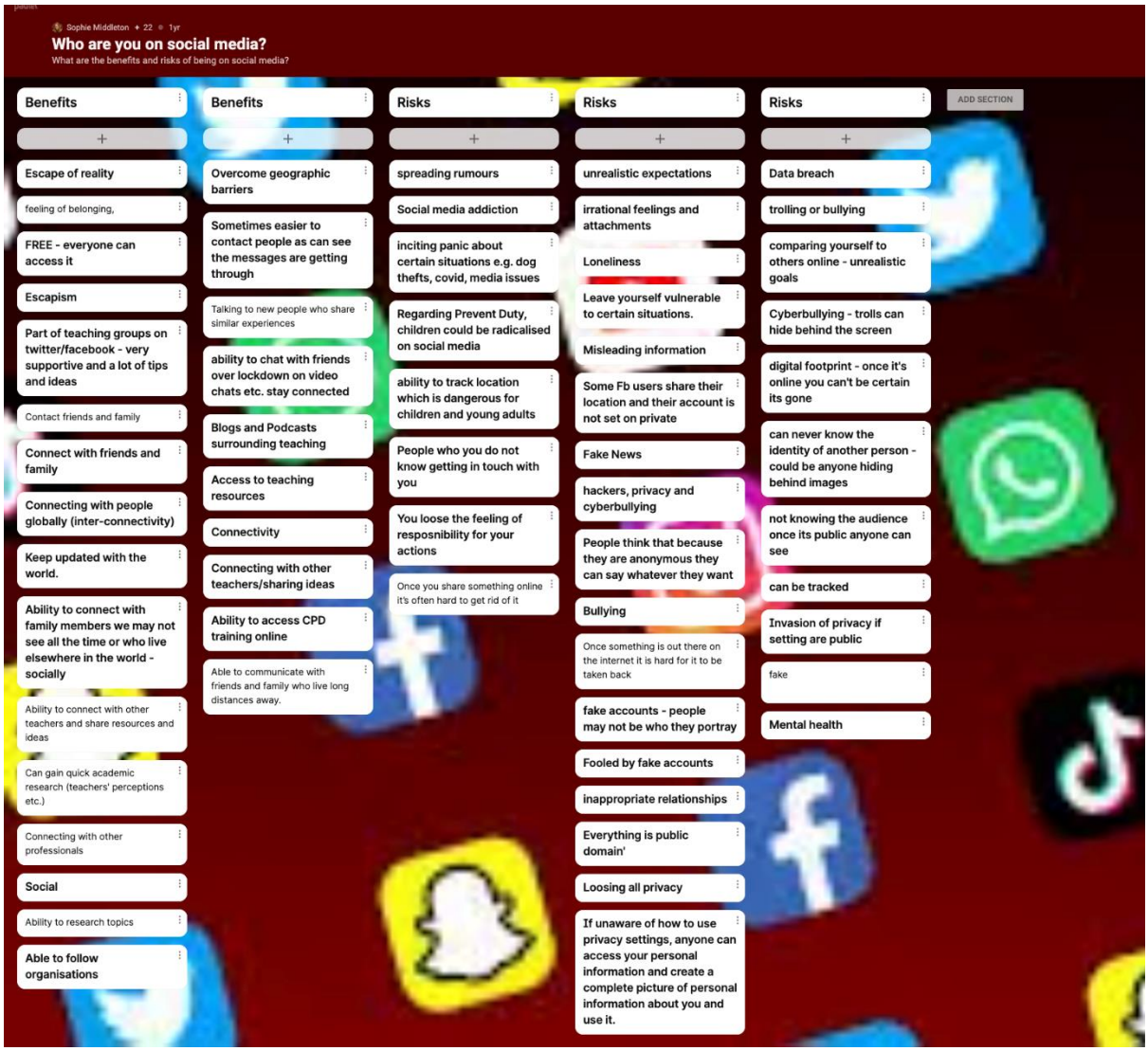


Figure 5.17 *Padlet board to show student responses to the benefits and risks of social media*

Looking at the board above, it is interesting to note that the students in this study perceive that the risks of social media appear to outweigh its benefits. This suggests that as social media exists, there are a great deal of benefits and many risks that need to be dealt with.

The students agreed that social media is a great communication aid to "connect with friends and family" and also with "family members we may not see all the time or live somewhere else in the world." The students suggested that social media is a portal that allows us to "connect with people globally" and will help us to "overcome geographic barriers" and "keep updated with the world." This is true, although the researcher pointed out that there can be uncertainties with the truth and accuracy of these 'updates,' often being referred to as "fake news."

This brought to light the idea of digital identities and how not everything online is an exact truth, whether it be news or gossip, social media identities or even organisations. Some of the students had mentioned social media implementing professional communications: "able to connect with other teachers and share resources and ideas" and "connecting with other professionals," but as with discussing falsities, the researcher went on to discuss how people don't think critically whilst online.

"We don't always check for the source.
How do I know who this person is?
How do I know if the organisation they claim to work for is real?
How do I know whether this statement is true?"

(Researcher, Session 2).

It might be suggested that the 'online era' and social media has had to shape society to be more aware of falsities and be distrustful of sources, not that this is a bad thing. It is important to shape students so that they want to investigate for truths online and to seek justifications for these.

The students discussed how difficult a topic e-safety can be and how when discussing be safe using social media, they would have to make the conversation age appropriate:

"I know 7-year-olds on TikTok, clearly not abiding age restrictions"

(Student).

"I started talking about TV and how sometimes there are things you can't watch because you're too little. It's the same with your phone and social media."

(Student).

"There are sometimes things on there that aren't very nice and would upset you. That would upset me because I don't want you to be upset."

(Student).

Although this 'avoidance' tactic is good with younger children, teachers in the latter stages of KS2 need to consider teaching students what to do when they are faced with inappropriate content.

"It's about respect for the child too, you don't want to treat them like they're stupid" and "it's no good just saying: no you're not watching it. You need to give them context and understanding or they'll do it when your back is turned anyway."

(Student).

The students decided that by listening to the students, showing concern and guidance makes most children respect their teachers and waiting to follow their example and so in having the knowledge to deal with these situations will help teachers to impart their knowledge to their students:

"It's about getting on their level."

(Student).

The most prominent concern about the use of social media was that of falsities: "fake news," "unrealistic expectations" and "misleading information." Students noted that engaging in falsities online, we often take on 'fake personalities' and lose or digital responsibility or respect for others online, sometimes leading to cyberbullying. This can have a serious impact on mental health and wellbeing: "leaving yourself vulnerable to certain situations" and "loneliness." Lockdown proved that a virtual life cannot surpass a physical life experience, specifically for our mental health. However, virtual and cyberbullying can feel every bit as real as physical bullying.

The falsities within the realms of social media have created a negative, distrusting, and judgemental environment which cannot be contained. The reality that there are "people you don't know are getting in touch with you," "people think they are anonymous they can say what they want," "once it's online you can't be certain where it's gone "and "you can be tracked" means that children need to be armed to deal with these. We cannot deny the reality that social media can be dangerous, therefore we must use the knowledge we have to train students to be as safe as possible.

Students also discussed issues with privacy and "things going viral" on social media. There were points made about personal understandings of 'things' being unexpectedly shown without approval. One student explained that they had observed a lesson where a teacher

investigated the theory of a 'Chinese whispers' situation when sharing information online, seeing how far it would go and whether the end post was the same as the starting one.

"A teacher took a photo of themselves holding a board with e-safety written on it and shared it on their profile and came back to it to show that even a friend of a friend's friend had liked the post."

(Student).

This student stated that the aim was for the children to understand that anything shared online can reach anyone in the world without you knowing anything about the other. The researcher explained that this scenario relates to digital footprints and ensuring that students understand what this means.

"Once something has been posted to the world wide web, it can't just be removed. Data can't always be deleted."

(Researcher, Session 2).

Some of the students mentioned that once a rumour has started online, it can have catastrophic consequences. An untrue and unjustified rumour or allegation can not only affect social standing but may also affect a person's career. It's important that students and teachers have these discussions because it is important that they understand about digital footprints and an online presence. The discussion continued to how social media reflects an online presence and students need to be careful about what they post online because it reflects them for all prospects.

5.3.5.3 Comparative discussions

The researcher included individual tasks where the students were able to express their competitive natures and make the activities exciting, also provoking discussion through a comparison of their experience or results.

A quick practical typing skills activity was used to determine a standard of typing accuracy and pace. If they chose to do so, students could share the results of the task with their peers and compare them.

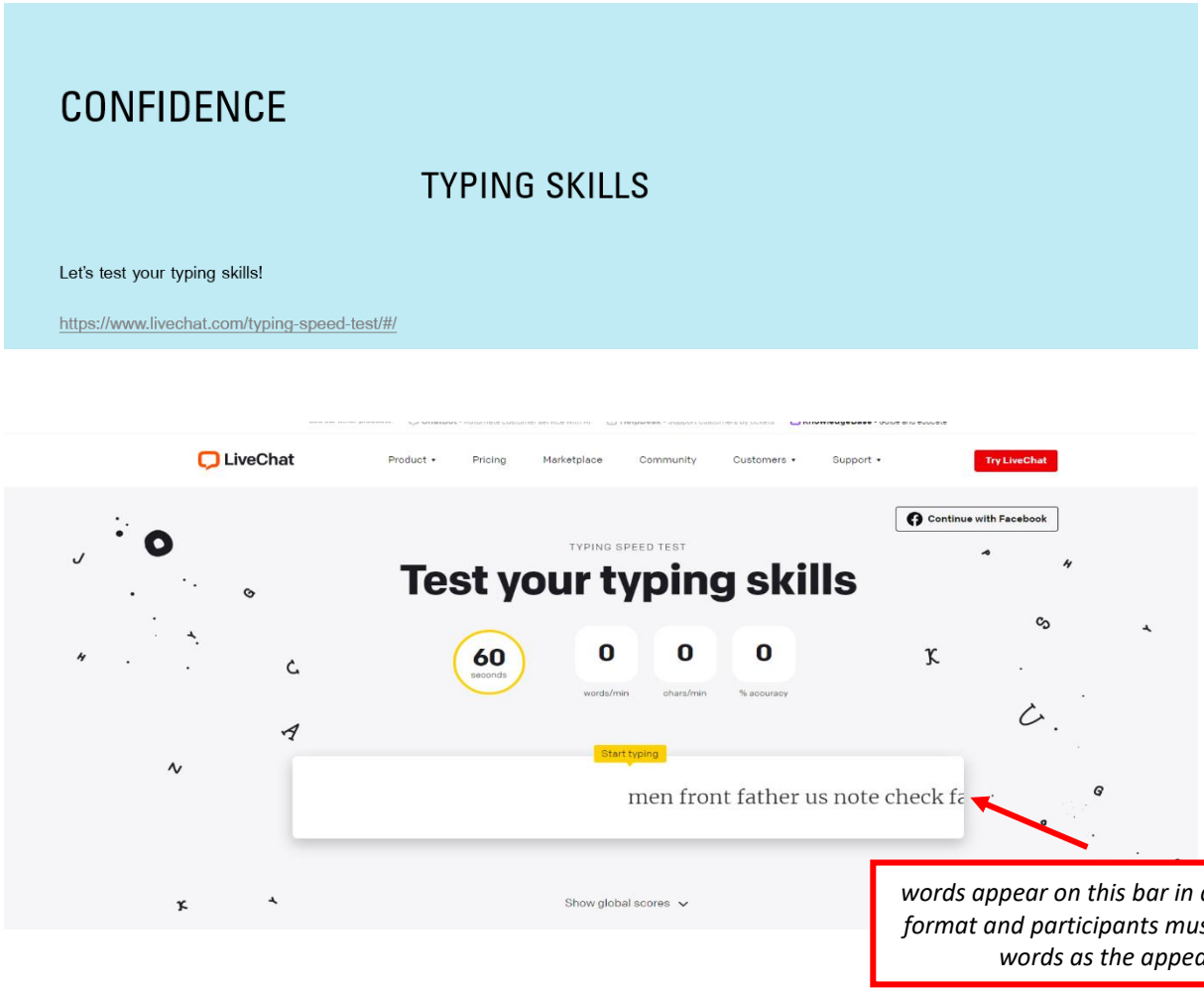


Figure 5.18 *link to teachers' typing skills test*

The researcher explained that individual words would appear on the bar in a sentence format but would not make sense as a sentence. The students' task was to type as many words correctly as they could during the time frame. The more words they typed correctly the higher their scores would be. The students seemed to enjoy this task, each commenting on their 'score,' the lowest score being a turtle and the highest being an octopus. One student commented that their score was twenty-three words per minute using a keyboard (a turtle) but when they used the app on their phone, they were sixty-five per minute (an octopus) showing

that their keyboard skills were relatively poor in comparison to their touch-typing skills. The feedback showed that the students enjoyed this activity as it evoked a competitive side that engaged the students and motivated them to beat their own scores.

"The typing test was the best! I had one of the highest scores but I want to do better!"

(Student).

"I enjoyed the typing test most of all because it was fun and a quick activity. I liked sharing the scores too"

(Student).

"They were so enthusiastic with the typing activity that I want to have a go myself!"

(Deputy Head).

5.3.6 Applicability

This framework was designed to give a generalised set of DL skills to student teachers. The researcher hoped that these teachers would use their skills and apply them personally, professionally, at home and in schools.

"I like that it's so easy to understand and has made me think about the personal and professional uses of DL. It's going to be a great discussion point for us during staff meetings."

(Deputy Head).

"E-safety is a huge topic for me. I'm going to get my own children to watch this presentation!"

(KS2 ICT Lead).

5.3.6.1 Implementation into the classroom

"I really enjoyed learning the more creative ways to implement technology into your teaching, it was great that the researcher had used lots of them herself."

(Student).

The researcher provided examples of lesson plans, the use of digital devices and resources, and teaching techniques in an attempt that students would go on to implement these skills into their own teaching practice. The researcher wanted to give students 'the seed' of knowledge that the students could 'water' and 'grow' with their own interpretations:

"I liked how we talked about the real-life applications of e-safety and how we could use this in our teaching."

(Student).

"The resources discussed I can use in my own lessons."

(Student).

"I'd like to use the lesson shown about writing an email in my own lessons."

(Student).

"The internet safety tips were excellent as were the resource list and lesson ideas that I could adapt."

(Experienced teacher).

"It was particularly useful for my own professional development and think I'd be able to give lessons in cultural, social, and ethical understanding now, which I'll admit I didn't have a clue about before."

(Experienced teacher).

The interventions were used to introduce new concepts and demonstrate teaching strategies, which students could go on to implement into their own classrooms. The content aimed to encourage the students to think critically and discover solutions to hypothetical challenges for them to feel confident at introducing it in their work.

"In learning about something alien to me (virtual reality), and something I'm not so familiar with (cultural and social understanding), I think I'd go on to do more research so I could create my own lesson."

(Student).

"It was good to talk about the challenges of online teaching and come up with our own solutions because we're a bit more prepared if it happens in the future."

(Student).

"I like how the session centred on how to incorporate this information into lessons- really useful for my own professional development."

(Student).

"I enjoyed the use of the cultural, social and ethical lesson understanding lesson plans as I understand how to better incorporate this topic into a lesson myself."

(Experienced teacher).

5.3.6.1 Audience suitability

While implementing DL into the classroom, teachers need to ensure that their content is age and ability appropriate. There need to be considerations when determining the extent of information given and sometimes limitations when exploring what has been learned.

"I agree that children need some exposure to risks otherwise they won't know what to do. Older children can be given more freedom than younger children."

(KS2 ICT Lead).

The aim of the sessions was to train teachers in basic DL skills and to provide and awareness and understanding so that they'd be able to incorporate this understanding in their own teaching. Although the training was aimed at student teachers, the researcher included lesson ideas and resources so that the students would be able to adapt this knowledge to suit children.

"I enjoyed the fact that it really made me think about what is available online and what needs to be taken into consideration when talking to children about the internet."

(Student).

"The content covered a range of ages of children."

(Deputy Head).

"Netiquette and ways to make children aware of this was a great suggestion."

(Experienced teacher).

"I liked how you had examples for both KS1 and KS2 that were useful to both."

(KS2 ICT Lead).

There were also mentions of the issues and skills discussed in the sessions and how to apply solutions and teaching strategies to meet a multitude of year groups and educational needs:

"I liked that you discussed audio, visual and kinaesthetic teaching approaches in your examples."

(Experienced teacher).

"You stressed the importance of digital footprints and discussed techniques for discussions with different ages and learning styles."

(KS2 ICT Lead).

5.3.6.2 Online teaching

The researcher reviewed the drastic transition from face-to-face to online teaching and learning during the first close of schools in England in 2020. They shared some of the experiences and strategies that the interviewed practising teachers had voiced.

"It was interesting to see what websites, communication apps and software had been, and is still being, used to keep in touch with colleagues, students and their parents."

(Student).

"COVID-19 meant we had to use digital platforms that not only meet our children's needs but those of the parents too."

(Deputy Head).

"It was interesting to hear about the digital platforms being used by other schools."

(KS1 ICT Lead)

The feedback from the practising teachers evidenced what had been mentioned in both the literature and in the findings from the interviews, that teachers had received little training in DL skills prior to lockdown and were unprepared to face the drastic transition to online teaching:

"We had to quickly move from face-to-face teaching and meetings, paper records, and communication to online, which I know most of my staff weren't ready for."

(Deputy Head).

Students had little experiences with observing and teaching in schools themselves as placements had to be postponed and the only option to practice was virtually. The students enjoyed discussing the impact of COVID on their own

5.4 Chapter Summary

In this chapter the findings of the interventions have been presented, focusing on those themes and categories most prominent in the data. The arising key themes showed that the students understood that DL skills related to the use of technology online, using the internet safely and efficiently to teach online. They saw a relationship between DL and the use of digital devices to support learning and guidance in their teaching practice. However, there were no references to how they would use technology in their practice.

The feedback showed that student and practising teachers were positive about the structure of the framework and individual sessions, stating that it had provided them with new information and ideas, giving a greater understanding of the topic that they would be able to implement into their own practice. There were some mentions of the framework being improved by avoiding technical issues, having tighter time frames and having activities and presentation slides that were more interactive and catered towards preferred learning styles.

Some students felt that the sessions were not more specified, and the researcher had to remind the participants that the interventions were to suit a variety of skillsets, year groups, and learning styles. The researcher recognises that this generalised framework may be adapted to suit different audiences in further deliveries.

The feedback showed that both student and practising teachers were satisfied with the objectives, instructions and presentation of the information, and the preparation of resources and materials. The sessions followed a four-part process (information > activity > discussion > recap) of presenting information and theory on a topic, instigated a discussion based on an activity and then recapped their own interpretation of the information.

In relation o distribution of knowledge, the researcher included a variety of activities and discussion topics to engage and motivate students, Feedback indicated that students were

happy with the demonstrations and examples as they were applicable to children. There were suggestions that in addition to the researcher demonstrating, there could be more opportunities for participants to practice.

The presence of the instructor (researcher) was well received, with respectful and positive comments about their style of delivery, clear instructions, suitable activities, promotion of discussion and applicable methods for implementation.

References

Reupert, A., Maybery, D., Patrick, K., & Chittleborough, P. (2009). The importance of being human: Instructors' personal presence in distance programs. International Journal of Teaching and Learning in Higher Education, 21, 47-56.

6. Chapter Six: Discussion: Emerging themes and suggested ways forward.

6.1 Introduction

This chapter incorporates the themes arising from the results and analysis of all phases of the research. It includes a discussion of the significance of the data findings in relation to the literature reviewed and explores whether the overall aim of the study has been fulfilled. The research aim was:

"To develop a digital literacy framework to support teachers with digital literacy skills as part of continuous professional development (CPD). This will be an intervention to empower student teachers to support primary school children in an ever-changing digital landscape."

The study began with the research questions:

1. *What does digital literacy (DL) mean in an educational context?*
2. *What are the current gaps in digital literacy for primary school teachers?*
3. *Can a Continuous Professional Development (CPD) framework be developed to train teachers in the identified required skills so that they can become digitally literate?*

The researcher explored literature to gain an understanding of what material was available to answer the first research question, they drew data from the three-rounds of interviews to answer the second question, they used the findings from the interviews and literature to design a CPD framework and then used the interventions to answer the third research question.

The theory that was created involved the researcher's defining of DL to suit an educational context and how the six components she had defined were requirements for a practising primary school teacher (PST) to be considered digitally literate. The researcher created a

training curriculum that educated teachers in these components and how to apply them into an educational context.

6.2 Emerging themes

There have been several themes, determined by the grouping of concepts within the analysis, that have emerged from this study. In relation to previous literature, this grounded theory study has found themes which have supported or challenged, what has been acknowledgeD before and has brought to light new interpretations and original themes.

6.2.1 Digital literacy in context

The focus of the study was to determine a suitable definition for DL in relation to a primary educational context. This was done to aid the researcher in determining the aim of becoming a digitally literate teacher and an outline of objectives to achieve the standards required to do so.

From the review of literature, it was evident that there is a challenge when trying to establish an agreed definition of DL as scholars have determined that "there is no one set of agreed definitions for DL" (UNESCO, 2018a). The literature suggests that there are many different definitions of DL, referring to different 'concepts' (Lankshear & Knobel, 2008.), which are determined by their context. Generalised definitions were found establishing that digital literacy is the umbrella term for a multitude of concepts/elements/components (Belshaw, 2012; Hague & Payton, 2010; Lankshear & Knobel, 2008), but they were not placed in specific contexts. In the review of literature in this study, the researcher found that there were few definitions based on educational contexts, nor in defining their required 'concepts.' Even fewer definitions were found to suit a primary educational context at that time. The researcher went on to study a multitude of models to determine an overview of the desired skills one must possess to be defined as 'digitally literate,' and to then adapt these using the standards of the Computing curriculum in England (2014), and how these could be manipulated to producing a more up to date framework to support the implementation of technology into the classroom.

Findings from the review of literature, showed that the closest model relatable to training primary school teachers was: "*The components of digital literacy model,"* introduced by Hague & Payton (2010).

Figure 2.5 *The components of digital literacy (Hague and Payton, 2010*

Their framework suggests that there are eight components to digital literacy: functional skills, e-safety. The ability to find and select information, critical thinking, communication, collaboration, cultural and social understanding, and creativity. They related each of these to the national curriculum (NC) for Key Stages (KS) 1 and 2 in England. They define the meaning of digital literacy in an educational context but do not set curriculum objectives to set standards for primary school teachers. The "new" Computing curriculum in England was introduced into schools in 2013 and has not been amended with the advancements of technology and the development of digital skills. It consists of six standards for KS1 and seven for KS2:

Key Stage 1	Key stage 2
• understand what algorithms are, how they are implemented as programs on digital devices, and that programs execute by following precise and unambiguous instructions • create and debug simple programs • use logical reasoning to predict the behaviour of simple programs • use technology purposefully to create, organise, store, manipulate and retrieve digital content • recognise common uses of information technology beyond school • use technology safely and respectfully, keeping personal information private; identify where to go for help and support when they have concerns about content or contact on the internet or other online technologies	• design, write and debug programs that accomplish specific goals, including controlling or simulating physical systems; solve problems by decomposing them into smaller parts • use sequence, selection, and repetition in programs; work with variables and various forms of input and output • use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and programs • understand computer networks, including the internet; how they can provide multiple services, such as the World Wide Web, and the opportunities they offer for communication and collaboration • use search technologies effectively, appreciate how results are selected and ranked, and be discerning in evaluating digital content • select, use and combine a variety of software (including internet services) on a range of digital devices to design and create a range of programs, systems and content that accomplish given goals, including collecting, analysing, evaluating and presenting data and information • use technology safely, respectfully, and responsibly; recognise acceptable/unacceptable behaviour; identify a range of ways to report concerns about content and contact

Table 2.7 *The Computing curriculum standards for Key Stages 1 and 2 in England (adapted from DfE, 2013).*

Findings in the literature suggest that the Computing curriculum in England is not very detailed or thorough and therefore does not give a good indication of required digital practices and well-structured standards, as they are too vague. It is surprising to find that there are no specific mentions of DL in the TS and therefore some amendments should be considered, perhaps with direct references to the Computing curriculum to advise teachers in how to meet these standards in their teaching practice. The lack of literature regarding DL in a primary educational setting may be in response to the lack of guidance from both the NC and is not seen as a priority in the TS in England: “Educational professionals and scholars are faced with a range of perspectives, in which perspectives, terms and relations, and research procedures are ill advised.” (Alexander, et al., 2006). This framework is based on the outlined standards in the Computing curriculum (in national curriculum in England (2013), these are considered to be outdated and once amended, this framework will follow suit.

The teacher used the literature to determine six components of DL were appropriate in a primary educational context:

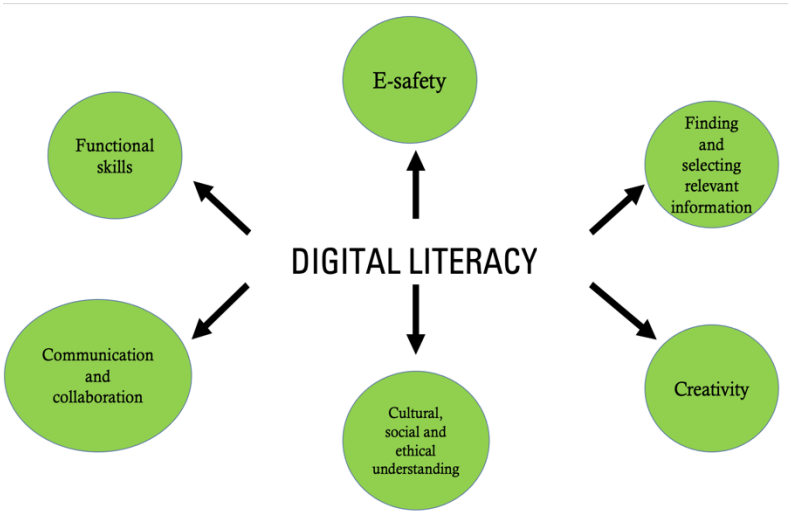


Figure 6.1 *The applicable components of DL for a DL framework for primary school teachers.*

The applicable components listed in *Figure 6.1* (above) were determined from the researcher's reviewing of relevant literature and their objectives determined from the findings from Phase 2 of the research. It was interesting to find that the objectives had to reflect on the participant's individual understanding of their needs but also on the needs of their profession. The participants discussed their experiences and understanding of CPD and the findings showed that they were interested in initiating change and overcoming barriers to training for the development of their profession, but also for the good of their students' learning development. The participants expressed a level of understanding in their own capabilities in these components and ambition to improve these.

6.2.2 Personal ability

Throughout the interviews, teachers explained that they were solely interested in receiving training that was relevant to their current teaching needs, subject needs, and student needs. A consideration of their own perceived skillset and ability should be coupled with a consideration of their teaching needs, when structuring the objectives for training interventions. Their original understanding related to functional skills, although many were unpractised or had limited experience and understanding of specific technologies and how to adapt DL skillsets. Results showed that the participants felt most confident with their communication and collaboration skills, as they sent emails, texts, and made phone or video calls regularly. They were certainly well rehearsed in using social media, both personally and professionally and understood the benefits and risks that can arise when communicating

through the medium of the internet. The findings showed that all the teachers understood that safety online is a concern and component of DL, they had experience in setting passwords and restrictions, and safeguarding. Although most teachers used the internet and search engines daily, there was little understanding or use of research methods, and many fell short when practising these skills. There was also little understanding of areas of cultural, social, and ethical practice, regarding communication and collaboration online. Teachers indicated that they were aware of interactions between cultures and being respectful when using the internet but were unsure about how able they would be to teaching appropriate practice. The most surprising finding for the researcher, was the lack of practice or training in creative methods of implementing technology into the classroom. As a former primary school teacher, the researcher had hoped that the practising teachers would be able to share ideas and pass on their methods and lesson practice, which could be incorporated into the framework. Issues concerning teacher context, school environments and attitude meant that teachers could greatly improve this skillset.

The research findings determined that there had been a lack of CPD training in DL skills and that most of the participants DL skills were self-taught due to the expectation that being surrounded by technology implies teachers have the skills to use technology and implement it into their classrooms. Responding to the assumption of being 'digital natives,' teachers expressed that they "could be better if they had more training." Professional training courses had been given during the introduction of technology into schools (DfE, 1997) and therefore irrelevant as the skills were no longer up to date. The pandemic further emphasised the shortage in efficient DL training and teachers and schools were not prepared for online teaching. The participants implied that a lacking in expertise in DL skills created a barrier when attempting to teach and guide students in this area, and often caused insecurities and an unwillingness to implement DL skills into their teaching practice.

As well as insufficient training, the research also highlighted concerns over time constraints, a lack of administrative support, and the availability and funding of digital resources are all barriers to the implementation of technology in schools. Within this context, teachers do not have the support or luxury of time to enhance their CPD or to introduce devices to accompany children in their learning for fear of wasting time if there are any technical or behaviour issues. There have been few attempts to overcome these barriers, there is little hope of appropriately educating the next generation in required skills for the future, such as

digital communication and staying safe online, effective searching skills for personal and professional needs and how to be respectful to the diversity of persons present on the world wide web (www). The findings showed that teachers felt they needed to be given more extensive training in DL skills for a better understanding of the skillset and the confidence to explore the uses of DL skills professionally and adapting these to suit both teaching and learning.

6.2.3 Training needs

The interviews began with the question: *what is digital literacy?* To determine the perceptions and understanding of the term. The researcher was interested to see whether the practising teachers' perceptions related to the theories found in the literature. In determining the applicable components for primary teachers, the researcher wanted to compare their understanding of DL in this context and their views of what teachers needed, to those of the teachers. The findings showed that teachers identified certain components of DL but showed gaps in the specifics and groupings of skillsets to make up these components. The gaps in their understanding, when compared to the defined objectives initially drawn from the researcher, showed areas of focus for the framework.

As discussed, when teachers were assessing their own capabilities, there were areas of both strength and for improvement, depending on the participant. The sample of practising teachers had been chosen as a diverse representation of this profession, and the variety in their skillsets in all three rounds of interviews provided suitable data to identify patterns of needs. The framework was then designed based on the general needs of this representative group.

The professional DL needs of primary school teachers is a concern that relates to how accurately they can identify their abilities and how well their training needs can be met. Results from the study indicate that primary school teachers need dedicated and catered training in DL skills and their pedagogical application of these skills. Findings suggest that teachers require CPD activities and resources to integrate DL effectively into classrooms. Despite the huge investments during the era of 'technology into schools,' training was not continued to the same standards continuously and therefore teachers had not been trained in

DL skills appropriately until schools went into lockdown and closed in response to the outbreak of coronavirus in March 2020. Teachers required emergency training in these skills when online teaching strategies were enforced, however there was still no amendments made to either the NC (2013) or TS, (2012), making it difficult to determine what teachers should be doing when practising to meet these standards. There are suggestions that both the NC and TS in England should be amended to suit more recent updates with technology in educational contexts and DL skills for teachers to determine more specifically what standards teachers and students should be meeting and to give suggestions as to how to implement them. In using a DL CPD framework, teachers are given the opportunity to develop DL skills, implement them into their teaching practice (face-to-face and virtually), in an attempt to improve learning in all areas for their students.

Teachers are working in a climate of increasing accountability and performativity (Solomon and Lewin 2016, Ball 2013). The practising teachers in this study expressed the amount of pressure teachers are under, regarding performance, workload, and their delivery of a variety of subjects in a rigid curriculum. Their performance relates to their delivery of lessons and the success of the children in meeting the satisfactory standards in the NC. Their workloads have expanded beyond their teaching workloads, now consisting of teaching, as well as, marking, planning and data management (DfE, 2018). Findings from this study showed that teachers were often working beyond the working day (9am-5pm), with teacher explaining that they were working between 10-13 hours a day. This is in line with national statistics, with 25% of teachers in the UK working, on average working 12 hours a day, 60 hours per week (figure from Allen-Kinross, 2018), meaning they are on average working 12 hours of unpaid overtime per week (Trades Union Congress, 2017). In having such huge time commitments, teachers in this study explained that they had little time for CPD and spent little time on their personal, professional development (PD). Even those that did show and interest in digital skills often explored technology in their own time, and even struggled with this. This shows that teaching hours need to be reduced through amendments to NC or increasing funding for support staff to give teachers time to participate in CPD, particularly in DL skills.

6.2.2 External factors

The results showed that maintenance, training, and support were large factors affecting the implementation of technology in teaching. Many of the teachers had only part-time access to maintenance, often once day per week every fortnight. Having a build-up of tasks, teachers were often unable to discuss concerns or projects and impacting their use of technology, often in a negative way. Without a 'safety net' (a maintenance worker or IT technician) in case something goes wrong, teachers were often reluctant to experiment. Even when technicians or trainers were available, the findings indicated that they didn't always have the pedagogical knowledge to support the implementation of DL skills in the classroom. The findings implied that teachers would prepare to receive training from a person with expertise in both DL and pedagogy, so that they would be able to learn relevant DL skills and be shown how these could be implemented into their own classrooms.

6.2.3 Training framework

The training framework used the findings from the literature to draw upon the objectives of DL in a primary educational setting and combined them with the results of the interviews, determining the skillsets and needs of the diverse participants.

Findings indicated that more training had been given in DL skills during lockdown to ensure that the standard of teaching remained high whilst delivering lessons via virtual platforms and using online resources. To help teachers with efficiency and effective use of technology, their schools provided a supportive environment and aimed to improve the personal abilities of teachers and students in DL skills through, training, guidance, experience, and encouragement with exploration. Form the results of the interviews, the researcher determined than those teachers who had been given instructions, training and had communication with their colleagues throughout online teaching, were those that felt more confident in their virtual teaching practice as they had a 'safety net' and felt supported by their schools to reach out to colleagues for advice and encouragement. Those who had previously been reluctant to use technology were given an opportunity to develop their DL skills, which they may not have given themselves prior to COVID-19. The fact that their job was now dependent on using technology as a medium for communication and the passing of

information, meant that by merely using different software or communication platforms or increasing their typing skills meant that teachers would be improving their DL skills, simply through more frequent exposure. Due to an improvement in DL skills, the proposed framework was adjusted to suit a higher level as a lot of basic skills had been covered and practiced and therefore teachers were ready to develop more complicated skills.

The extent of training in DL skills received by schools during lockdown increased dramatically as it was now a priority to maintain teaching strategies. The findings showed that in the initial interviews most teachers felt that their DL skills could "be better." This set a notion for online teaching practice, as some teachers felt unprepared and that their standard of teaching would be at a lower level than it would be in a face-to-face lesson. When students returned to school, their baseline levels had decreased in some cases. Teachers in this study expressed concerns that it was their lack of familiarity and confidence when teaching online, particularly at the beginning of lockdown, that had affected their own standards of teaching and as a result students weren't reaching the desired standards. Many teachers explained that teaching online had lowered their teaching efficiency, as there were issues with the pace of the lessons as teachers couldn't find certain functions on the software being used and sometimes attendance and control of behaviour were affected as their decrease in confidence also lowered their perception of authority. As standards were not being met as consistently during lockdown, once returning to school, the implementation of technology into teaching practice has taken a backseat to the core-subjects. Teachers have suggested that teaching online is not the same as implementing technology into a classroom and although their DL skills have improved, they have still not received any training on how to use technology as a support too in a physical classroom. Therefore, there are concerns from teachers that although they don't want these new-found skills to go to waste, they cannot go back to situation where they are learning new things, which in the short-term uses large amounts of time, until they become more familiar with, and confident in using technology in the classroom. As education is now trying to make up for some of the difficulties teachers faced with online learning, (e.g., accessibility to devices, communication, network unreliability, attendance, and behaviour) it is subject content being delivered as quickly and effectively as possible that takes precedent over developing DL skills in the classroom.

If training does take a backseat, there are concerns that new-found DL skills will not stay at the same standard as they have been. Some teachers have asked: "Will these skills continue to

be practiced?" (Teacher 26). When schools had first reopened, some teachers mentioned that training in DL skills remained a priority due as there were concerns of other lockdowns coming into place. However, as soon as assessment results had come to light, many schools redirected their attention to other matters of concern. Findings suggested that teachers Without regular practice, which already has decreased through not using these skills daily, there are concerns that they will become more and more outdated, until they reach a position similar to what they were in before lockdown. The results suggested that has been a shift in priorities and in methods of teaching practice. Now that students can go back to writing on paper, teachers have questioned whether the use of word processing software, such as Word or other Microsoft Office tools software, will be used. Children had been sending questions, homework and communicating using text, enhancing their typing skills, their abilities with word processing and their communication through a variety of online forms (emails, virtual platforms, text, discussion forums, etc.) will not be used to the extent that they have been. For some children, their only access to technology is through school, without practicing DL skills at school there is no opportunity to maintain them. If these skills aren't practiced, there are concerns they will be forgotten, and the achievements educators have made will go to waste. To maintain some of the levels of DL skills, there have been suggestions for a balance between the pace of practice and training in technology implementation. Although DL skills will need to be adapted to suit a physical education environment, setting a foundation for this training may take up time in the short-term, but once established will work well for the longevity of practice if these skills are refreshed at regular intervals. From the findings, Teacher 13 suggested that the use of the new devices and available software would combine the DL skills used in online teaching into the classroom and would make the transfer of skills easier.

The value of relevance of a DL CPD framework to teachers is crucial, given the wealth of decontextualised and inert research literature regarding DL CPD for primary school teachers in England. "Also, in light of the prominence of ICT CPD that focuses on functional skills and ability, rather than pedagogic use" (Lankshear 1997). Demonstrating a critical gap between the learning needs of teachers and the available CPD provisions. The findings showed that workload, teaching contexts and school environments were the biggest factors regarding CPD, particularly in DL. The data also suggests that the participants felt that they would only participate in CPD that would have a guaranteed impact, clear implementation, and responds/addresses teaching needs. In the initial interviews, many teachers explained that

DL felt outside of immediate teaching needs and with heavy workloads, a lack of funding and availability of resources and unsupportive school environments, training in DL skills was set aside. The outbreak of the pandemic, forced schools to prioritise and practice DL skills, bringing to light a greater need for CPD in DL skills, in relation to primary education practice.

In creating a DL curriculum to support primary school teachers in the classroom, a consideration of suitable components of DL, their relationship to the NC and Teachers' Standards (TS) and an identification of teachers' perceptions of their own teaching needs should be made.

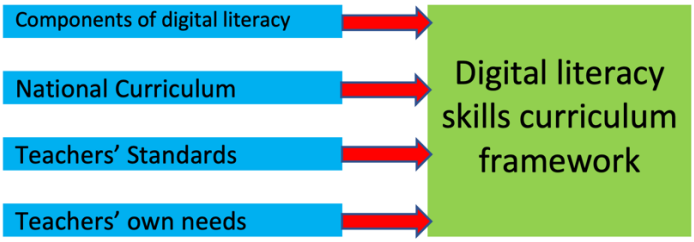


Figure 6.2*The four components to creating a digital literacy framework.*

A curriculum should consider each of these components and break each of these down to establish objectives:

1. Components of digital literacy: establishing suitable components.
2. National curriculum: considering the thirteen Computing standards.
3. Teachers' standards: determining applicable teaching and professional requirements.
4. Teachers' own needs: identifying personal abilities, workload, and school context.

6.3 Suggested ways forward

Within this context themes regarding defining of DL to suit a primary educational context would help to determine the objectives and standards needed to be met to enable PSTs to be efficiently trained in DL skills. Next, and overall investigation regarding the general needs of teachers is required to identify teachers' current skillsets and areas they wanted to improve, which would be combined with the set DL standards for primary school teachers.

6.3.1 Developing the framework

The framework has been designed to suit a broader context of skillsets, year groups, school environments and the availability of resources. It was designed to be a foundation to learn basics about DL skills which could be adapted to suit any audience.

6.3.1.1 Immediate adjustments

In using this framework to deliver a full course, means that after each session, the deliverer can identify areas of enjoyment and areas to be adapted or improved. As with this course, feedback is advisable to allow the participants to suggest ways to better meet their needs. This approach is like marking, and a course can be adjusted to fill in any gaps in learning. This approach has been shown in this study. Feedback forms were completed online at the end of each session, however for smaller groups a face-to-face discussion may work better. Online feedback was beneficial to the researcher as these participants could suggest areas for improvement and amendments could be made to the structure of the following session so that it was more suited to that cohort's needs.

6.3.1.2 Adaptations

As mentioned, this framework gives a generalised set of curriculum standards, set towards a specific audience: primary school teachers. This would be a good foundation course that could be adapted to suit different needs, such as abilities, year groups, experience and learning styles.

6.3.1.2.1 CPD training

This framework was initially designed as a CPD training course for practising teachers. The researcher identified a wariness from the practising teachers when they discussed CPD and its delivery. This framework was designed into six, one-hour sessions for them to be delivered to staff during meeting times, on a weekly basis. This was to deal with conflicts of interest, such as workloads and responsibilities. Teachers in the interviews suggested that some of their schools would be able to set aside an hour on a weekly basis for the course to be delivered to the whole team, either virtually or face-to-face. Unlike with the

interventions in this study, recording of the sessions would not be recommended, unless it was for very small numbers of staff who wouldn't be able to participate. A recording of a session would not work for a CPD course as they would not be able to participate in activities, which are essential in the make-up of the four-part process: reflection, planning, acting and evaluation.

Findings had shown that staff and schools would only participate in CPD that would be worthwhile and to the point. This course gives 'tasters' of components of DL skills that schools could participate in and then decide on areas that they would like to further explore. The participants had explained that for a course to be worthwhile, it had to be delivered effectively, and they spoke cautiously about receiving training from experts outside of the field as they could not always relate to pedagogical practice. The researcher has experience as a former primary school teacher and has a MA in Education: Pedagogy. They used this experience whilst designing the framework being able to create an original course that combined DL and educational contexts and the presentation and activities brought each skill and objective to relate to this chosen context with suggestions for implementation in the classroom.

This curriculum was designed using the same set of objectives that the researcher had determined for a CPD course which were used as a foundation, and therefore the content was the same. What differed was the delivery. The researcher had set activities, which were like those of the interventions, but these were designed to be done face-to-face and in smaller groups and the researcher had spoken to the participating three schools about their "short-comings" and had identified the level of content to be delivered and specific areas of concern.

This was a basic framework designed for a variety of skillsets and year groups. There was a limitation as to the number of sessions and time constraints for each. If the framework were to be more in-depth, and catered for specific CPD, it would mean breaking down the content of the sessions and expanding on the information being distributed which would require either more or longer sessions.

This course could now be delivered both virtually and physically as part of CPD. The researcher would recommend that there be a mix of the two so that they can address the content in different contexts. Sessions, such as 'Finding and selecting relevant information,'

may be more appropriate to be delivered online has it is more highly focused on information rather than activities.

The course would be ideal for CPD, as the foundation of the framework could be adapted to suit the developments of technology and its practice and would just need to be refreshed regularly.

6.3.1.2.2 Creating a module

The interventions were designed as an overview of all the components of DL. The feedback from the students suggested that they would have enjoyed it if the sessions could have spent more time on specific aspects of the session.

The course could be expanded into a module format for Higher Education (HE) students, with a lecture and seminar structure. The objectives would be altered to suit the level of qualification. In the lecture, the presenter would deliver information regarding the specific area of DL, as opposed to doing an overview of the components, the framework would go into more depth of certain aspects of the component. As the module would be adapted on a regular basis, the lecture could be adapted to suit the development of technology and preferred technological resources used in schools.

Following from the lecture, a seminar would contain more activities to embed the information given in the lecture. As well as similar tasks, such as group work tasks, discussions, and individual research. Seminars would be used to support students with their assessments and coursework and therefore access to relevant literature would be recommended. The purpose of the course would be to train teachers in DL skills for them to be able to implement these skills into their teaching practice. A suggestion for assessment would be to use literature to determine a definition of DL in an educational context and to design a lesson plan to teach about DL skills, implementing technology into their practice.

6.3.1.2.3 Class training

The course objectives are related to those in the NC in England and therefore could be adapted to suit a lower level of ability. DL skills could be a theme of topic work and the intervention sessions themselves provide ideas for teaching areas of DL and these could be

implemented into the classroom. The course would have to take place over a longer time period if the whole criteria is to be delivered. The objectives could be covered over multiple lessons and covering two components per term.

It would be beneficial to the field to carry out further research with practising teachers, Higher Educational students from a variety of institutions and modules, abilities, specific year group focuses and as refresher courses over longitudinal time frames to measure the progress of development after the course has commenced.

6.4 Chapter Summary

In this chapter, the emerging themes found in the study have been presented. The findings indicated difficulties in defining DL as there is no agreed upon definition (UNESCO, 2018a). This proved to be more difficult when determining a definition for DL in a specified context, in this case being primary education. They researcher used the themes from the literature review and models of DL that were most applicable, determining that there are six components of DL relevant to primary school teachers. The objectives were later defined in response to the emerging themes in the interview analysis.

Although the framework draws on the criteria outlined in the Computing curriculum (DfE, 2013), these standards have not been updated since 2013 and are considered outdated. When the NC is amended, this framework will follow.

The findings suggest that personal ability and training needs affect the requirements and structure of a training framework. The researcher suggests that the framework may be adapted to suit different abilities and needs. They propose that the framework is an overview of the six components and the delivery can be adapted to suit any audience. The researcher suggest it may be adapted for CPD training, a HE module or a topic for primary school children.

References

Department for Education (2013) National curriculum in England: computing programmes of study [online] Available at: https://www.gov.uk/government/publications/nationalcurriculum-in-england-computing-programmes-of-study/national-curriculum-in-englandcomputing-programmes-of-study [Accessed 14/03/2019]

Hague, C. and Payton, S. (2010) Digital literacy across the curriculum'. *Futurelab.* Available at: https://www.nfer.ac.uk/media/1770/futl06.pdf *(*Date accessed: 1.3.2019)

UNESCO. (2018). A global framework of reference on digital literacy skills for indicators 4.4.2. Information Paper No. 51. Montreal, Canada: UNESCO Institute for Statistics. Available at: http://uis.unesco.org/sites/default/files/documents/ip51-global-framework-reference-digital-literacy-skills-2018-en.pdf. (Date accessed: 17.4.2019).

7. Chapter Seven: Conclusion

"I hope I've been of some help."

(Teacher 6).

7.1 Introduction

This chapter looks back to the aim and objectives presented in Chapter one of this study, and provides concluding thoughts, which have emerged from the analysis and discussion of the findings. Recommendations will be considered and formally presented, together with suggestions for future ways forward.

The original aim of this research was *to develop a digital literacy framework to support teachers with digital literacy skills as part of continuous professional development (CPD). This will be an intervention to empower teachers to support PS children in an ever-changing digital landscape.*

This has been achieved through the fulfilment of the six set objectives:

- To review the existing state of the field and to determine the gaps in digital strategies in education.
- To define, identify and analyse the purpose of digital literacy in an educational context.
- To identify what teachers want to know about and what they think their training needs are.
- To identify the current availability of technological tools and digital access for both teachers and primary school children.
- To identify how teachers can develop their students' understanding of a use of digital communication tools, such as social media and networking.
- To develop a curriculum for teachers to identify the skills required for digital literacy training interventions.

7.2 Objective 1: To review the existing state of the field and to determine the gaps in digital strategies in education.

This objective was explored in great depth in both the literature review and in the interviews. As expected, the state of the field changes through time, but the speed at which this occurs is driven by its context.

When the study began, the researcher explored relevant literature to determine the presence of digital literacy in Education. In a globalised context, there was no agreed definion for the term, and for those that did exist, there were commonalities between the derived concepts but there were also "significantly different *kinds* of concepts on offer*"* (Lankshear & Knobel, 2008). The researcher began with a broader scope of attempting to define DL in a generalised context, to then filtering their search to DL in an educational context and then in a primary educational context. There was little information available about DL skills in a pedagogical context, in training DL frameworks designed for primary school (PS) practitioners and in the implementation of DL skills in relation to the Computing curriculum in England.

Without criteria set from a definition, the findings showed that prior to COVID, there was a lack of expectation in training in DL skills because the Computing curriculum wasn't being properly exercised as there was little understanding of, or instructions regarding what DL entailed. Heavy workloads, time restrictions, school support and funding meant that initially, the teachers expressed their unwillingness to attend training courses that "showed no clear impact" (Teacher 19,) they were unsure whether DL skills were a requirement, what they entailed and whether training in this skillset would be worthwhile if it wasn't going to be implemented into their teaching. There had been no encouragement from the government that teachers themselves developed these skills to be able to pass them on, instead ignoring the data that most schools were seeking support externally for teaching the Coding curriculum.

The literature findings showed that the Computing curriculum had been introduced in 2013 and consisted of six standards for KS1 and seven for KS2. PSTs expressed concerns about the implementation of standards, as they appeared to be outside of their skillsets. PSTs teach a variety of subjects at a lower level, rather than in higher key stages who require specialists to cover subject areas to meet higher ability requirements. The standards in the Computing

curriculum are specific, in that they require a specialist knowledge to be able to implement them, yet also vague, in that they give no instructions for implementation.

"Design, write and debug programs that accomplish specific goals, including controlling or simulating physical systems, solve problems by decomposing them into smaller parts."

The specialist knowledge that is required in this KS2 standard, is possessed by very few PST in England, both before and after the impact of COVID-19. A lacking in knowledge, results in a lack of implementation into the classroom.

In only having thirteen standards for KS1 and 2, the Computing curriculum does not go into the specifics as those of the core-subjects: English, Maths and Science. With more standards to be met and limitations of time, the findings indicate that pre-pandemic, Computing was not seen as a priority as there are so few standards to address. However, the outbreak of COVID-19 in 2020, and the transition from face-to-face to virtual teaching brought to light that training in DL skills should have been a higher priority before "it was too late" (Teacher 11). Without the necessary skillset, teachers and students were unprepared for the extreme shift in teaching strategy. To compete with their standard of teaching in the classroom, schools were allocated large amounts of funding to invest in training in DL skills and access to digital devices and appropriate software. Training in and practice with DL skills meant that most teachers and students made an improvement in their DL skills due to a higher frequency of use, and with more specified purposes.

Once schools were reopened, and teaching was once again delivered physically, DL skills were not practiced as much, or to the same extent, as they had been during online learning. When children were assessed, some were not meeting the expected standards for their year group, and left teachers feeling guilty that their online delivery had not met the same standard of practice pre virtual teaching and this was having an impact of children's abilities. As once again schools will have to invest more time in teaching core-subjects to meet those requirements, there are concerns that DL will take a backseat and the skillsets that teachers and students have developed will go to waste as they will be forgotten due to lack of practice.

7.3 Objective 2: To define, identify and analyse the purpose of digital literacy in an educational context.

The reviewing of literature helped to reveal theories concerning DL skillsets, although not focused on a primary educational context. The researcher viewed various models which identified concepts of DL and filtered them down to five models which they felt would be the would be most applicable to this context. These were:

- JISC: *Seven Elements Model of Digital Literacies* (2014).
- JISC: *Digital Capability Framework* (2015).
- Belshaw: *The Essential Elements of Digital Literacy* (2012).
- Mishra and Koehler: *Technological Pedagogical Content Knowledge framework* (*TPACK*) (2006).
- Hague and Payton: *The components of digital literacy* (2010).

The researcher drew upon and grouped patterns/relationships which arose within the concepts in these models.

This framework	JISC (2014)	JISC (2017)	Belshaw (2012)	Mishra and Koehler (2006)	Hague and Payton (2010)
FUNCTIONAL SKILLS	ICT literacy; Media literacy	ICT proficiency; Digital learning and development; Learning skills	Cognitive; Confident	Technological pedagogical content knowledge (TPK)	Functional skills
E-SAFETY	Digital identity and wellbeing	Digital identity and wellbeing	Communicative; Cultural	Technological pedagogical content knowledge (TPK)	E-safety
FINDING AND RETRIEVING RELEVANT INFORMATION	Information literacy; Digital scholarship	Information data and media literacy	Critical	Content knowledge (CK)	Finding and retrieving information; Critical thinking
COMMUNICATION AND COLLABORATION	Communication and collaboration	Digital communication, collaboration, and participation	Communicative	Technological Content knowledge (TCK)	Communication; collaboration
CULTURAL SOCIAL, AND ETHICAL UNDERSTANDING	Digital creation	Digital identity and wellbeing	Cultural Civic	Content knowledge (CK)	Cultural and social understanding
CREATIVITY	Media literacy; ICT literacy	Digital creation, problem solving and innovation	Cognitive Constructive Creative Confident	Technological, Pedagogical, and Content Knowledge	Creativity

				(TPACK)	

Table 2.5 *The relatable components of the researcher's digital literacy skills for primary educational contexts framework and JISC (2014); JISC (2017); Belshaw (2012); Mishra & Koehler (2006) and Hague & Payton (2010).*

From this, the researcher defined digital literacy in an educational setting as:

Digital literacy in education involves using technology creatively and developing functional skills, through exploration and practice. It is the understanding of e-safety by critically questioning the use of technology and information and the risks involved. This involves critically conducting searches to find and select relevant information using digital tools. It involves the ability to communicate and collaborate effectively online and with this have knowledge and understanding of cultural, social, and ethical behaviours.

And theorised that for practising teachers to be deemed digitally literate, they need to be skilled in the six components of digital literacy: functional skills, e-safety, finding and selecting relevant information, communication and collaboration, cultural, social and ethical understanding and creativity. The researcher then combined the findings from the literature and three-rounds of interviews to identify the criteria within these components:

Component	Criteria
Introduction and functional skills	• To understand the meaning of digital literacy in an educational context. • To understand how to build confidence and develop an understanding of exploration and adaptation to using software to find different tools and techniques. • To explore and develop technological functional skills.
E-safety	• To look at statutory guidance and legislative framework on online safety. • To understand the risks children may encounter online, including harmful content online and cyberbullying • To look at useful resources and lesson ideas and YAPPY • To be able to access advice and support for children and parents in using the internet safely. • To consider how online behaviour affects professional reputations
Finding and selecting relevant information	• To consider using the web as a research tool • To understand issues of evaluation and copyright • To understand how to identify reliable sources. • To gain an understanding of research methods such as key word searching, Boolean retrieval, truncation and wildcard.

	• To view different approaches to teaching information literacy.
Communication and collaboration	• To explore online communication platforms. • To consider effective formats to communicate and collaborate online. • To develop an understanding of communication methods for sharing files, using videos and conversations, internally and externally • To consider how to use digital communities to exchange ideas, share and exchange resources and collaboratively to develop digital resources. • To view different approaches to teaching about online communication and collaboration. • To consider how to use learning activities that encourage learners to collaborate and communicate using digital technologies.
Cultural, social, and ethical understanding	• To look at the legal and illegal implications of technology and content use. • To understand that digital culture is the internet, and it provides a medium between other cultures and social interaction • To understand digital rights and responsibilities • To encourage appropriate online behaviour with the appreciation of cultural limitations and boundaries.
Creativity	• To experience methods to use a range of digital resources and technologies to create a relevant, rich, and effective digital learning environment.

Table 7.1 *Table to show the components of the digital literacy framework and the criteria of skills.*

7.4 Objective 3: To identify what teachers want to know about and what they think their digital literacy training needs are.

To identify the wants and needs of PST, regarding DL, the researcher firstly approached the practising teachers and asked for their perceptions of, experience with, and hopes for DL in their practice.

The researcher focused on the most prominent themes in the data when identifying the needs of PSTs. Key themes that arose from the three-rounds of interviews were: their sometimes-

limited experiences with DL in an educational setting, their perceptions/understandings of DL skillsets, their implementation of DL in the classroom, and their confidence in DL skills.

In terms of experience, the initial interviews showed that many teachers did not have much experience with implementation technology into their teaching practice. They believed that themselves and children main experiences with technology were at home and without professional instruction, bad habits would be developed. Teachers believed that more exposure to technology in a school setting during lockdown and with more exposure to using technology in educational context and more formally, students may be guided to use technology more efficiently, effectively and to its full potential. Teachers need to receive professional training in the skillsets children need to be taught, and in what way, so that their habits will come from a formal source so that their skillset will be more applicable to a formal setting.

The initial understanding of DL skills from teachers in this study related mainly to technology. They showed some understanding that DL consists of a multitude of components, referencing functional skills, e-safety, digital communication, and information literacy (IL), but did not mention an understanding of cultural, social, and ethical respect online or how to use technology creatively in their teaching practice. When asked how they felt about their DL practice, some stated that they "wanted to know more." This implies that teachers need to be made aware of all components of DL, gain an understanding of their concepts and then be able to implement their skills into their teaching and to be able to impart valid and verified information regarding DL to their students. To do impart verified knowledge, teachers need to understand verifiable concepts of DL skills in a primary educational setting through CPD as DL skills need constantly updating as technology evolves.

Although unprepared to teach solely using technology, teachers received extensive training in DL skills, their relationship to a primary educational context and their applicability for implementation in the classroom. Teachers expressed a need for these skills to be practiced now that they were back to teaching in a physical classroom and for CPD in DL skills be put in place to refresh their understanding and keep them up to date with these verified skills.

The teachers also noted that they felt that with more specified training, greater accessibility to technological resources and more time to explore, the likelihood of technology being implemented into their teaching practice would improve.

This was combined with the information gathered from the intervention feedback, to determine that teachers should initially be given a course giving an overview of DL skills and their individual components. The findings showed from both the practising and student teachers had a very generalised understanding of DL skills and therefore require an introduction to the skillset. Teachers can then move into more specific areas of DL and receive training in these, with the intent to implement it into their practice.

7.5 Objective 4: To identify the current availability of technological tools and digital access for both teachers and primary school children.

The findings showed that when designing the framework, accessibility to and availability of digital resources was limited. Schools had received grants during the 'Digital Strategy for Schools' (DfE, 1997), and many had introduced ICT suites containing desktop computers that were still being used. Prior to COVID-19, many teachers commented on the lack of devices in their schools and their unreliability, making it difficult for teachers to implement digital devices into their practice for fear that something would go wrong, and their limited time would be wasted. Many schools did not have room in their budget to invest in technologies and so schools were limited on availability. Some schools had class supplies of laptops, iPads, desktops, etc., but teachers expressed their reluctance to using them as many were "old and broken" (Teacher 13).

After lockdown was implemented in England, funding was later allocated to provide more digital equipment to schools and their students with the 'Get help with technology' (GHwT) programme. This programme provided laptops and tablets to disadvantaged children and young people access remote education (GOV.UK, 2020a). The EdTech Report (Government Social Research, 2021) reported that 94% of PS Headteachers had increased their technology budget and were spending at least 50% more on e-learning platforms, digital devices,

technology for live remote lessons and digital devices for staff to teach remotely (Government Social Research, 2021). Meaning that primary schools in England now have access to large amounts of new technologies (laptops, tablets, recording software, etc) and software that are now available to use as support tools in teaching practice.

7.6 Objective 5: To develop a curriculum for teachers to identify the skills required for digital literacy training interventions.

The researcher carried out research of relevant literature to gain an understanding of the phrase 'digital literacy.' Although a phrase without an agreed definition, there were patterns within the findings that the researcher grouped to form six components, in relation to DL in a primary educational context:

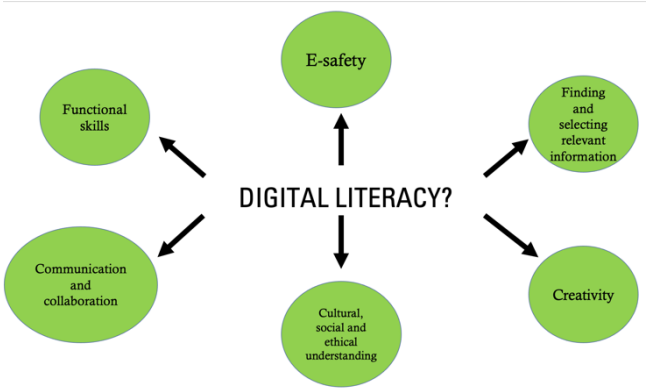


Figure 6.1

The applicable components of DL for a DL framework for primary school teachers.

Using these six identified components: 1. Functional skills, 2. E-safety, 3. Finding and selecting relevant information, 4. Communication and collaboration, 5. Cultural, social, and ethical understanding and 6. Creativity. The researcher used the findings from the literature and interviews to determine a set of criteria for each component (seen in Table 7.2) and then planned activities to be included in each session, to embed knowledge and understanding for the participants to meet these objectives:

Session	Title	Objectives	Activities

7.	**Introduction and functional skills**	• To understand the meaning of digital literacy in an educational context. • To understand how to build confidence and develop an understanding of exploration and adaptation to using software to find different tools and techniques. • To explore and develop technological functional skills.	• To indicate initial perceptions of the term digital literacy and create a word cloud to see patterns in thoughts. • To discuss some of the challenges teachers have faced during lockdown and what solutions have been found. • To test your own typing skills. • Searching for and using other relevant and available training resources.
8.	**E-safety**	• To look at statutory guidance and legislative framework on online safety. • To understand the risks children may encounter online, including harmful content online and cyberbullying • To look at useful resources and lesson ideas and YAPPY • To be able to access advice and support for children and parents in using the internet safely. • To consider how online behaviour affects professional reputations	• To discuss your own experiences with social media • To discuss social media and about at how it benefits us socially, professionally, and academically • To discuss online safety for students and identify the risks of students using social media • To look at how to build a positive online reputation
9.	**Finding and selecting relevant information**	• To consider using the web as a research tool • To understand issues of evaluation and copyright • To understand how to identify reliable sources. • To gain an understanding of research methods such as key word searching, Boolean retrieval, truncation and wildcard. • To view different approaches to teaching information literacy.	• To discuss what should be considered when asking students to find and filter information.
10.	**Communication and collaboration**	• To explore online communication platforms. • To consider effective formats	• To discuss own personal and professional experiences of online communication and collaboration.

		to communicate and collaborate online. • To develop an understanding of communication methods for sharing files, using videos and conversations, internally and externally • To consider how to use digital communities to exchange ideas, share and exchange resources and collaboratively to develop digital resources. • To view different approaches to teaching about online communication and collaboration. • To consider how to use learning activities that encourage learners to collaborate and communicate using digital technologies.	• To share ideas about online communication lessons. • To share ideas about methods to communicate digitally with learners and how they can interact with each other. • .To discuss own experiences with remote learning platforms.
11.	**Cultural, social, and ethical understanding**	• To look at the legal and illegal implecations of technology and content use. • To understand that digital culture is the internet and it provides a medium between other cultures and social interaction • To understand digital rights and responsibilities • To encourage appropriate online behaviour with the appreciation of cultural limitations and boundaries.	• To discuss experiences of virtual reality. • To discuss rules of netiquette and designing a poster to explain this term. • To discuss the ethical, legal and environmental concerns of digital culture
12.	**Creativity**	• To experience methods to use a range of digital resources and technologies to create a relevant, rich and effective digital learning environment.	• To look at and evaluate examples of creative use of technology in the classroom. • To discuss ideas and experiences of lessons that incorporate e-learning or using digital tools for creative presentations.

Table 4.4 *Table to show schedule and objectives of the digital literacy skills for primary educational contexts framework*

An overview of each session was offered:

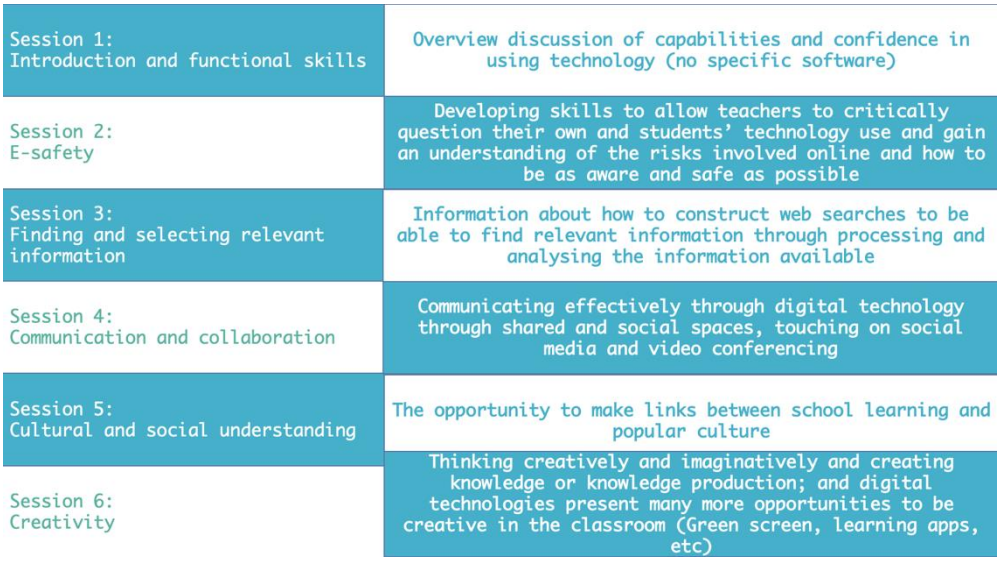


Figure 4.5 *An overview of the individual sessions in the digital literacy skills for primary educational contexts framework.*

The purpose of this framework is to develop teachers' knowledge and understanding of DL skills, to feel confident enough to implement these skills into their teaching practice and to then guide their students into developing their own DL skills. It was originally designed for this purpose, but as a CPD training course for practising teachers. The initial lockdown and closing of schools, in England, in response to COVID-19 meant that teachers did not have time away from their heavy workloads to participate in the course. It was then slightly amended and presented to a group of Primary Education (BA) students as an introductory course to DL skills.

It was then delivered in six, one-hour sessions to Primary Education (BA) students at Northumbria University, Newcastle. It was then evaluated by thirty-five of the participants and four practising teachers, using online feedback forms. The framework was deemed a success overall, although there were mentions of amendments to some of the activities, such as break out groups and their timings, due to cohort preferences. The most prominent finding was that although mentioned throughout that this was an introductory course, the students made suggestions that they would have enjoyed it if certain areas of the session went into more depth. It has been suggested that this framework may be adapted to suit different ability groups and that certain areas of the sessions may be expanded into their own sessions.

7.7 Conclusions from the Interviews

The findings from the interviews suggested that prior to lockdown, PSTs were often constrained by availability and accessibility of resources, time restraints, lack of training and the constraints of existing responsibilities. Post-lockdown, a greater availability to devices and resources and greater experience of and training of using technology in teaching, created a higher DL skillset and an improvement in teachers' confidence in implementing DL into their teaching strategies. Teachers still expressed a need to receive professional training in the skillsets children need to be taught, and in what way, so that their habits will come from a formal source so that their skillset will be more applicable to a more formal setting. They expressed some anxiety towards returning to schools after rigorous training in DL skills and daily implementation of DL skills in their practice, that technology would once again take a back seat to core-subjects and their improved skillset would greatly deteriorate.
The data from the initial interviews that participants had an understanding that DL consisted of multiple concepts and wished to receive further training in these.

7.8 Conclusions from the Interventions

The feedback showed that student and practising teachers were positive about the structure of the framework and individual sessions, stating that it had provided them with new information and ideas, giving a greater understanding of the topic that they would be able to implement into their own practice. There were some mentions of the framework being improved by avoiding technical issues, having tighter time frames and having activities and presentation slides that were more interactive and catered towards preferred learning styles.

The feedback showed that both student and practising teachers were satisfied with the objectives, instructions and presentation of the information, and the preparation of resources and materials. The sessions followed a four-part process (information > activity > discussion > recap) of presenting information and theory on a topic, instigated a discussion based on an activity and then recapped their own interpretation of the information. The presence of the instructor (researcher) was well received, with respectful and positive comments about their

style of delivery, clear instructions, suitable activities, promotion of discussion and applicable methods for implementation.

7.9 Original contribution to knowledge

This study makes an original contribution to knowledge in three parts:

- In determining a definition for DL in a primary educational context through exploration of theory and practice, to form a basis for components that will form the structure of a training framework.
- In identifying the DL training needs of teachers through discussions in interviews, learning of their experience, practice and wants for DL in education. These identified wants and needs of the representative PST will be used to determine the objectives for a foundation framework.
- In designing, developing, and evaluating a CPD framework to determine if it has met the purpose of the research and suggested ways forward

From the literature, there began the first challenge of this study. Research prior to this had determined that there was "no agreed" (UNESCO, 2018a), definition for the collective term of 'digital literacy.' Scholars had theorised about the umbrella term and had attempted to determine the exacting qualities and concepts that belong to it, aiming to identify the components one would possess to be considered a digitally literate person.

The research explored the presenting of models to determine patterns within the suggested components and attempted to find a model suited to the research context. The investigation into the term, suggested that no models had been designed to suit a primary educational context, and therefore the researcher would have to draw upon models that showed some applicability. They would then go on to determine the required skills to become a DL PST. Once the required skills are identified, training objectives can be set.

The first step had been to find relevant research to set a foundation of the components of DL in a generalised context, that could be built upon, or adapted to suit this research context. The

researcher identified five models that would be suitable foundations for this study and identified six components that would be the basis of this curriculum.

The researcher would use a constructivist approach to approach persons with experience and 'expertise' within the context (practising PST), to give voice to their perceptions and experiences with DL. The researcher would use the findings from the interviews to identify the perceived DL training needs of PST to influence the objectives of the framework. The objective was to suit a diversity of skills, experience, attitudes and school contexts and therefore would be for a basic, or foundational framework, which could then be adapted for more specified content, learning styles, abilities and timings.

This research will have great significance within the sphere of education, in England. There are currently no DL training curriculums available to PST to support them with the implementation of technology into the classroom. The national curriculum (NC) in England does not give a supportive outline in teaching students DL skills. There are currently only thirteen standards in the Primary NC: six for Key Stage (KS)1, and seven for KS2. And are often not prioritised as there is confusion about their meaning, as PST aren't always familiar with ICT and are not computer-specialised practitioners. Therefore, as the digital world evolves, teachers require training in DL skills to teach their students these skills.

This framework will not only be used to develop PSTs' DL skills but will also give suggestions as to how teachers can implement the skills in their delivery, giving examples of its pedagogical attributes.

7.8 Limitation and future works

The main challenge within this study was the lack of literature that was directly related to the research topic. This meant that the researcher had no direct comparisons to make and use as a foundation to build upon. Although this ensured originality, the literature review meant that the researcher had limited theoretical foundations to influence the research questions. However, with limited research on this research topic, the researcher was able to identify gaps in literature, presenting a need for further development in this area.

COVID-19 had a significant impact on the study. Although the researcher was able to carry out more rounds of interviews to determine changes in the field, it also meant that they were unable to carry out further rounds of interventions for their action research. The study had originally planned to carry out three rounds of interventions, onsite with nine primary schools (three per round) located in North-East England. As with the sampling of participants, the researcher had approached schools from catchment areas of different social classes, different sizes and a staff with different levels of experience. However, COVID-19 occurred early in the research process, closing schools, and causing uncertainties with how to proceed with teaching, and meant the schools who had volunteered to participate had more pressing concerns. The researcher would no longer be able to receive feedback from experienced teachers in the field, and so approached the training from another angle, student teachers with even lesser experience in placements than other cohorts due to the impact of COVID-19 and the closure of schools. The researcher was not able to choose participants with different sets of criteria; they were given a cohort of students chosen by the Primary Education (BA) Lead at Northumbria University. However, the researcher did approach four practising teachers to evaluate the sessions as representatives of their profession. In future research, the researcher would conduct more rounds of action research with multiple groups of participants for a more comparative study.

Time constraints also proved to be a limitation for this study. Teaching participants were only available at certain times, usually outside of working hours and so meant that a limited number of participants could be approached per day. The interviews took place over three weeks in the first round, two weeks in the second round and again three in round three. The researcher was only able to carry out one round of interventions as it took longer than anticipated to allocate a group of participants. It would have been interesting to measure the change in skillsets if the interventions had been conducted in the same way as the interview: prior to, during and post the closure of schools in England. As there were no longevity due to time constraints, fewer comparisons could be made. To determine more comparative data, further studies, with different cohorts and rounds. It would be beneficial to the field to carry out further research with practising teachers, Higher Educational students from a variety of institutions and modules, abilities, specific year group focuses and as refresher courses over longitudinal time frames to measure the progress of development after the course has commenced.

7.10 Chapter summary

Primary school teachers are vital members of our society and are responsible for educating, guiding, and supporting their students and colleagues, and also their wider associates. Teachers are responsible for giving their students critical life skills, making them ready for the future and having huge impacts on society. With an increase in the uses of digital technologies for research, communication, cultural experiences, hobbies and as a learning tool, it is important that we are collectively aware of the benefits and risks of this evolutionary change, the educating of which often is dependent on teachers.

After the closure of schools in England in March 2020 the whole of education looked to technology as a medium to teaching students remotely, the problem was that with very little training or experience in digital literacy skills and the use of technology as support tool for teaching, most teachers and their students were unprepared for this dramatic change in education. It became evident that digital literacy skills had previously been cast aside from other prioritised tasks and were now essential skills and teachers needed extensive training in these skills to teach efficiently and effectively using technology.

As digital literacy has no agreed upon definition, (UNESCO, 2018a), the skillset which teachers require is often unknown. Instead of receiving training is foundational digital literacy skills, schools are more often delivering training in specific software, which will not prepare teachers enough for when that software is no longer in use. Instead, this study proposes that teachers are trained in a foundation of digital literacy skills, specified to a primary educational context. Teachers will learn the required skills to ensure transferability as technology changes and digitalised societies advance.

References.

Government Social Research. (2021). Educational Technology (EdTech) Survery 2020-21, Research Report. *CooperGibson Research.* Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1057817/Education_Technology_EdTech_Survey.pdf. (Date accessed: 12.6.2020)

GOV.UK (2020a). "Get help with technology for remote education." *Department for Education.* (Available at: https://www.gov.uk/guidance/get-help-with-technology-for-remote-education). (Date accessed: 12.6.2020).

UNESCO. (2018). A global framework of reference on digital literacy skills for indicators 4.4.2. Information Paper No. 51. Montreal, Canada: UNESCO Institute for Statistics. Available at: http://uis.unesco.org/sites/default

Bibliography

Abutabenjeh, S. and Jaradat, R. (2018). Clarification of research design, research methods, and research methodology: A guide for public administration researchers and practitioners. *Teaching Public Administration*, *36*(3), pp.237-258.

Abdullah, M., & Osman, K. (2010). 21st century inventive thinking skills among primary students in Malaysia and Brunei. Procedia - Social and Behavioral Sciences, 9, 1646- 1651. doi:10.1016/j.sbspro.2010.12.380

Addeo, F., Paoli, A. D., Esposito, M., & Bolcato, M. Y. (2019). Doing social research on online communities: The benefits of netnography. *Athens journal of social sciences*, *7*(1), 9-38.

Adler, P.A. and Adler, P. (1987). *Membership roles in field research* (Vol. 6). Sage.

Afshari, M., Bakar, K.A., Luan, W.S., Samah, B.A. and Fooi, F.S. (2009). Factors affecting teachers' use of information and communication technology. *International journal of instruction*, *2*(1).

Alexander, B., Adams Becker, S., Cummins, M. and Hall Giesinger, C. (2017), Digital Literacy in Higher Education, Part II: An NMC Horizon Project Strategic Brief, No. 3.4, The New Media Consortium, Austin, TX. Available at: https://library.educause.edu/resources/2017/8/digital-literacy-in-highereducation-part-ii-an-nmc-horizon-project-strategic-brief. (Date accessed: 3.5.2019).

Aliyyah, R. R., Rachmadtullah, R., Samsudin, A., Syaodih, E., Nurtanto, M., & Tambunan, A. R. S. (2020). The perceptions of primary school teachers of online learning during the COVID-19 pandemic period: A case study in Indonesia. *Journal of Ethnic and Cultural Studies*, *7*(2), 90-109.

Allen-Kinross, P. (2019). 1 in 4 teachers work 60 hours per week- but that's not why they're leaving. *Schools Week.* Available at: https://schoolsweek.co.uk/1-in-4-teachers-work-over-60-hours-a-week-but-thats-not-why-theyre-leaving/ . (Date accessed: 22.3.2022)

Allmann, K. and Blank, G. (2021). Rethinking digital skills in the era of compulsory computing: methods, measurement, policy and theory. *Information, Communication & Society*, *24*(5), pp.633-648.

Astleitner, H. (2002). Teaching critical thinking online. *Journal of instructional psychology*, *29*(2), pp.53-76.

Atkins, L. (2018). *Exploring teachers' professional development and digital literacy: a grounded theory study.* Available at: https://dora.dmu.ac.uk/bitstream/handle/2086/17158/Lucy%20Atkins%20Thesis.pdf?sequence=1 . (Date accessed: 12.5.2020)

Attewell, P. (2001). Comment: The first and second digital divides. *Sociology of education*, *74*(3), 252-259.

Avery, R. & Assiter, A. (2018) Engaging families in online safety: guidance for education settings. *The Education People.*

Azari, R. and Pick, J.B. (2005). Technology and society: socioeconomic influences on technological sectors for United States counties. *International Journal of Information Management*, *25*(1), pp.21-37.

Ball, S. J., & Bowe, R. (1992). Subject departments and the 'implementation' of National Curriculum policy: An overview of the issues. Journal of Curriculum Studies, 24(2), 97–115.

Ball, S.J. (2013) The Education Debate. 2nd Edition. Bristol: The Policy Press.

Barber, W. and King, S. (2016). Teacher-Student Perspectives of Invisible Pedagogy: New Directions in Online Problem-Based Learning Environments. *Electronic Journal of e-Learning*, *14*(4), pp.pp235-243.

Barton, R., Haydon, T. (2006). Trainee teachers' views on what helps them to use information and communication technology effectively in their subject teaching. Journal of computer assisted leaning, 22, pp, 257-272.

Bawden, D. (2001). Information and digital literacies: a review of concepts. *Journal of documentation*.

Bawden, D. (2008) 'Origins and Concepts of Digital Literacy' in C. Lankshear, & M. Knobel, Digital Literacies: Concepts, Policies and Practices New York: Peter Lang Publishing

Bazeley, P. (2007). Qualitative data analysis with NVivo. London, UK: SAGE.

Beetham, H. (2017). Digital capabilities framework: an update. *Jisc Building Capability Blog.* Available at: https://digitalcapability.jiscinvolve.org/wp/2017/03/09/digital-capabilities-framework-an-update/. (Date accessed: 2.5.2020)

Belshaw, D. (2012) What is 'digital literacy?' A Pragmatic investigation., Durham theses, Durham University. Available at: http://etheses.dur.ac.uk/3446/ (Date accessed: 11.3.2019)

Bennett, S., Maton, K., & Kervin, L. (2008). The 'digital natives' debate: A critical review of the evidence. *British*

journal of educational technology, *39*(5), 775-786.

Bennett, C. (1996), "Schools, Technology and Educational Leadership: A Framework for Change", NASSP Bulletin, Vol. 80 No. 577, pp. 57-65

Bennett, S., & Maton, K. (2010). Beyond the 'digital natives' debate: Towards a more nuanced understanding of students' technology experiences. *Journal of Computer Assisted Learning*, 26(5), 321-331.

Bickman, L., 1981. Some distinctions between basic and applied approaches. *Applied social psychology annual*.

Bickman, L., & Rog, D. (2009). Applied research design: A practical approach. In L. Bickman & D. Rog (Eds.), Handbook of applied social research methods (2nd ed., pp. 3–43). Thousand Oaks, CA: Sage.

Biesta, G. J. J. (2012). Giving teaching back to education: Responding to the disappearance of the teacher. Phenomenology & Practice, 6(2), 35–49.

Biggins, D., Holley, D., Evangelinos, G. and Zezulkova, M. (2017). Digital competence and capability frameworks in the context of learning, self-development and HE pedagogy. In *E-learning, e-education, and online training* (pp. 46-53). Springer, Cham.

Bigus, O. E., Hadden, S. C. and Glaser, B. G. (1994). "The study of basic social processes". In *More grounded theory methodology: A reader*, Edited by: Glaser, B. G. 38–64. Mill Valley, CA: Sociology Press.

Bingimlas, K.A. (2009). Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. *Eurasia Journal of Mathematics, science and technology education*, *5*(3), pp.235-245

Blumer, Herbert. (1969). *Symbolic interactionism: Perspective and method*. Berkeley: University of California Press.

Boekaerts, M., P. Pintrich, and M. Zeidner. (2000). Self-regulation: An introductory review. In Handbook of self-regulation, ed. M. Boekarts, P.R. Pintrich, and M. Zeidner, 1–9. San Diego, CA: Academic Press.

Bogdan, Robert C. and Biklen, Sari Knopp (1982) Qualitative Research for Education: An Introduction to Theory and Methods, Boston and London: Allyn & Bacon Inc.

Bohm, David (1983) Wholeness and the Implicate Order, London and New York: Ark. Brooks, C. and Warren, W.P. (1967) Understanding Poetry, New York: Holt, RineHart and Wilson, third edition

Bolander Laksov, K. (2018). 'Lessons learned: towards a framework for integration of theory and practice in academic development.' *International Journal for Academic Development.* London: Routledge.

Bonello, M. and Meehan, B. (2019). Transparency and coherence in a doctoral study case analysis: reflecting on the use of NVivo within a'Framework'approach. *The qualitative*

Bowen, J. A. (2012). Technology for engagement. In Teaching naked: How moving technology out of your college classroom will improve student learning (pp 129-152). San Francisco: Jossey Bass

Bransford, John D., Brown Ann L., and Cocking Rodney R. (2000). *How people learn: Brain, mind, experience, and school*. Washington, D.C.: National Academy Press

Bringer, J., Johnston, L., & Brackenridge, C. (2004). Maximizing transparency in a doctoral R thesis: The complexities of writing about the use of QSR*NVIVO within a grounded theory study. *Qualitative Research*, 4(2), p, 247–265.

Brito, R.M., Rodríguez, C. and Aparicio, J.L. (2018). Sustainability in teaching: An evaluation of university teachers and students. *Sustainability*, *10*(2), p.439.

Brown, G. and Harris, L.R., (2018). Methods in feedback research. *Cambridge Handbook of Instructional Feedback*.

Brown, N.C., Sentance, S., Crick, T. and Humphreys, S., (2014). Restart: The resurgence of computer science in UK schools. *ACM Transactions on Computing Education (TOCE)*, *14*(2), pp.1-22

Brown, R.H., Barram, D.J. and Irving, L. (1995). Falling Through the Net: A Survey of the" Have-Nots. *Rural and Urban America*.

Brush, T., Glazewski, K.D. and Hew, K.F. (2008. Development of an instrument to measure preservice teachers' technology skills, technology beliefs, and technology barriers. *Computers in the Schools*, *25*(1-2), pp.112-125.

Bubb, S., & Jones, M. A. (2020). Learning from the COVID-19 home-schooling experience: Listening to pupils, parents/carers and teachers. *Improving schools*, *23*(3), 209-222.

Buckingham, D. (2015). Defining digital literacy-What do young people need to know about digital media?. *Nordic journal of digital literacy*, *10*(Jubileumsnummer), pp.21-35.

Buelens, H., Totté, N., Deketelaere, A., & Dierickx, K. (2007). Electronic discussion forums in medical ethics education: the impact of didactic guidelines and netiquette. *Medical Education*, *41*(7), 711-717.

711–717.

Bugeja, M. (2007). Making whole: The ethics of correction. *Journal of Mass Media Ethics*, *22*(1), 49-65.

Burns, T., & Gottschalk, F. (2020). Education in the Digital Age: Healthy and Happy Children. Educational Research and Innovation. *OECD Publishing*.

Byrne, J., Kardefelt-Winther, D., Livingstone, S., Stoilova, M. (2016). Global Kids Online Research Synthesis, 2015−2016. *UNICEF Office of Research Innocenti and London School of Economics and Political Science.*

Cabrera, G.A. (2018). The use of computer applications in qualitative research: A review. *Asia Pacific Journal of Academic Research in Social Sciences*, *3*, pp.35-42.

The Cabinet Office. (2012) *Government Digital Strategy.* Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/296336/Government_Digital_Stratetegy_-_November_2012.pdf. (Date accessed: 11.2.22)

Cabrera, G.A. (2018). The use of computer applications in qualitative research: A review. *Asia Pacific Journal of Academic Research in Social Sciences*, *3*, pp.35-42.

Calvani, A., Cartelli, A., Fini, A. and Ranieri, M. (2008). Models and instruments for assessing digital competence at school. *Journal of E-learning and Knowledge Society*, *4*(3), pp.183-193.

Carmichael, E. and Farrell, H. (2012). Evaluation of the Effectiveness of Online Resources in Developing Student Critical Thinking: Review of Literature and Case Study of a Critical Thinking Online Site. *Journal of University Teaching and Learning Practice*, *9*(1), p.4.

Candela, A.G. (2019). Exploring the function of member checking. *The Qualitative Report*, *24*(3), pp.619

Carter, S. and Henderson, L. (2005). Approaches to qualitative data collection in social science. *Handbook of health research methods: Investigation, measurement and analysis*, *1*, pp.215-230.

Casselden, B. (2016). *A delicate balancing act: An investigation of volunteer use and stakeholder perspectives in public libraries*. University of Northumbria at Newcastle (United Kingdom).

Chalkiadaki, A., (2018.) A systematic literature review of 21st century skills and competencies in primary education. *International Journal of Instruction*, *11*(3), pp.1-16.

Chandra, Y. and Shang, L. (2019). Computer-Assisted Qualitative Research: An Overview. *Qualitative Research Using R: A Systematic Approach*, pp.21-31.

Charmaz, K. (1995). Grounded theory. In Rethinking methods in psychology. J. A. Smith, R. Harre and L. V. Langenhove. (eds.) London, Sage: 29-49.

Charmaz, K. (1995). Grounded theory. In Rethinking methods in psychology. J. A. Smith, R. Harre and L. V. Langenhove. (eds.) London, Sage: 29-49.

Charmaz, K. and Belgrave, L.L. (2007). Grounded theory. *The Blackwell encyclopedia of sociology*.

Charmaz, K. (2014) Constructing Grounded Theory. Second edition. London: Sage.

Charmaz, K. (2020). "With constructivist grounded theory you can't hide": Social justice research and critical inquiry in the public sphere. *Qualitative Inquiry*, *26*(2), pp.165-176.

Chaudron, S., Beutel, M., Cernikova, M., Navarette, V. D., Dreier, M., & Fletcher-Watson, B. (2015). Young children (0-8) and digital technology. *A qualitative exploratory study across seven countries. Joint Research Centre. European Commission*.

Chick, N. (2013). Metacognition. *Vanderbilt University Center for Teaching.* Available at: https://cft.vanderbilt.edu/guides-subpages/metacognition/#:~:text=Metacognition%20is%2C%20put%20simply%2C%20thinking,as%20a%20thinker%20and%20learner. (Date accessed: 22.9.2020)

Chinn, C.A., Barzilai, S. and Duncan, R.G. (2021). Education for a "post-truth" world: New directions for research and practice. *Educational Researcher*, *50*(1), pp.51-60.

Choo, C.W. (1996). The knowing organization: How organizations use information to construct meaning, create knowledge and make decisions. *International journal of information management*, *16*(5), pp.329-340.

CILIP. (2004). Found in: Armstrong, C., Boden, D., Town, S., Woolley, M., Webber, S. and Abell, A. CILIP defines Information Literacy for the UK. Available at: http://eprints.rclis.org/7459/1/Article_Update_25102004.pdf. (Date accessed: 11.1.2022).

Clough, P., Nutbrown, C. (2012). *A Student's Guide to Methodology.* Sage Publications.

Cochran-Smith, M., & Lytle, S. (1999). Relationships of knowledge and practice: Teacher learning in communities. *Review of Research in Education*, 24, 249-305.

Cohen, L., Manion, L. and Morrison, K. (2011). *Research Methods in Education* (7thedition). London: Routledge.

Cook, T. *Foreword.* Found in: Hedrick, T.E., Bickman, L. and Rog, D.J. (1993). *Applied research design: A practical guide*. Sage Publications.

Corbin, J. and Strauss, A. (2008) Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory. Los Angeles: Sage Publications, Inc.

Corbin J, Strauss A (2015) Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory. Fourth edition. Sage, Thousand Oaks, Ca.

Cordell, R.M., 2013. Information literacy and digital literacy: Competing or complementary?. *Communications in Information Literacy*, *7*(2), p.14.

Cordes, S., 2009. Broad horizons: The role of multimodal literacy in 21st century library instruction. In *World library and information congress: 75th IFLA general conference and council*.

Couse, Leslie J., and Dora W. Chen. (2010). "A Tablet Computer for Young Children? Exploring Its Viability for Early Childhood Education." Journal of Research on Technology in Education 43 (1):75-98.

Craft, A. (2010). *Creativity and Education Futures: Learning in a Digital Age*. Trentham Books Ltd: Stoke on Trent.

Crenshaw, E.M. and Robison, K.K. (2006). Globalization and the digital divide: The roles of structural conduciveness and global connection in Internet diffusion. *Social Science Quarterly*, *87*(1), pp.190-207.

Creswell, J. W. (1998). Qualitative inquiry and research design: Choosing among five traditions. Thousand Oaks, CA: Sage

Creswell, J. W., & Miller, D. L. (2000). Getting good qualitative data to improve educational practice, *Theory Into Practice*, *39*(3), 124-130.

Creswell, J.W. (2003). Research design : qualitative, quantitative, and mixed methods approaches 2nd ed., CA: Sage: Thousand Oaks.

Creswell, J. (2007). *Qualitative inquiry and research design: Choosing among five approaches*. (2nd ed). Sage publications.

Cresswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed method research* (2nd ed.). Thousand Oaks, CA: Sage.

Creswell, J.W. and Poth, C.N., (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

Crick, T., 2017. Computing education: An overview of research in the field. London: Royal Society.

Cronbach, L. J. (1975). Beyond the two disciplines of scientific psychology. *American psychologist*, *30*(2), 116.

Cruz-Jesus, F., Vicente, M.R., Bacao, F. and Oliveira, T. (2016). The education-related digital divide: An analysis for the EU-28. *Computers in Human Behavior*, *56*, pp.72-82.

Cruz, M. & Orange, E. (2016). 21st Century skills in the teaching of foreign languagesat primary and secondary schools. Turkish Online Journal of Educational Technology. Special Issue for IETC, ITEC, IDEC, ITICAM 2016. 1-12.

Cunningham, M., Kerr, K., McEune, R., Smith, P., & Harris, S. (2003). Laptops for Teachers: An evaluation of the first year of the initiative. ICT in School Research and Evaluation Series No 19. Becta/DfES.

Davies, J., & Merchant, G. (2007). Looking from the inside out: Academic blogging as new literacy. *A new literacies sampler*, *29*, 115-136

Dawson, V. R. (2018). Fans, friends, advocates, ambassadors, and haters: Social media communities and the communicative constitution of organizational identity. *Social Media+ Society*, *4*(1), 2056305117746356.

Deady, K. (2017). Preparing students for a digital future: How teachers can bring digital literacy into the classroom. *Teachaway.* Available at: https://www.teachaway.com/blog/preparing-students-digital-future-how-teachers-can-bring-digital-literacy-into. (Date accessed: 4.4.2020)

Department for Education (2010) The importance of teaching. London: HMSO, Cm 7980.

Department for Education (2011) Teacher's Standards. Available from: https://www.gov.uk/Government/publications/teachers-standards [date accessed 14/03/2019]

Department for Education (2013) National curriculum in England: computing programmes of study [online] Available at: https://www.gov.uk/government/publications/nationalcurriculum-in-england-computing-programmes-of-study/national-curriculum-in-englandcomputing-programmes-of-study [Accessed 14/03/2019]

Department for Education (2018) Policy paper: Reducing Teacher Workload [online] Available from: https://www.gov.uk/government/publications/reducing-teachers-workload/reducingteachers-workload [Accessed

24/01/2021]

Denzin, N. K. (1989). *Interpretive biography*. Newbury Park, CA: Sage.

Denzin, Norman K., and Yvonna S. Lincoln. (2003). Introduction. The discipline and practice of qualitative research. In *Collecting and interpreting qualitative materials*, ed. Norman K. Denzin and Yvonna S. Lincoln, 1–45. Thousand Oaks: SAGE Publications.

Denzin, N., & Lincoln, Y. (Eds.). (2005). Handbook of qualitative research (3rd ed.). Thousand Oaks, CA: Sage.

Dey, I. (1993). Qualitative data analysis: A user-friendly guide for social scientists. London, Routledge.

Dewey, J. (1929). The quest for certainty.

Diaz, C. (2017). Behind the Digital World: High School Education Evolved. Available at: https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=the+digital+world+is+evolving+in+education&btnG=#d=gs_cit&u=%2Fscholar%3Fq%3Dinfo%3AL0JsKAR3JbsJ%3Ascholar.google.com%2F%26output%3Dcite%26scirp%3D1%26hl%3Den). (Date accessed: 1.3.2022)

Dick, R.D. (1991). An empirical taxonomy of critical thinking. *Journal of instructional Psychology*, *18*(2), p.79.

Dille, K.B. and Rokenes, F.M. (2021). Teachers' professional development in formal online communities: A scoping review. *Teaching and Teacher Education*, *105*, p.103431.

Dillenbourg, P., & Jermann, P. (2010). Technology for classroom orchestration. In *New science of learning* pp. 525-552. Springer, New York, NY.

Dodgson, J. E. (2019). Reflexivity in qualitative research. *Journal of Human Lactation*, *35*(2), pp.220-222.

Draucker, C.B., Martsolf, D.S., Ross, R. and Rusk, T.B. (2007). Theoretical sampling and category development in grounded theory. *Qualitative health research*, *17*(8), pp.1137-1148.

Dresang, E. T. (2005). Access: The information-seeking behavior of youth in the digital environment. *Library Trends*, *54*(2), 178-196.

Driscoll, D.L. (2011). Introduction to primary research: Observations, surveys, and interviews. *Writing spaces: Readings on writing*, *2*, pp.153-174.

Dunne, C. (2011). The place of the literature review in grounded theory research. *International journal of social research methodology*, *14*(2), pp.111-124.

Duraku, Z. H., & Hoxha, L. (2020). The impact of COVID-19 on education and on the well-being of teachers, parents, and students: Challenges related to remote (online) learning and opportunities for advancing the quality of education. Available at: *https://www. researchgate. net/publication/341297812*. (Date accessed: 12.3.2022)

Elmore, P. G., & Coleman, J. M. (2019). Middle school students' analysis of political memes to support critical media literacy. Journal of Adolescent & Adult Literacy, 63(1), pp. 29– 40

Emerson, R.M. (1987). Four ways to improve the craft of fieldwork. *Journal of Contemporary Ethnography*, *16*(1), pp.69-89.

Emerson, R.M., Fretz, R.I. and Shaw, L.L. (1995). Writing ethnographic fieldnotes. Chicago guides to writing, editing. *and publishing. Chicago, IL: University of Chicago Press. Feld, S., & Brenneis, D.(2004). Doing anthropology in sound. American Ethnologist*, *31*(4), pp.461-474.

Emerson, R.M., Fretz, R.I. and Shaw, L.L. (2001). Participant observation and fieldnotes. *Handbook of ethnography*, pp.352-368.

Engler, S., 2021. Grounded theory. In *The Routledge handbook of research methods in the study of religion* (pp. 300-313). Routledge.

Engward, H. (2013). Understanding grounded theory. *Nursing Standard (through 2013)*, *28*(7), p.37.

Emre, D.İ.N.C. (2019). Prospective teachers' perceptions of barriers to technology integration in education. *Contemporary Educational Technology*, *10*(4), pp.381-398.

Erlandson, D.A., Harris, E. L., Skipper, B. L. & Allen, S. D. (1993). Doing naturalistic inquiry. A guide to methods. London: Sage.

Ertmer, P. A. (1999). Addressing First- and Second-Order Barriers to Change: Strategies for Technology Integration. Educational Technology Research and Development, 47(4), 47-61.

Ertmer, P.A. and Ottenbreit-Leftwich, A.T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of research on Technology in Education*, *42*(3), pp.255-284.

Eryansyah, E., Erlina, E., Fiftinova, F. and Nurweni, A., (2019). EFL Students' Needs of Digital Literacy to Meet the

Demands of 21stCentury Skills. | IRJE| Indonesian Research Journal in Education|, pp.442-460.

Eryansyah, E., Erlina, E., Fiftinova, F. and Nurweni, A., (2019). EFL Students' Needs of Digital Literacy to Meet the Demands of 21stCentury Skills. | IRJE| Indonesian Research Journal in Education|, pp.442-460.

European Council. (2018). COUNCIL RECOMMENDATION of 22 May 2018 on key competences for lifelong learning (Text with EEA relevance). *Official Journal of the European Union.* (Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604(01)&rid=7). (Date accessed: 29.11.2022)

Evans, L. (2002) What is teacher development? Oxford Review of Education, vol.28(1), pp. 123– 137.

Facer, K. (2009). Facer, K.. Educational, social and technological futures: a report from the Beyond Current Horizons Programme. Beyond Current Horizons Programme.

Farmer, L. (2004). Using technology for storytelling: Tools for children. *New review of children's literature and librarianship*, *10*(2), pp.155-168.

Feeler, W. (2012). *Being there: A grounded-theory study of student perceptions of instructor presence in online classes*. The University of Nebraska-Lincoln.

Feist, D., & Reid, D. (2018). Technology and teaching: Technology and student-centered pedagogy in 21st century classrooms. In *Handbook of research on digital content, mobile learning, and technology integration models in teacher education* (pp. 69-87). IGI Global.

Ferrari, A. (2012). Digital competence in practice: An analysis of frameworks. *Sevilla: JRC IPTS*, *10*, 82116.

Ferro, E., Helbig, N.C. and Gil-Garcia, J.R. (2011). The role of IT literacy in defining digital divide policy needs. *Government Information Quarterly*, *28*(1), pp.3-10.

Fisher, M., & Baird, D. (2009). Pedagogical mashup: Gen Y, social media, and digital learning styles. *Handbook of Research on New Media Literacy at the K-12 Level, IGI Global, Hershey, PA*.

Flavell, J.H. 1976. Metacognitive aspects of problem solving. In The nature of intelligence, ed. L.B. Resnick, 231–5. Hillsdale, NJ: Earlbaum

Fleisher, M. L. (1989). Warehousing violence. London, Sage.

Fleury, J., Sidani, S., Melnyk, B. M., & Morrison-Beedy, D. (2018). Using theory to guide intervention research. *Intervention research: Designing, conducting, analyzing, and funding*, *2*, pp. 55-78.

Flick, U. ed. (2017). *The Sage handbook of qualitative data collection*. Sage.

Fontanella BJB, Ricas J, Turato ER. (2008). Amostragem por saturação em pesquisas qualitativas em saúde: contribuições teóricas. Cad Saúde Pública [online].(Available at: http://www.scielo.br/pdf/csp/v24n1/02.) (date accessed: 11.12.2021).

Fosnot CT. (1996). *Constructivism: Theory, Perspectives, and Practice*. Teachers College Press: New York.

Foulger, T.S., Ewbank, A.D., Kay, A., Popp, S.O. and Carter, H.L. (2009). Moral spaces in MySpace: Preservice teachers' perspectives about ethical issues in social networking. *Journal of Research on Technology in Education*, *42*(1), pp.1-28.

Fraillon, J. (2019). Digital literacy: Myths and realities. *Australian Council for Educational Research, Research Conference 2019.*

Frau-Meigs, D., Velez, I. and Michel, J.F. eds. (2017). *Public policies in media and information literacy in Europe: cross-country comparisons*. Taylor & Francis.

Freerar, J. (2019). Development of a framework for digital literacy. *Reference Services Review*.

Frels, R.K. and Onwuegbuzie, A.J. (2012). Interviewing the Interpretive Researcher: An Impressionist Tale. *Qualitative Report*, *17*, p.60.

Friese, S., (2019). *Grounded theory analysis and CAQDAS: A happy pairing or remodeling GT to QDA* (pp. 282-313). SAGE Publications: London, UK.

Gallager, R. G. (2008). *Principles of digital communication*(Vol. 1). Cambridge: Cambridge University Press.

Garzon Artacho, E., Martínez, T. S., Ortega Martin, J. L., Marin Marin, J. A., & Gomez Garcia, G. (2020). Teacher training in lifelong learning—The importance of digital competence in the encouragement of teaching innovation. *Sustainability*, *12*(7), p. 285

Gee (1991) Social Linguistics: Ideology in Discourses, Falmer Press: London

Gee, J. P. (2004). *An introduction to discourse analysis: Theory and method*. routledge.

Geertz, C. (1983) *Local knowledge: Further essays in interpretive anthropology.* New York: Basic Books.

Glaser, B. G., Strauss, A.L. (1967). *The discovery of grounded theory: Strategies for qualitative research.* New York: Aldine de Gruyter.

Glaser, B.G. (1978). *Theoretical sensitivity.* California, The Sociology Press.

Glaser, B., Bailyn, L., Fernandez, W., Holton, J.A. and Levina, N. (2013). What Grounded Theory Is. *Academy of Management Proceedings* (Vol. 2013, No.1). NY: Academy of Management.

Glesne, C. & Peshkin, A. (1992). Becoming qualitative researchers: An introduction. White Plains, NY: Longman.

Goodfellow, R. (2011). Literacy, literacies and the digital in higher education. *Teaching in Higher Education*, *16*(1), pp.131-144.

Government Social Research. (2021). Educational Technology (EdTech) Survery 2020-21, Research Report. *CooperGibson Research.* Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1057817/Education_Technology_EdTech_Survey.pdf. (Date accessed: 12.6.2020)

GOV.UK (2020a). "Get help with technology for remote education." *Department for Education.* Available at: https://www.gov.uk/guidance/get-help-with-technology-for-remote-education. (Date accessed: 12.6.2020)

GOV.UK. (2020b) "Training and support for remote and face-to-face education." Available at: https://get-help-with-tech.education.gov.uk/EdTech-demonstrator-programme. (Date accessed: 30.9.2020)

GOV.UK. (2020c). "UK education providers helped teachers, parents and students respond to the impact of COVID-19 worldwide." UK: Foreign & Commonwealth Office. Available at: https://www.gov.uk/government/news/uk-education-providers-are-helping-teachers-parents-and-students-respond-to-the-impact-of-covid-19-worldwide. (Date accessed: 1.6.2020)

Granberg, C. (2011). *ICT and learning in teacher education: The social construction of pedagogical ICT discourse and design* (Doctoral dissertation, Interaktiva medier och lärande (IML), Umeå universitet).

Gravett, S., de Beer, J., Odendaal-Kroon, R. and Merseth, K.K. 2017. The affordances of case-based teaching for the professional learning of student-teachers. *Journal of curriculum studies*, *49*(3), pp.369-390.

Guba, E. G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Communication and Technology Journal*, *29*(2), 75-91.

Guba, E. G., & Lincoln, Y. S. (1989) *Fourth generation evaluation*. Thousand Oaks, CA: Sage.

Guba, E.G., (1990). The paradigm dialog. In *Alternative Paradigms Conference, Mar, 1989, Indiana U, School of Education, San Francisco, CA, US*. Sage Publications, Inc.

Guest, G., Namey, E.E. and Mitchell, M.L. (2013). Qualitative research: Defining and designing. *Collecting qualitative data*, pp.1-40.

Guggemos, J. and Seufert, S., (2021). Teaching with and teaching about technology–Evidence for professional development of in-service teachers. *Computers in Human Behavior*, *115*, p.106613.

Gupta, A. and Ferguson, J. (1997). Discipline and practice:'The field'as site, method, and location in anthropology. *Anthropological locations: Boundaries and grounds of a field science*, *100*, pp.1-47

Ha, T. T. (2010). *Theory and design of digital communication systems*. Cambridge University Press.

Hafner, A. L., Allison, B., Jones, A., & Stewart, I. H. (2012). Assessing the development of apprentice principals in traditional and residency programs. *Procedia-Social and Behavioral Sciences*, *69*, 1134-1141.

Hague, C. and Payton, S. (2010) Digital literacy across the curriculum'. *Futurelab.* Available at: https://www.nfer.ac.uk/media/1770/futl06.pdf *(*Date accessed: 1.3.2019)

Hall, R., Atkins, L. and Fraser, J. (2014). Defining a self-evaluation digital literacy framework for secondary educators: the DigiLit Leicester project.

Hammersley, M. (2012) Methodological Paradigms in Educational Research. British Educational Research Association [online] Available from: https://www.bera.ac.uk/researchers-resources/publications/methodological-paradigms-ineducational-research [Date accessed 14/01/2020]

Haraway, D. (2020). Situated knowledges: The science question in feminism and the privilege of partial perspective. In *Feminist theory reader*. pp. 303-310) Routledge.

Hardy, I. (2012) The Politics of Teacher Professional Development: Policy, Research and Practice. Abingdon: Routledge

Hargittai, E. (2010). Facebook privacy settings: Who cares?. *First Monday*.

Harrison, H., Birks, M., Franklin, R., Mills, J. (2017*). Case Study Research: Foundations and Methodological Orientations*. Available at: http://www.qualitative-research.net/index.php/fqs/article/view/2655/4079#gref.Date accessed: 16.5.2019

Harvey, P.D., Tibiriçá, L., Kallestrup, P. and Czaja, S.J. 2020. A computerized functional skills assessment and training program targeting technology based everyday functional skills. *JoVE (Journal of Visualized Experiments)*, (156), p.e60330.

Hassan, M.M. and Mirza, T. and Hussain M.W, (2021). The Digital Literacy in Teachers of the Schools of Rajouri (j&K)-India: Teachers Perpactive. *International Journal of Education and Management Engineering.* 11(1), pp.28-40

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*(1), 81-112.

Hazen, E. P., Goldstein, M. A., & Goldstein, M. C. (2010). *Mental health disorders in adolescents: A guide for parents, teachers, and professionals*. Rutgers University Press.

Helleve, I., Ulvik, M., & Roness, D. (2019). Expectations to mentoring as support for professional development. *Nordisk tidsskrift for utdanning og praksis*, *13*(2), 56-75.

Helleve, I., Grov Almås, A. and Bjørkelo, B. (2020). Becoming a professional digital competent teacher. *Professional Development in Education*, *46*(2), pp.324-336.

Heinrichs, C. R. (2016). Exploring the influence of 21st century skills in a dual languageprogram: A case study. International Journal of Teacher Leadership, 7(1), 37- 56.

Henriksen, D., Henderson, M., Creely, E., Ceretkova, S., Černochová, M., Sendova, E., ... & Tienken, C. H. (2018). Creativity and technology in education: An international perspective. *Technology, Knowledge and Learning*, *23*(3), 409-424.

Helsper, E. J., & Eynon, R. (2010). Digital natives: where is the evidence?. *British educational research journal*, *36*(3), 503-520.

Herold, D. (2012). Digital natives: Discourses of exclusion in an inclusive society. *Generational use of new media*, 71-86.

Henwood, K.L. and Pidgeon, N.F. (1992). Qualitative research and psychological theorizing. *British journal of psychology*, *83*(1), pp.97-111

Herring, J. (2011). Improving students' web use and information literacy: A guide for teachers and teacher librarians. London: Facet.

Higgins, Steven, Z Xiao, and Maria Katsipataki. (2012). "The impact of digital technology on learning: A summary for the education endowment foundation." Durham, UK: Education Endowment Foundation and Durham University.

Hilbert, M., 2011). Digital gender divide or technologically empowered women in developing countries? A typical case of lies, damned lies, and statistics. In *Women's Studies International Forum* (Vol. 34, No. 6, pp. 479-489). Pergamon.

Hill, R., Betts, L.R. and Gardner, S.E. (2015). Older adults' experiences and perceptions of digital technology:(Dis) empowerment, wellbeing, and inclusion. *Computers in Human Behavior*, *48*, pp.415-423.

Hillrich, R. (1976), Towards an acceptable definition of literacy, English Journal, 65, 50-55.

Hinds, D. (2019). Realising the potential of technology in education: A strategy for education providers and the tehnology industry.

Hinrichsen, J., & Coombs, A. (2013). The five resources of critical digital literacy: a framework for curriculum integration. *Research in Learning Technology*, *21*.

Hobbs, R. (2010). Digital and media literacy: A plan of action. A white paper on the digital and media literacy recommendations of the knight commission on the information needs of communities in a democracy. The Aspen Institute.

Hoon, A., Oliver, E., Szpakowska, K., & Newton, P. (2015). Use of the 'Stop, Start, Continue'method is associated with the production of constructive qualitative feedback by students in higher education. *Assessment & Evaluation in Higher Education*, *40*(5), 755-767.

Horn, I. S., & Campbell, S. S. (2015). Developing pedagogical judgment in novice teachers: Mediated field experience as a pedagogy for teacher education. *Pedagogies: An International Journal*, *10*(2), 149-176.

Huber, E., & Shalavin, C. A. (2018). Surveying the digital literacy landscape for academic and professional staff in higher education.

Hutchison, A. C., Woodward, L., & Colwell, J. (2016). What are pre-adolescent readers doing online? An examination of upper elementary students' reading, writing, and communication in digital spaces. Reading

Research Quarterly, 51(4), pp. 435– 454

ICF International (Firm), 2015. *Literature review on the impact of digital technology on learning and teaching*. Social Research.

Isenfjord, E., Munthe, E. (2017) Educating digitally competent teachers: A study of integration of professional digital competence in teacher Education. *Teacher and Teaching Education.* 67 pp. 37-45c

Isobe, M. and Yamazaki, S., (2004). Evaluation Criteria for" Developing, Planning and Communicating ideas" for'Design and Technology'in the Revised National Curriculum of 1999 in England. *International Journal of Curriculum Development and Practice*, *6*(1), pp.1-7.

Ito, M (2009). Media literacy and social action in a post-Pokemon world. A keynote address for the 51st NFAIS Annual Conference. Available at: www.itofi sher.com/mito/publications/media_literacy.html (date accessed: 11.3.2019)

Jackson, K. and Bazeley, P. (2019). *Qualitative data analysis with NVivo*. Sage.

Jain, S., Lall, M. and Singh, A. (2021). Teachers' voices on the impact of covid-19 on school education: Are ed-tech companies really the panacea?. *Contemporary Education Dialogue*, *18*(1), pp.58-89.

Jimoyiannis, A. and Gravani, M. (2011). Exploring adult DL using learners' and educators' perceptions and experiences: The case of the second chance schools in Greece. *Journal of Educational Technology & Society*, *14*(1), pp.217-227.

JISC. (2014). Developing digital literacies. Available at: https://www.jisc.ac.uk/full-guide/developing-digital-literacies. (Date accessed: 11.5.2019)

JISC. (2015). Digital Capabilities Framework. Available at: https://repository.jisc.ac.uk/6611/1/JFL0066F_DIGIGAP_MOD_IND_FRAME.PDF. (Date accessed: 11.5.2019)

JPodcaster. (2012). Making Sense of the 8 Elements of Digital Literacy. *Professionalism in the Digital Environment.* Available at: https://digilitpride.wordpress.com/2012/10/01/making-sense-of-the-8-elements-of-digital-literacy/. (Date accessed: 15.3.2022)

Jorgensen, U. (2001). Grounded theory: Methodology and theory construction. *International encyclopedia of the social & behavioral sciences*, *1*, pp.6396-6399

Kant, I. (1949) *Prolegomena,* (P. Carus, Ed.). La Salle, 111.: Open Court Publishing Co.

Kappalumakkel, T. (2018) Sohar: *Empowering Teachers and Learners through Action Research.* North Batinah Nursing Institute.

Kearsley, G., Lynch, B. (1992). Educational Leadership in the Age of Technology: the new Skills, Journal of Research on Computing in Education, 25 (1),50–61.

Kelentrić, M., Helland, K., & Arstorp, A. T. (2017). Professional digital competence framework for teachers. *The Norwegian Centre for ICT in education*, 1-74.

Kelly, R. (2017). The effective use of qualitative methods in establishing best practices in an academic bridge program.

Klebansky, A., & Fraser, S. P. (2013). A strategic approach to curriculum design for information literacy in teacher education-implementing an information literacy conceptual framework. *Australian Journal of Teacher Education (Online)*, *38*(11), 103-125.

Kimmel, L., & Kestenbaum, J. (2014). What's up with WhatsApp: a transatlantic view on privacy and merger enforcement in digital markets. *Antitrust*, *29*, 48.

Kirschner, P. A. (2015). Do we need teachers as designers of technology enhanced learning? Instructional Science, 43(2), 309–322

Kitsantas, A., & Dabbagh, N. (2011). The role of Web 2.0 technologies in self-regulated learning. *New directions for teaching and learning*, *2011*(126), 99-106.

Kivunja, C. and Kuyini, A.B. (2017). Understanding and applying research paradigms in educational contexts. *International Journal of higher education*, *6*(5), pp.26-41.

Koshy, V. (2010). Action Research for Improving Educational Practice. London: Sage.

Kothari, C. R. (2004). Research Methodology. 2nd Ed. New Delhi: New Age International Limited Publishers.

Koutsogiannis, D. (2007). A political multi-layered approach to researching children's DL practices. Language and

Education, 21(3), 216-231.

Koutsogiannis, D. (2011). Adolescents' DL practices and (language) education. Thessaloniki: Greek Language Center [In Greek].

Kuhn, T. (1996) The Structure of Scientific Revolutions. 3rd Edition. Chicago: The University of Chicago Press

Kuhn, T.S. (1970) The Structure of Scientific Revolutions, 2nd edn, International Encyclopedia of Unified Science, enlarged, first published 1962 (The University of Chicago Press

Kuusimäki, A. M., Uusitalo-Malmivaara, L., & Tirri, K. (2019). Parents' and teachers' views on digital communication in Finland. *Education Research International*, *2019*.

Kyale, S. (2007). Contradictions of assessment for learning in Institutions of Higher Education. *D. Boud, & N. Falchikov, Rethinking Assessment in Higher Education, Learning for the Longer Term. Nueva York: Routledge*.

Kvernbekk, T. (2012). Argumentation in theory and practice: Gap or equilibrium?. *Informal logic*, *32*(3), pp.288-305.

La Caze, S. (2017). Changing classroom practice through blogs and vlogs. *Literacy Learning: The Middle Years*, *25*(1), 16-27.

Lanham, R. (1995). Digital literacy. *Scientific American*, 273(3). pp. 198-200

Lankshear, C. (1997). Changing literacies. Philadelphia: Open University Press.

Lankshear, C., & Knobel, M. (2003). *New literacies: Changing knowledge and classroom learning*. Open University Press.

Lankshear, C., & Knobel, M. (2005) E-Learning and Digital Media Editorial. *E-Learning. 2(2).*

Lankshear, C. & Knobel, M. (Ed.) (2008). *Digital literacies: Concepts, policies and practices.* New York: Peter Lang Publishing Inc.

Larke, L.R. (2019). Agentic neglect: Teachers as gatekeepers of England's national computing curriculum. *British Journal of Educational Technology*, *50*(3), pp.1137-1150.

Latham, D., Gross, M. and Witte, S. (2013) Preparing teachers and librarians to collaborate to teach 21st century skills: The views of LIS and Education faculty. School Libraries Research, 16, pp. 1-23.

Lather, P. (1986). Research as praxis. *Harvard educational review*, *56*(3), pp.257-278.

Lauriala, A. (2013), "Chapter 27: Changes in Research Paradigms and their Impact on Teachers and Teacher Education: A Finnish Case", Craig, C.J., Meijer, P.C. and Broeckmans, J. (Ed.) *From Teacher Thinking to Teachers and Teaching: The Evolution of a Research Community* (*Advances in Research on Teaching, Vol. 19*), Emerald Group Publishing Limited, Bingley, pp. 569-595.

Lave, J., & Kvale, S. (1995). What is anthropological research? An interview with Jean Lave by Steinar Kvale. *Qualitative Studies in Education*, *8*, pp. 219-228.

Lipnevich, A. A., Berg, D. A. G., & Smith, J. K. (2016). Toward a model of student response to feedback. In G. T. L. Brown

Lawless, K. A., & Pellegrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. Review of Educational Research, 77(4), pp.575–614

Leech, N.L. and Onwuegbuzie, A.J. (2011) Beyond Constant Comparison Qualitative Data Analysis: Using NVivo. School Psychology Quarterly, vol.26 (1), pp. 70 – 84.

Lei, J. (2009). Digital natives as preservice teachers: What technology preparation is needed?. *Journal of Computing in teacher Education*, *25*(3), pp.87-97.

Legislation.gv.uk. (1999(. *The New Opportunities Fund (Specification of Initiatives) Order1999.* Available at: https://www.legislation.gov.uk/uksi/1999/966/contents/made. (Date accessed: 11.7.2021)

Legislation.gov.uk. (2012 and 2016), The School Publications (England) (Amendments) Regulations, (Available at: https://www.legislation.gov.uk/uksi/2016/451/introduction/made) (Date accessed: 31.3.2010).

Lempert-Shepell, E. (1995). Teacher self-identification in culture from Vygotsky's developmental perspective. Anthropology and Education Quarterly, 26, 425-442.

Lengsfeld, J.H. (2011). An econometric analysis of the sociodemographic topology of the digital divide in Europe. *The information society*, *27*(3), pp.141-157.

Li, S., Easterby-Smith, M., & Bartunek, J. (2009). Research methods for organizational learning: The transatlantic gap. *Management Learning*, *40*(4), 439-447.

Lin, H. & Lee, G. (2006). Determinants of success for online communities: an empirical study. Behavior and Information Technology, 25(6), 479-488. Littlejohn, A., Beetham, H. & McGill

Lincoln, Y. S., & Guba, E. G. (1985) *Naturalistic inquiry*. Thousand Oaks, CA: Sage.

Lincoln, Y. S., & Guba, E. G. (1985) *Naturalistic inquiry*. Thousand Oaks, CA: Sage.

Lingard, L., Albert, M., & Levinson, W. (2008). Grounded theory, mixed methods, and action research. *Bmj*, *337*.

Lipnevich, A. A., Berg, D. A., & Smith, J. K. (2016). Toward a model of student response to feedback. *Handbook of human and social conditions in assessment*, 169-185.

Lofland, J. and Lofland, L.H. (1995). Developing analysis. *Analyzing social setting*, pp.183-203.

Lohnes, S., & Kinzer, C. (2007). Questioning assumptions about students' expectations for technology in college classrooms. *Innovate: Journal of Online Education*, *3*(5)

Loos, E., Nimrod, G., & Fernández-Ardèvol, M. (2018). Older audiences in the digital media environment: A cross-national longitudinal study.

Lund, A., Furberg, A., Bakken, J., & Engelien, K. (2014). What does professional digital competence mean in teacher education? *Nordic Journal of Digital Literacy*, *9*(4), 281–299

Madden, M., Smith, A. W., & Vitak, J. (2007). Digital footprints: Online identity management and search in the age of transparency.

Magoon, A.J., (1977). Constructivist approaches in educational research. *Review of educational research*, *47*(4), pp.651-693.

Malterud, K. (2001). Qualitative research: standards, challenges, and guidelines. *The lancet*, *358*(9280), pp. 483-488.

Manning, K. (1997). Authenticity in constructivist inquiry: Methodological considerations without prescription. *Qualitative Inquiry*, *3*(1), 93-116.

Marsh, J. (2010). The relationship between home and school literacy practices. In: D. Wyse, R. Andrews & J. Hoffman (eds.), The Routledge international handbook of English, language and literacy teaching, pp. 305-316

Maxwell, J. A. (2005). *Qualitative research design: An interactive approach* (2nd ed.). Thousand Oaks, CA: Sage.

Maykut, P., & Morehouse, R. (1994). The qualitative posture: Indwelling. In P. S. Mayku

Mays, N., & Pope, C. (2000). Assessing quality in qualitative research. *Qualitative research*

McGarry, K. (1993), The changing context of information (2nd edn.), Library Association Publishing, London,

McKeever, M. (2017). Educational inequality in apartheid South Africa. *American Behavioral Scientist*, *61*(1), 114-131.

Mehan, H. (1974). Accomplishing classroom lessons. In A. V. Cicourel, et al., Language use and school performance. New York: Academic Press.

Melhuish, K. and Falloon, G. (2010). Looking to the future: M-learning with the iPad.

Merchant, G. (2007). Writing the future in the digital age. *Literacy*, *41*(3), 118-128.

Mercuri, S. & Ramos, L. (2014). Technology-based biliteracy centers for the 21st century learner. GIST Education and Learning Research Journal, 9. 196-216

Middleton, S., Emembolu, I., Strachan, R,. Davenport, C,. Keogh, S,. Pickard, A,. Sanderson, J Bradnum, J., Anderson, E. (2020). 'The Impact of Coronavirus on primary schools in North East England. Challenges and Solutions.' Digital Learning Lab/NUSTEM, Northumbria University, UK. (Available at: https://committees.parliament.uk/writtenevidence/5920/pdf/). (Date accessed: 31.8.2020)

Mills, J., Bonner, A. and Francis, K. (2006). The development of constructivist grounded theory. *International journal of qualitative methods*, *5*(1), pp.25-35.

Mir, R. and Watson, A. (2000). Strategic management and the philosophy of science: The case for a constructivist methodology. *Strategic management journal*, *21*(9), pp.941-953.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for integrating technology in teachers' knowledge. Teachers College Record, 108 (6), 1017–1054

Mojtahed, R., Nunes, M.B., Martins, J.T. and Peng, A. (2014). Equipping the Constructivist Researcher: The Combined use of Semi-Structured Interviews and Decision-Making maps. *Electronic Journal of Business Research Methods*, *12*(2), pp.pp87-95.

Molnar, A.R., (1979). The next great crisis in American education: Computer literacy. *Journal of Educational*

Technology Systems, *7*(3), pp.275-285.

Moore, P. (2002). An analysis of information literacy education worldwide. White Paper prepared for UNESCO, the U.S. National Commission on Libraries and Information Science, and the National Forum on Information Literacy, for use at the Information Literacy Meeting of Experts, Prague, The Czech Republic.

Moreira, M.A., OECD (2015): Students, Computers and Learning: Making the Connection. PISA, OECD Publishing. *HUMANIDADES DIGITALES*, p.18

Morris, K. (2019) . Teaching Digital Citizenship: 10 Internet Safety Tips For Students (With Posters). *Helping Teachers create digitally literate global learners*: Primary Tech.

Mortari, L., (2015). Reflectivity in research practice: An overview of different perspectives. *International Journal of Qualitative Methods*, *14*(5), p.1609406915618045.

Mueller, J., Wood, E., Willoughby, T., Ross, C., & Specht, J. (2008). Identifying discriminating variables between teachers who fully integrate computers and teachers with limited integration. *Computers & education*, *51*(4), 1523-1537.

Muhr, T. (1997). ATLAS.ti. Visual qualitative data analysis management model building (Version 4.1) [Computer software]. Berlin: Scientific Software Development

Nagel, T. (1986). *The view from nowhere.* New York: Oxford University Press.

Nagle, J. (2018). Twitter, cyber-violence, and the need for a critical social media literacy in teacher education: A review of the literature. *Teaching and Teacher Education*, *76*, 86-94.

Nascimbeni, F. and Vosloo, S. (2019). Digital literacy for children: Exploring definitions and frameworks. *Scoping Paper*, *1*. Available at: https://www.researchgate.net/profile/Fabio-Nascimbeni-2/publication/344751370_Digital_literacy_for_children_exploring_definitions_and_frameworks/links/5f8db53d458515b7cf8bb18e/Digital-literacy-for-children-exploring-definitions-and-frameworks.pdf. (Date accessed: 11.3.2020)

National Literacy Trust. (2018). Fake news and critical literacy: The final report of the Commission on Fake News and the Teaching of Critical Literacy in Schools. Available at: https://literacytrust.org.uk/research-services/research-reports/fake-news-and-critical-literacy-final-report/. (Date accessed: 11.9.2020)

Nascimento, L.D.C.N., Souza, T.V.D., Oliveira, I.C.D.S., Moraes, J.R.M.M.D., Aguiar, R.C.B.D. and Silva, L.F.D. (2018). Theoretical saturation in qualitative research: an experience report in interview with schoolchildren. *Revista brasileira de enfermagem*, *71*, pp.228-233.

Niedbalski, J. and Ślęzak, I. (2018). The Main Features of Nvivo Software and the Procedures of the Grounded Theory Methodology: How to Implement Studies Based on GT Using CAQDAS. In *World Conference on Qualitative Research* (pp. 90-101). Springer, Cham.

Novak, J. (2004). Concept maps and how to use them. *Insight 6 (2).* pp.15-16.

Nwankwo, M. C., Achufusi-Aka, N. N., & Eke, J. A. (2022). Chapter Nine Covid-19 Impact on Mode of Teaching and Learning Science Education in Nigeria. *Attaining Sustainable Development Goals in Families, Companies and Communities*, 111.

Oblinger. Diana. E. D. U. C. A. U. S. E., Oblinger, J., Roberts, G., McNeely, B., Windham, C., Hartman, J., ... & Kvavik, R. (2005). *Educating the net generation* (Vol. 272). Brockport Bookshelf, Book.

ohmygoodnessgracious.com. (2013). A broken invisibility cloak. *ohmygoodnessgracious.com.* Available at: http://www.ohmygoodnessgracious.com/2013/01/24/a-broken-invisibility-cloak/. (Date accessed: 1.4.21).

O'Keefe, D. J. (1975). Logical Empiricism and the Study of Human Communication. *Communications Monographs.* 42(3), pp. 169-183.

Oliviera, J. (2014). Students' and teachers' attitudes and views on employing the use of iPads in science lessons (MPhil Dissertation). Faculty of Education, University of Cambridge.

Omwenga, E., Nyabero, C., & Okioma. (2016). Assessing the influence of the PTTC Principal's competency in ICT on the teachers' integration of ICT in teaching Science in PTTCs in Kenya. *Journal of Education and Practice*, 6(35), pp. 142-148.

The Open University, (2019). Digital and Information Literacies. Found in *Education and Development.* Available at: https://www.open.edu/openlearn/mod/oucontent/view.php?id=64085&section=1. (Date accessed: 11.5.21).

Page, T., & Thorsteinsson, G. (2017). The Impact of Conventional School Education on Students Creativity. *Journal on School Educational Technology*, *13*(1), 12-20.

Palinkas, L.A., Horwitz, S.M., Green, C.A., Wisdom, J.P., Duan, N. and Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and policy in mental health and mental health services research*, *42*(5), pp.533-544.

Palomino, M.D.C.P. (2018). Information and communication technologies and inclusive teaching: Perceptions and attitudes of future early childhood and primary education teachers. *Problems of education in the 21st century*, *76*(3), pp.380-392

Parkin, P. (2009) *Managing change in healthcare: Using action research. SAGE Publications Ltd.* Available at: https://sk.sagepub.com/books/managing-change-in-healthcare. Date accessed: 12.6.

Patton, M. (1990). Qualitative research and evaluation methods. London, Sage.

Patton, M. (2002). Qualitative research and evaluation methods (3rd ed.). Thousand Oaks, CA: Sage.

Patton, M. Q. (2015). Qualitative research & evaluation methods (4th ed.). Thousand Oaks, CA: Sage.

Pavlenko, G.V. and Pavlenko, A.I. (2020). Digital Literacy as a Condition for Positive Experience of the COVID-19 Lockdown for Families With Preschool Children. In *Research Technologies of Pandemic Coronavirus Impact (RTCOV 2020)* (pp. 507-512). Atlantis Press.

Pedró, F. (2009, September). New millennium learners in higher education: Evidence and policy implications. In *International Conference on 21st Century Competencies, Brussels: OECD/CERI*.

Peredaryenko, M.S. and Krauss, S.E., 2013. Calibrating the human instrument: Understanding the interviewing experience of novice qualitative researchers. *The qualitative report*, *18*(43), p.1.

Perifanou, M., Economides, A. and Tzafilkou, K., 2021. Teachers' digital skills readiness during COVID-19 pandemic.

Pickard, A. (2002). *Access to electronic information resources: Their role in the provision of learning opportunities for young people. A constructivist inquiry* (Doctoral dissertation, University of Northumbria).

Pickard, A. (2013). 'Action Research.' *Research Methods in Information, 2nd edition*. Facet Publishing.

Pilgrim, J., Vasinda, S., Bledsoe, C., & Martinez, E. (2019). Critical thinking is critical: Octopuses, online sources, and reliabil-ity reasoning. The Reading Teacher, 73(1), pp. 85– 93

Pivetta, E., Harkin, L., Billieux, J., Kanjo, E., & Kuss, D. J. (2019). Problematic smartphone use: An empirically validated model. *Computers in Human Behavior*, *100*, 105-117.

Plichta, P., (2017). Socialization and education of children and adolescents with intellectual disabilities in the digital age. (Translated from Polish). Toruń: Wydawnictwo Adam Marszałek (2017).

Polizzi, G. (2020). Digital literacy and the national curriculum for England: Learning from how the experts engage with and evaluate online content. *Computers & Education*, *152*, p.103859.

Pollard, A. (2010). Professionalism and pedagogy: A contemporary opportunity: A commentary by the Teaching and Learning Research Programme and the General Teaching Council for England.

Postholm, M.B. (2008). Teachers developing practice: Reflection as key activity. Teaching and Teacher Education 24, no. 7: 1717–28.

Potyrała, K. and Tomczyk, Ł. (2021). Teachers in the lifelong learning process: examples of digital literacy. Journal of Education for Teaching, 47(2), pp.255-273.

Pramling Samuelsson, I. and Johansson, E., (2006). Play and learning—inseparable dimensions in preschool practice. *Early child development and care*, *176*(1), pp.47-65.

Prensky, M. (2001). Digital Natives, Digital Immigrants. On the Horizon, 9(5): 1–6

Primeau, L.A., 2003. Reflections on self in qualitative research: Stories of family. *American Journal of Occupational Therapy*, *57*(1), pp.9-16.

Raisingchildren.net.org, (date unknown). Digital citizenship: teens being responsible. *Raisingchildren.net.org*, Available at: https://raisingchildren.net.au/pre-teens/entertainment-technology/digital-life/digital-citizenship. (Date accessed: 1.4.21).

Reason, P. (1981). Issues of validity in new paradigm research. In P. Reason & J. Rowan

(Eds.), *Human Inquiry* (pp. 239-250). New York, NY: Wiley.

Rennie, D. L (1994). Human science and counselling psychology: Closing the gap between research and practice. *Counselling Psychology Quarterly*, *7*, 235-250.

Reupert, A., Maybery, D., Patrick, K., & Chittleborough, P. (2009). The importance of being human: Instructors'

personal presence in distance programs. International Journal of Teaching and Learning in Higher Education, 21, 47-56.

Ribble, M.S., Bailey, G.D. and Ross, T.W., (2004). Digital citizenship: Addressing appropriate technology

behavior. *Learning & Leading with technology*, *32*(1), p.6.

Richards, L. (2009). Handling qualitative data: A practical guide (2nd ed.). Thousand Oaks, CA: Sage

Ritchie J, Spencer E. Qualitative data analysis for applied policy research. In, Bryman A, Burgess RG, eds. Analyzing Qualitative Data. London: Routledge; (1994).

Rodríguez-García, A. M., Moreno-Guerrero, A. J., & Lopez Belmonte, J. (2020). Nomophobia: An individual's growing fear of being without a smartphone—a systematic literature review. *International Journal of Environmental Research and Public Health*, *17*(2), 580.

Rodwell, M. K. (1998) *Social work constructivist research*. New York, NY: Garland Publishing.

The Royal Society (2017) After the Reboot: computing education in UK schools. London. CC-BY 4.0.

Rubin, M. J. (2013, March). The effectiveness of live-coding to teach introductory programming. In *Proceeding of the 44th ACM technical symposium on Computer science education* (pp. 651-656).

Ruthven, I., & Lalmas, M. (2003). A survey on the use of relevance feedback for information access systems. *The Knowledge Engineering Review*, *18*(2), 95-145.

Sá, M.J. and Serpa, S. (2020.) The COVID-19 pandemic as an opportunity to foster the sustainable development of teaching in higher education. *Sustainability*, *12*(20), p.8525.

Sabra, J. B. (2017). "I hate when they do that!" Netiquette in mourning and memorialization among Danish Facebook users. *Journal of Broadcasting & Electronic Media*, *61*(1), 24-40.

SALLY. (2015) Digital Literacy has 8 Essential Elements. *Finding Heroes.* Available at: https://findingheroes.co.nz/2015/06/11/digital-literacy-has-8-essential-elements/. (Date accessed: 11.2.2022)

Salmona, M., & Kaczynski, D. (2016). Don't blame the software: Using qualitative data analysis software successfully in doctoral research. In *Forum: Qualitative Social Research* (Vol. 17, No. 3, pp. 42-64). Freie Universität Berlin.

Sánchez-Cruzado, C., Santiago Campión, R. and Sánchez-Compaña, M., 2021. Teacher digital literacy: The indisputable challenge after COVID-19. Sustainability, 13(4), p.1858.

Sandercock, P. (2016) Instructor perceptions of student information literacy: comparing IL models to reality. Journal of Information Literacy, 10(1), pp. 3-29.

Sands, R. G. (2004). Narrative analysis: A feminist approach. In D. K. Padgett (Ed.), *The*

Savage, M. (2015) *Digital literacy for Primary Teachers*. Norwich: Critical Publishing

Sawmiller, A. (2010). Classroom blogging: What is the role in science learning?. *The Clearing House*, *83*(2), pp.44-48.

Sbaraini, A., Carter, S.M., Evans, R.W. and Blinkhorn, A. (2011). How to do a grounded theory study: a worked example of a study of dental practices. *BMC medical research methodology*, *11*(1), pp.1-10.

Schneider, K. J. (1999). Multiple-case depth research. *Journal of Clinical Psychology*, *55*(12), 1531-1540.

Schwandt, T.A. (1994). Constructivist, interpretivist approaches to human inquiry. *Handbook of qualitative research*, *1*, pp.118-137.

Schwandt, T.A. (1998). Constructivist, interpretivist approaches to human inquiry. In N.K. Denzin& Y.S. Lincoln (Eds.), *The landscape of qualitative research theories and issues.* (pp. 221 -259). Thousand Oaks, CA: Sage.

Scott, K. W. (2004). Relating the categories in grounded theory analysis: Using a conditional relationship guide and reflexive coding matrix. The Qualitative Report, 9(1), 112-126.

Scottish government. (2015). Literature Review of the Impact of Digital Technology on Learning and Teaching. Available at: https://www.gov.scot/publications/literature-review-impact-digital-technology-learning-teaching/. (Date accessed: 22.7.2020).

Selwyn, N. (2009). The digital native–myth and reality. *Aslib Proceedings* 61(4), pp. 364-379.

Selwyn, N. (2010). *Schools and schooling in the digital age: A critical analysis*. Routledge.

Selwyn, N. (2012). Making sense of young people, education and digital technology: The role of sociological theory. *Oxford Review of Education*, 38(1), 81-96.

Selwyn, N. (2013). *Distrusting educational technology: Critical questions for changing times*. Routledge.

Sevilla, C. (2007). Research Methods: Philippines: Rex Printing Company, INC.

Shannon, C., Reilly, J. and Bates, J. (2019). Teachers and information literacy: understandings and perceptions of the concept. *Journal of information literacy*, *13*(2), pp.41-72.

Shannon, P. and Hambacher, E. (2014). Authenticity in Constructivist Inquiry: Assessing an Elusive Construct. *Qualitative Report, 19*(52).

Sharma, Ravi, Arul-Raj Fantin, Navin Prabhu, Chong Guan, and Ambica Dattakumar. (2016). Digital Literacy and Knowledge Societies: A Grounded Theory Investigation of Sustainable Development. Telecommunications Policy 40 (7): 628–43. doi:10.1016/j.telpol.2016.05.003

Sharp, E. A., Norman, M. K., Spagnoletti, C. L., & Miller, B. G. (2021). Optimizing synchronous online teaching sessions: a guide to the "new normal" in medical education. *Academic pediatrics*, *21*(1), 11-15.

Sheikh A. & Siti H. (2016). Transforming science teaching environment for the 21st century primary school pupils. Malaysian Online Journal of Educational Technology, 4(4). 68-76

Silverman (1997) *Qualitative research: theory, method and practice.* SAGE Publications.

Skutil, M , Maněnová, M , Wolf, J , Vítová, J . (2021). Analyzing the factors influencing the primary school students' digital literacy skills during covid-19 period. International Journal of Quality in Education (5): 1-13.

Slettebø, T. (2021). Participant validation: Exploring a contested tool in qualitative research. *Qualitative Social Work*, *20*(5), pp.1223-1238.

Snow, D., Morrill, C. Anderson, L. (2003). Elaborating analytic ethnography: Linking fieldwork and theory. *Ethnography*, *4*(2), pp.181-200.

Soler Costa, R., Mauri Medrano, M., Lafarga Ostáriz, P., & Moreno-Guerrero, A. J. (2020). How to teach pre-service teachers to make a didactic program? The collaborative learning associated with mobile devices. *Sustainability*, *12*(9), 3755.

Soler-Costa, R., Lafarga-Ostáriz, P., Mauri-Medrano, M., & Moreno-Guerrero, A. J. (2021). Netiquette: ethic, education, and behavior on Internet—a systematic literature review. *International journal of environmental research and public health*, *18*(3), 1212.

Solomon, Y, and Lewin, C. (2016) Measuring 'progress': performativity as both driver and constraint in school innovation. Journal of Education Policy, vol.31(2), pp. 226-238.

Sparks, J.R., Katz, I.R. and Beile, P.M. (2016). Assessing digital information literacy in higher education: A review of existing frameworks and assessments with recommendations for next-generation assessment. *ETS Research Report Series*, *2016*(2), pp.1-33.

Spengler, S. S. (2015). *Educators' perceptions of a 21 st century digital literacy framework* (Doctoral dissertation, Walden University).

Spiteri, M. and Chang Rundgren, S.N. (2020). Literature review on the factors affecting primary teachers' use of digital technology. *Technology, Knowledge and Learning*, *25*(1), pp.115-128.

Spivey, N. N. (1995). Written discourse: A constructivist perspective.

Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, CA: Sage.

Stenhouse, L. (1984). Library access, library use, and user education in academic sixth forms: An autobiographical account. The research process in educational settings: Ten Case Studies. R. G. Burgess. London, Falmer Press.

Strauss, A.L. (1987). *Qualitative analysis for social scientists*. Cambridge university press.

Strauss, A. and Corbin, J. (1998). Basics of qualitative research techniques.

Street, B. (1995) Social Literacies Longman: London

Street, B. (2003). What's "new" in New Literacy Studies? Critical approaches to literacy in theory and practice. *Current issues in comparative education*, *5*(2), pp.77-91.

Stringer (1999) *Action Research.* Thousand Oaks, California: Sage Publications Ltd.

Stringer (2014) *Action Research, 4th Edition.* Thousand Oaks, California: Sage Publications Ltd.

Tagg, S. K. (1985). Life story interviews and their interpretation. In The research interview: Uses and approaches. M. Brenner, J. Brown and D. Canter. [eds.] New York, Academic Press: 56-78

Talbert, J.E. and McLaughlin, M.W. (1994) Teacher Professionalism in Local School Contexts, American Journal of Education, vol.102(Fall), pp. 123-153.

Tapscott, D. (1998) Growing Up Digital: The Rise of the Net Generation. New York: McGraw Hill.

Tapscott, D., & Williams, A. D. (2008). *Wikinomics: How mass collaboration changes everything*. Penguin.

Tejedor, S., Cervi, L., Pérez-Escoda, A. and Jumbo, F.T. (2020). Digital literacy and higher education during COVID-19

lockdown: Spain, Italy, and Ecuador. *Publications*, *8*(4), p.48.

Telio, S., Regehr, G., and Ajjawi, R. (2016). Feedback and the Educational Alliance: Examining Credibility Judgements and Their Consequences. *Medical Education* 50(9) pp.933-42.

Teruggi L.A.& Zuccoli F. (2015). The status of twenty-first century skills within the University of Milan- Bicocca's degree programme in primary education. EPedagogium, 2. 75- 87.

Tessier, S. (2012). From fieldnotes, to transcripts, to tape recordings: Evolution or combination?. *International Journal of Qualitative Methods*, *11*(4), pp.446-460.

Tezci, Erdogan. (2011). Turkish Primary School Teachers' Perceptions of School Culture regarding ICT Integration. *Educational Technology Research and Development*, 59 (3), pp. 429–443.

Thornberg, R. and Dunne, C. (2019). Literature review in grounded theory. *The Sage handbook of current developments in grounded theory*, pp.206-221.

Tisdall, K., Davis, J and Gallagher, M. (2008). *Researching with Children and Young People: Research Design, Methods and Analysis.* SAGE Publications Ltd.

Tomczyk, Ł. (2019). Digital literacy in the area of e-safety among teachers (second stage of the primary school) in Poland. In *Conference proceedings of» eLearning and Software for Education «(eLSE)* (Vol. 15, No. 02, pp. 130-135). Carol I National Defence University Publishing House

Tømte, C., Enochsson, A. B., Buskqvist, U., & Kårstein, A. (2015). Educating online student teachers to master professional digital competence: The TPACK-framework goes online. *Computers & Education*, *84*, 26-35.

Torgerson, C. J., & Zhu, D. (2004). Evidence for the effectiveness of ICT on literacy learning. *The impact of ICT on literacy education*, *99*, 34-68.

Townsend, M.B. (2017). *iPads in K-12 schools: A grounded theory study of value* (Doctoral dissertation, University of Phoenix).

Twining, P., 2013. PeterT's bliki. EdFutures.

Tzifopoulos, M. (2020). In the shadow of Coronavirus: Distance education and DL skills in Greece. *International Journal of Social Science and Technology*, *5*(2), pp.1-14.

UK Parliament Post. (2021) Post Note 643: Developing essential digital skills. Available at: https://researchbriefings.files.parliament.uk/documents/POST-PN-0643/POST-PN-0643.pdf. (Date accessed: 12.10.2021)

UNESCO. (2018a). A global framework of reference on digital literacy skills for indicators 4.4.2. Information Paper No. 51. Montreal, Canada: UNESCO Institute for Statistics. Available at: http://uis.unesco.org/sites/default/files/documents/ip51- global-framework-reference-digital-literacy-skills-2018-en.pdf. (Date accessed: 17.4.2019).

UNESCO (2018b). Global Education Monitoring Report: Migration, displacement and education, building bridges, not walls. Paris: UNESCO. Available at: https://www.unicef.org/globalinsight/media/1271/file/%20UNICEF-Global-Insight-digital-literacy-scoping-paper-2020.pdf. (Date accessed: 23.11.2022).

UNICEF. (2019). Digital Literacy for Children: exploring definitions and frameworks. *UNICEF OFFICE OF Global Insight and Policy.* Available at: https://www.unicef.org/globalinsight/media/1271/file/%20UNICEF-Global-Insight-digital-literacy-scoping-paper-2020.pdf. (Dare accessed: 23.11.2022).

University of Queensland Library. (2022). Communicate and Collaborate online. *University of Queensland Library*. Available at: https://web.library.uq.edu.au/research-tools-techniques/digital-essentials/communicate-online. (Date accessed: 21,4.2021).

Urquhart, L, Rees., C., Ker, J. (2004). Making sense of feedback experiences: a multi-school study of medical students' narratives. *Med Educ* 48 (2). pp. 189– 203.

Van Dijk, C. N., Van Witteloostuijn, M., Vasić, N., Avrutin, S., & Blom, E. (2016). The influence of texting language on grammar and executive functions in primary school children. *PloS one*, *11*(3), e0152409.

Van Rijnsoever, F.J., 2017. (I can't get no) saturation: a simulation and guidelines for sample sizes in qualitative research. *PloS one*, *12*(7), p.e0181689.

Viner K. 2016. How technology disrupted the truth. The Guardian, 12th July, pp.25-27.

Vongkulluksn, V.W., Xie, K. and Bowman, M.A., (2018). The role of value on teachers' internalization of external barriers and externalization of personal beliefs for classroom technology integration. *Computers & Education*, *118*, pp.70-81.

Von Glaserfield E. (1995). A constructivist approach to teaching. *Constructivism in Education*. Erlbaum: Hillsdale, NJ; 3–16.

Von Gillern, S., Gleason, B. and Hutchison, A. (2022.) Digital citizenship, media literacy, and the ACTS Framework. *The reading teacher*, *76*(2), pp.145-158

Vygotsky, L.S. (1978). Mind in society. The development of higher psychological processes. Cambridge, MA: Harvard University Press.

Wacquant, L., 2002. Scrutinizing the street: Poverty, morality, and the pitfalls of urban ethnography. *American journal of sociology*, *107*(6), pp.1468-1532.

Wagner, T. (2008). Rigor redefined. Educational Leadership, 66(2). 20-25.

Warford, M.K. (2011). The zone of proximal teacher education. Teaching and Teacher Education 27, no. 2: 252–8.

Webwise.ie. (unknown). Digital Literacy Skills: Cultural and Social Understanding. *Advice for Teachers.* Available at: https://www.webwise.ie/teachers/advice-teachers/digital-literacy-cultural-social-understanding/ . (Date accessed: 22.12.2021).

Weick, K. E. (1989). Theory construction as disciplined imagination. *Academy of management review*, *14*(4), 516-531.

Williams, D. & Coles, L. (2007). Evidence-based practice in teaching: An information perspective. Journal of Documentation, 63 (6), pp.812-835

Wilson, C. B., & Clissett, P. (2011). Involving older people in research: practical considerations when using the authenticity criteria in constructivist inquiry. *Journal of Advanced Nursing*, *67*(3), pp.677-686.

Winter, G. (2000). A comparative discussion of the notion of validity in qualitative and quantitative research. *The Qualitative Report*, *4*(3&4).

Woods, P. (1995). Creative teachers in primary schools. Buckingham: Open University Press.

Wood, R. and Ashfield, J. (2008). The use of the interactive whiteboard for creative teaching and learning in literacy and mathematics: a case study. *British journal of educational technology*, *39*(1), pp.84-96.

Yin, R. K. (2014). *Case study research: Design and methods* (5th ed.) Thousand Oaks, CA:

Sage.

Zhao, Y., Llorente, A.M.P. and Gómez, M.C.S., (2021). Digital competence in higher education research: A systematic literature review. Computers & Education, p.104212).

Zhou, L., Wu, S., Zhou, M., & Li, F. (2020). 'School's out, but class' on', the largest online education in the world today: Taking China's practical exploration during The COVID-19 epidemic prevention and control as an example. *Best evid chin edu*, *4*(2), 501-519.

Zimmerman, B.J. 2001. Theories of self-regulated learning and academic achievement. *In Self regulated learning and academic achievement: Theory, research, and practice,* ed. B.J. Zimmerman and D. Schunk, 1–25. New York: Springer-Verlag.

Zimmerman, B.J. 2006. Development and adaption of expertise: The role of self-regulatory processes and beliefs. In *The Cambridge handbook of expertise and expert performance*, ed. K.A. Ericsson, N. Charness, P.J. Feltovich, and R.R. Hoffman, 705–22. Cambridge: Cambridge University Press

Appendix 1: Interview consent form for practising teachers

Northumbria University
NEWCASTLE

Faculty of
Engineering and Environment
School of Computing and Information Sciences

Interview Consent Form

Research project title: Towards digital citizenship: a digital literacy curriculum to support teachers in the classroom
Research investigator: Sophie Middleton
Research Participants name:

The interview will take approximately 20 minutes. We don't anticipate that there are any risks associated with your participation, but you have the right to stop the interview or withdraw from the research at any time.
Thank you for agreeing to be interviewed as part of the above research project.
Ethical procedures for academic research undertaken from UK institutions require that interviewees explicitly agree to being interviewed and how the information contained in their interview will be used. This consent form is necessary for us to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation. Would you therefore read the accompanying information sheet and then sign this form to certify that you approve the following:

- The interview will be recorded and a transcript will be produced.
- If requested, you will be sent the transcript and given the opportunity to correct any factual errors.
- The transcript of the interview will be analysed by Sophie Middleton as research investigator.
- Access to the interview transcript will be limited to Sophie Middleton and academic colleagues and researchers with whom he might collaborate as part of the research process.
- Any summary interview content, or direct quotations from the interview, that are made available through academic publication or other academic outlets will be anonymized so that you cannot be identified, and care will be taken to ensure that other information in the interview that could identify yourself is not revealed.
- The actual recording will be kept on an encrypted student portal at Northumbria University.
- Any variation of the conditions above will only occur with your further explicit approval.

Quotation Agreement

- I also understand that my words may be quoted directly. With regards to being quoted, please initial next to any of the statements that you agree with:
- I wish to review the notes, transcripts, or other data collected during the
- research pertaining to my participation.
- I agree to be quoted directly.
- I agree to be quoted directly if my name is not published and a made-up name (pseudonym) is used.
- I agree that the researchers may publish documents that contain quotations by me.

All or part of the content of your interview may be used; (please mark those agreed to with an x)

☐ In academic papers, policy papers or news articles

☐ On our website and in other media that we may produce such as spoken presentations
☐ On other feedback events
☐ In an archive of the project as noted above

By signing this form I agree that;

1. I am voluntarily taking part in this project. I understand that I don't have to take part, and I can stop the interview at any time;
2. The transcribed interview or extracts from it may be used as described above;
3. I have read the Information sheet;
4. I don't expect to receive any benefit or payment for my participation;
5. I can request a copy of the transcript of my interview and may make edits I feel necessary to ensure the effectiveness of any agreement made about confidentiality;
6. I have been able to ask any questions I might have, and I understand that I am free to contact the researcher with any questions I may have in the future.

Participant's Printed Name

Participants Signature

_____

Date

Researchers Signature 

Contact Information:

Sophie Middleton

Room B108, Ellison Building, Northumbria University, Newcastle upon Tyne, NE1 8ST,
Tel: 07709201794
E-mail: Sophie.m.b.middleton@northumbria.ac.uk

If you are worried about this research, or if you are concerned about how it is being conducted, you can contact Peter, Glaves, Faculty of Engineering and Environment, Research Ethics Director at: **peter.glaves@northumbria.ac.uk**

Appendix 2: Intervention consent slide:

Apendix 3: Round one interview questions

Teacher details:

Name:	
Gender:	
Age:	
How long have you been teaching for?	
Name of School:	
Current Year Group:	
Would you be willing to take part in follow up interviews?	

1. What digital devices do you use professionally? (*e.g. desktop PC, SMARTBoard, class set of iPads (please specify amount), etc.)*	
2. What digital devices do you use professionally? (*e.g. desktop PC, SMARTBoard, class set of iPads (please specify amount), etc.)*	
3. How did you learn to use these digital devices? (self-taught, give details of any training courses, etc.)	
4. Can you state your level of frequency for using each of the following in a professional basis: (e.g. daily, weekly, termly, etc.).	
• Word processing	
• Email	
• Internet	
• Database	
• Spreadsheets	
• Graphics	
• Multimedia (audio & video)	
• Blogging	
• Online discussion groups or forums	
• Video conferencing	
• Computer games	
5. How do you use the devices above in your teaching practice? (*please give details with examples)*	
• Word processing	
• Email	
• Internet	

• Database	
• Spreadsheets	
• Graphics	
• Multimedia (audio & video)	
• Blogging	
• Online discussion groups or forums	
• Video conferencing	
• Computer games	
6. How would you rate your computer skills for each of the following: (none, basic, intermediate, advanced) Why?	
• Word processing applications	
• Database applications	
• Presentation applications	
• Multimedia applications	
• Web design application	
• Search engine skills	
• Communication applications	
7. What social media platforms do you use? (e.g. Facebook, Instagram etc)	
8. How do you use these platforms in your teaching practice? (please give detail with examples)	
9. What do you understand by the phrase digital literacy?	
10. Would you consider yourself a digitally literate teacher? Why/why not?	
11. Can you give any other details about ICT training or uses in your school?	

Appendix 4: Round two interview questions

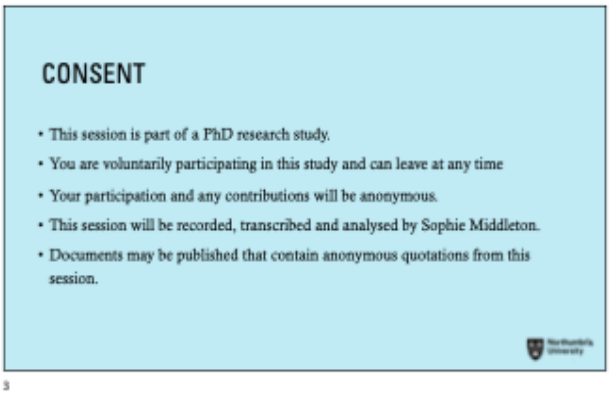
1. *What happened at school when you received the news you were going to close?*
2. *What methods has your school taken since closing?*
3. *Have you invested in any new software or devices?*
4. *How are you communicating with your students?*
5. *How are you communicating with parents?*
6. *How are you communicating with colleagues?*
7. *Have you received any DL training?*
8. *How are you feeling about these changes?*
9. *How do you think the children are coping with these changes?*
10. *Does your school have a strategy for ways forward?*

Appendix 5: Round three interview questions

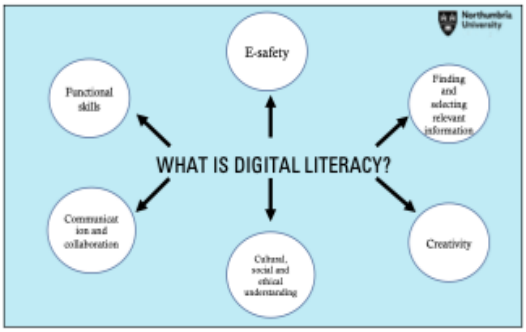
1. *Tell me a little bit about what happened in school throughout the lockdown period-*
2. *what approaches to teaching did you use?*
3. *What software/devices?*
4. *How well adapted would you say you are to online teaching?*
5. *What has been happening in school since you went back?*
6. *What did you find out about students' progress through lockdown?*
7. *Are you still teaching using technology?*

Appendix 6: Slides from Session 1: Introduction and Functional skills

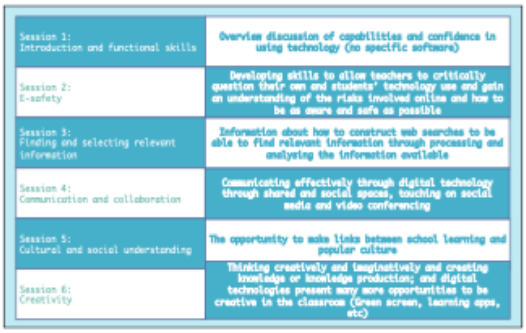
Appendix 6.1: Slides 1 and 2 from session 1



Appendix 6.2: Slides 3 and 4 from session 1

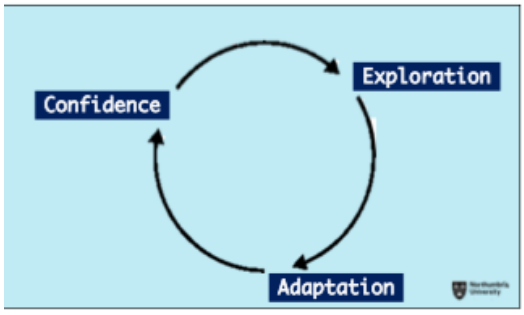


Appendix 6.3: Slides 5 and 6 from session 1

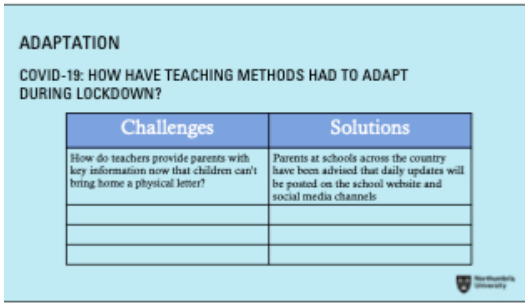


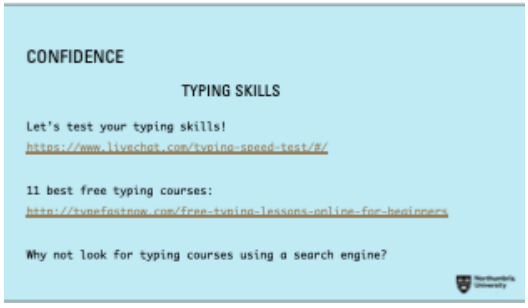
Session 1: Introduction and functional skills	Overview discussion of capabilities and confidence in using technology (no specific software)
Session 2: E-safety	Developing skills to allow teachers to critically question their own and students' technology use and gain an understanding of the risks involved online and how to be as aware and safe as possible
Session 3: Finding and selecting relevant information	Information about how to construct web searches to be able to find relevant information through processing and analysing the information available
Session 4: Communication and collaboration	Communicating effectively through digital technology through shared and social spaces, touching on social media and video conferencing
Session 5: Cultural and social understanding	The opportunity to make links between school learning and popular culture
Session 6: Creativity	Thinking creatively and imaginatively and creating knowledge or knowledge production; and digital technologies present many more opportunities to be creative in the classroom (Green screen, learning apps, etc)

Appendix 6.4: Slides 7 and 8 from session 1

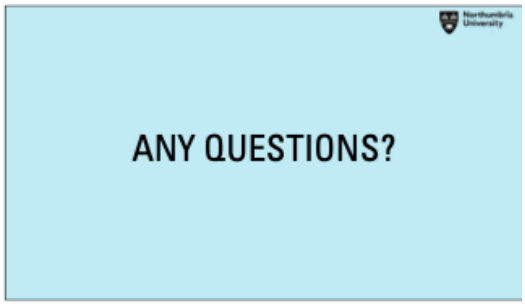


Appendix 6.5: Slides 9 and 10 from session 1





Appendix 6.6: Slides 11 and 12 from session 1



Appendix 6.7: Slides 13 and 14 from session 1

Appendix 6.8: Slides 11 and 12 from session 1

Appendix 7: Script for Slides from Session 1: Introduction and Functional skills

SLIDE 3: In this first lesson I'm going to talk about the importance of digital literacy; explaining what it is, how it can be used in your teaching practice and what this course will entail.

SLIDE 4: (Get students to go to poll everywhere and write what they think digital literacy is- it will create a word cloud)

SLIDE 5: (Discuss their perceptions on word cloud.)
In the interviews I carried out with primary school teachers in the NE of England in 2019, their perception of Dl was mainly based around technology and functional skills, about how to use ICT in the classroom and how confident you are with using technology. And this is right, functional skills are a component of digital literacy skills but digital literacy is not just about how well we can use digital devices.

SLIDE 6: If we take a literal look at the term and break it down into its separate words 'digital' and 'literacy,' we know that 'digital' involves the use of technology and 'literacy' means knowledge and understanding, so it basically means knowledge and understanding of technology and how this is put into practice. Digital literacy is a really important entitlement for young people in an increasingly digital world. These skills are going to help yourselves and your students to take a full and active part in social, cultural, civic, economic and intellectual life now and in the future. To be digitally literate is to have access to a broad range of practices and cultural resources that you are able to apply to digital tools. It's the ability to make and share meaning in different modes and formats, to create, collaborate effectively and to understand how and when digital technologies can be used to support these processes.
I've broken digital literacy skills or literacies into 6 components: functional skills, safety, finding and selecting relevant information, communication and collaboration, cultural, social and ethical understanding and creativity. This course will use each component for 1 weekly session.

SLIDE 7: Each session will last about 50 mins and I'll post the presentation and resources on a Monday and you can watch this at any time during the week that is most suitable for you and then I'd appreciate if you could fill out the feedback forms once you've completed the session so I can evaluate strengths and weaknesses. So the course will be done over 6 sessions (explain table).

SLIDE 8: The key to functional skills are: exploration, adaptation and confidence. Really, you need to be confident to explore software and technology, don't be afraid to get things wrong. You need to explore the software you're using, simply by looking and searching, sometimes if you don't feel confident enough to do it yourself, look on google or youtube for some practical advice and training. Once you feel a little bit more sure of yourself and feel happier at exploring, you're going to be able to adapt this confidence to explore different software and might even move on to exploring hardware! The pit of possibilities is bottomless! Satisfied with your exploration and adaptation skills will give you confidence to not only practice and update your exploration skills but also to teach and guide your students with these skills.

SLIDE 9: As I mentioned earlier, sometimes exploration of software doesn't mean being left on a limb, you can find courses and guides that can help you. I'm sure that you, like I, often search for answers to my questions about certain software functions in a search engine. I often use YouTube to show me how to perform a task using different software. It's even a good idea to look online at different policies provided by the Department of Education to see what guidance you should be giving children and what standards they should be meeting.

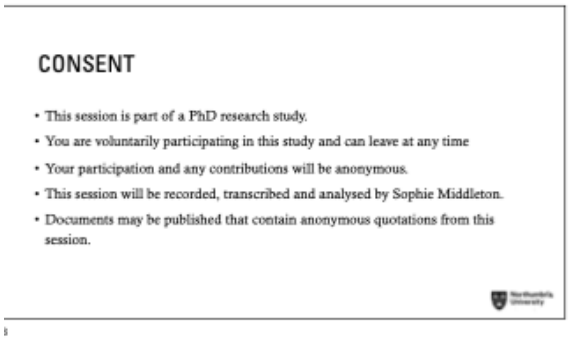
SLIDE 10: (Go to Microsoft word, show them around using search by, help bar, find and replace, etc. Ask them to go on Word themselves and open the document they've been sent. Ask them to show navigation bar, how to make word into a headline so can show on navigation bar. Can they insert a footnote?)

SLIDE 11: Typing skills are becoming even more significant, there are talks of the government replacing the cursive writing standard by touch typing skills. How good are your typing skills? Take the test!

SLIDE 12: The key to being digitally literate is maintaining your skills. This is done by embedding them into your teaching. Use tes and other blogs to find out and discuss ways to use digital literacy in your lessons. Search for ideas and training using google and Youtube.

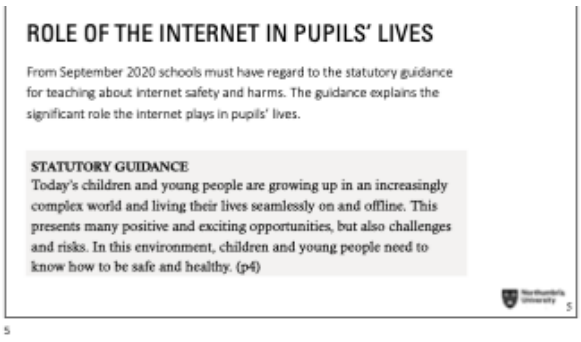
Appendix 8: Slides from Session 2: E-safety

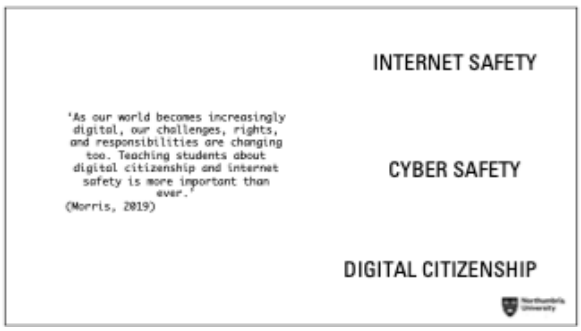
A



Appendix 8.1: Slides 1 and 2 from session 2

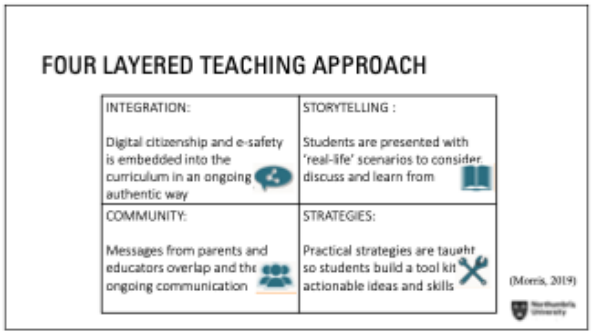
Appendix 8.2: Slides 3 and 4 from session 2

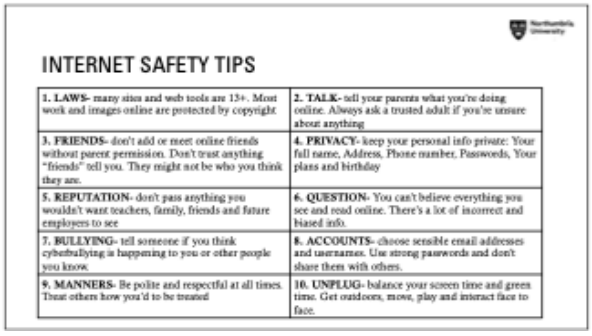




Appendix 8.3: Slides 3 and 4 from session 2

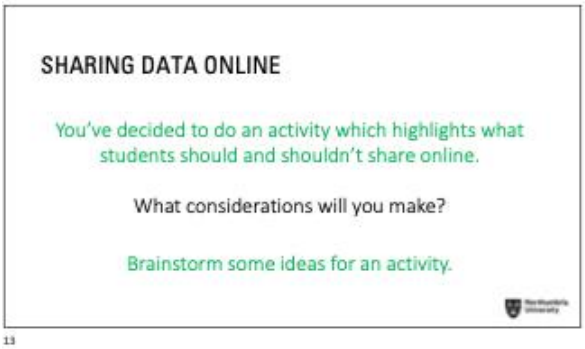
Appendix 8.4: Slides 5 and 6 from session 2

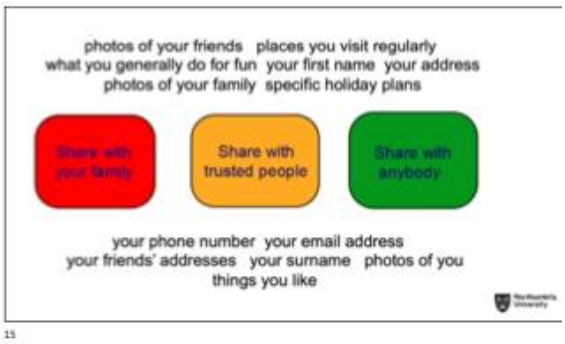


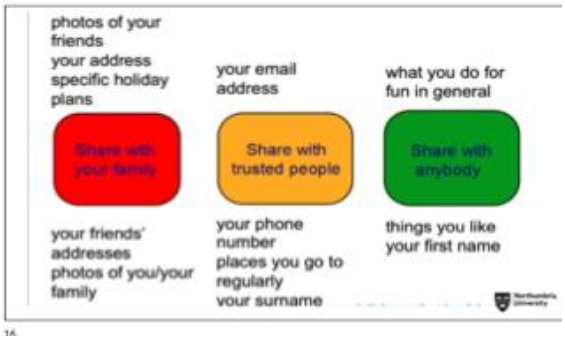


Appendix 8.5: Slides 7 and 8 from session 2

Appendix 8.6: Slides 9 and 10 from session 2







Appendix 8.7: Slides 11 and 12 from session 2

Appendix 8.8: Slides 13 and 14 from session 2

Appendix 8.9: Slides 14 and 15 from session 2

Appendix 9: Script for Slides from Session 2: E-safety

SLIDE 4: You don't need to be an expert to help your students become safe, responsible, and productive users of technology- you play a crucial role in guiding young people to navigate life offline *and* online. You can make more of a difference than you might know! In this session we're going to be talking about internet and cyber safety and how these fit under the umbrella of digital citizenship.

SLIDE 5: NEED TO EXPLAIN THIS TERM When we break down the term digital citizenship, we are thinking about how we can be a good citizen, digitally. Mike Ribble described digital citizenship as: '*The norms of appropriate, responsible behaviour with regards to technology use.; It's really important that we guide our students in this area- at school we often have safety measures in place so children can't access unsuitable areas but what happens when they get home? Children have opportunities to explore outside of these protected platforms: they are* connecting, sharing, creating, and viewing outside of the classroom and they need to be aware of how to protect themselves and others

SLIDE 6: The concept of privacy is continuously changing with the advancement of technology and our association with social media. We're all witnesses to how some children are now sharing huge quantities of their lives with online followers and 'digital friends.' As teachers, we're responsible for discussing online privacy issues with our students, it might be a good idea with older students to have a debate about their opinions about having the right to a private life. What do you think?
(activity about how technology impacts our lives, positives and negatives. What information do you tend to share?)

SLIDE 7:

1. Integration is about giving students an opportunity to gain real-world experience. Use platform such as blogging for older students. Think about how you can incorporate some authentic, public experiences into your classroom program, even if it's heavily moderated and teacher-controlled initially. Why not highlight research and media literacy skills? Establish the norms for communicative and collaborative skills by giving group projects and allow them to give feedback online- would they say the same things online as they would face-to-face? Model digital citizenship through social media.

2. Storytelling:- it's not enough to tell students the dos and don't, we need to embed these by putting them into real-life scenarios so children will remember. Questions such as: if you saw someone cyberbullying or making unkind comments what do you think you could do to support the person being bullied? Stop and talk to an adult, block the person and screenshot the offence. If you were sent an email telling you that you'd won £25,000, how could you check it was genuine? Check the email address, perhaps search on a search engine to find out if others have acknowledged it is a scam.

3. Community – COVID-19 has emphasised the importance of a digital community, involving both students and parents. The students need to know they have trusted adults and peers that they can go to if they have any issues and the same message about e-safety is reinforced both at school and at home. ASK STUDENTS IN LECTURE: Think about the communities you have been part of during the pandemic-

have you used Microsoft Teams? Zoom? How have you communicated with your students? What safety measures has your school taken? Do your students know how to use these platforms safely?

4. Strategies - apart from teaching students what we *should not do*, we need to equip them with practical strategies so they know *what to do instead. Need to build a practical toolkit- students need to understand copyright- not just using any image from Google. Children need to understand not to share their personal information (YAPPY), need to create stronger passwords, we want children to understand what information is inappropriate and unsafe and we also want them to think about their digital footprint.*

SLIDE 8: Explain internet safety tips

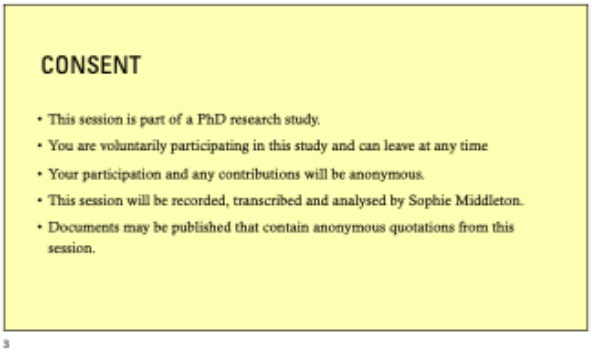
SLIDE 9: Discuss YAPPY

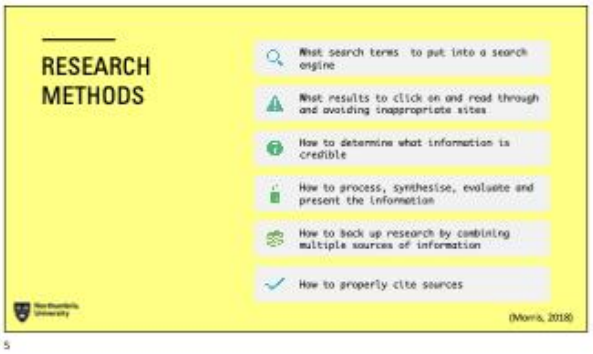
SLIDE 10: Your digital footprint and online reputation is so important and is often ignored. You really need to take this seriously as a professional and to make sure you discuss this in the classroom. Any digital and online activities, your digital actions and any online contributions and communications on the internet are recorded and so we need to be sensible and protect and shape our digital footprints in a positive way. When it comes to digital footprints we have some control but not always.
Thinking about digital software and the advancement of technology, images can be altered and adapted. Data is stored and accessed without our knowledge. Words can be misquoted or taken out of context or intentions can be misread. Personal communications and interactions can be shared and we can be tagged in posts and photos when we haven't given our consent or permission. From this, we don't always have control.
Our digital footprints carry quite a weight and some of us don't even realise it! Our future employers can use our digital footprints to make judgements; often character judgements but there may also be an expectation that a portfolio of work might be available. Because of this, we really need to think about what is shared and our students need guidance in both the online and offline world. Young students have limited experience and maturity and don't always take what they post online to be something they'd be happy with in 10,20, 30 years time.

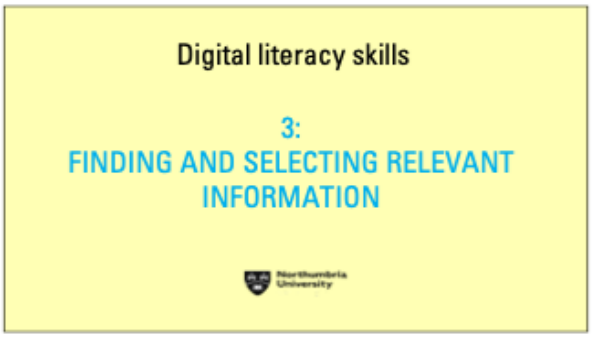
We need to remember that when we visit websites, search and interact online, a trail of information is left behand and these can be searched or shared. Our digital footprints can be both helpful and harmful to our reputations both now and in the future so remember that once online, things can exist forever even if they are deleted. Because of this, you really need to think before you post online. The personal information and opinions you share with one person can then be shared with a larger audience, think about who else might be reading.
It might be a good idea to google your own name to see what others will find out about you! Just remember that you can keep certain personal details private, any old or inactive accounts should be disabled or deleted so they don't come back to haunt you! Finally you must also think about your association with the digital footprints of others, both whether they are appropriate but also thinking about their privacy, remember to ask before tagging others into your opinions and photos.

SLIDE 11: Useful resources, (explain why you like them.)

Appendix 10: Slides from Session 3: Finding and selecting relevant information

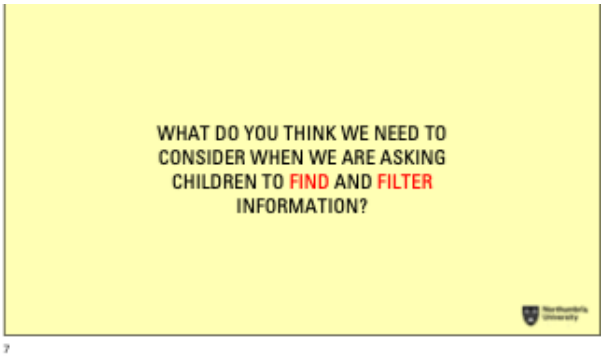


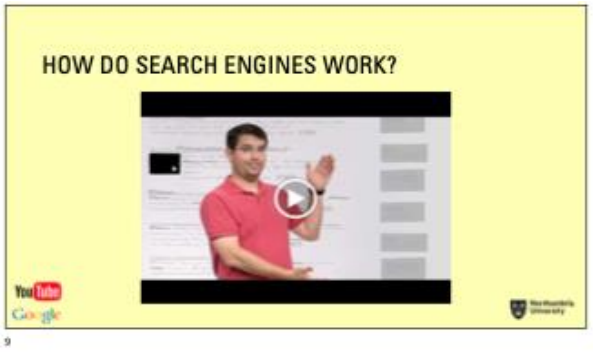


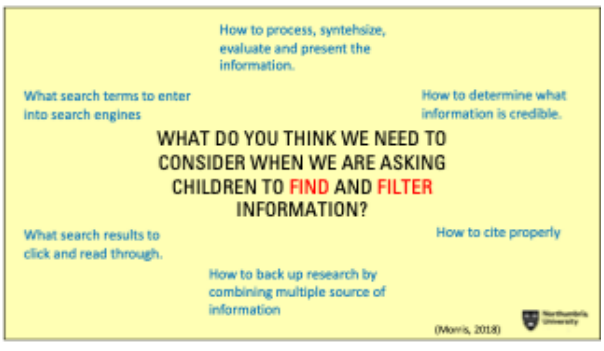


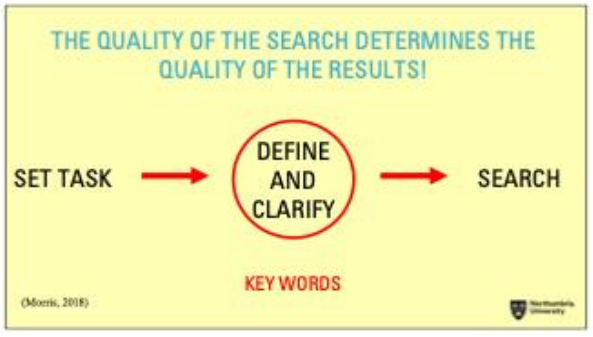
Appendix 10.1: Slides 2 and 3 from session 3

Appendix 10.2: Slides 4 and 5 from session 3



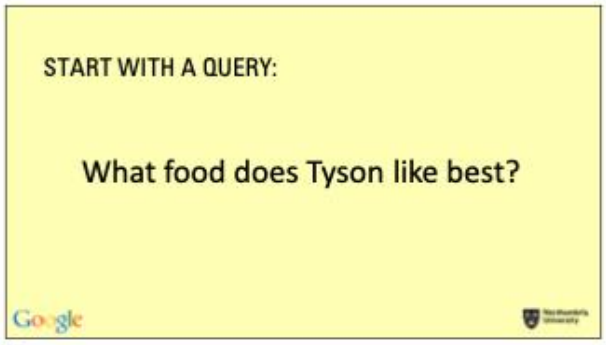






Appendix 10.3: Slides 6 and 7 from session 3

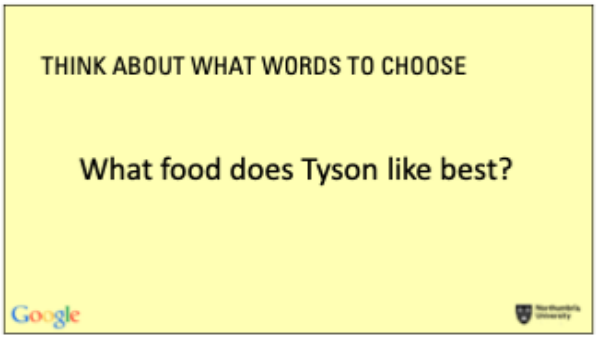
Appendix 10.4: Slides 8 and 9 from session 3



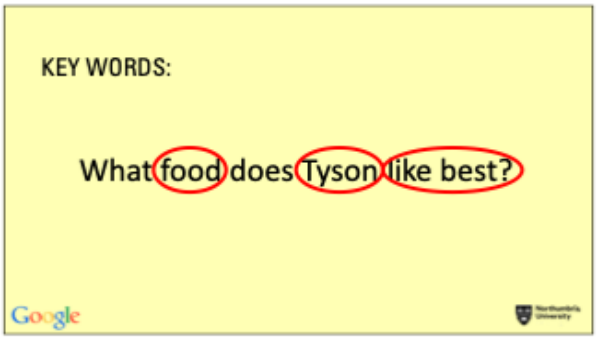
11

5

Appendix 10.5: Slides 10 and 11 from session 3



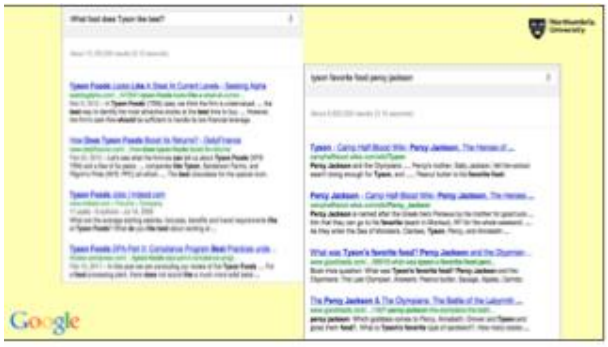
13



Appendix 10.6: Slides 12 and 13 from session 3

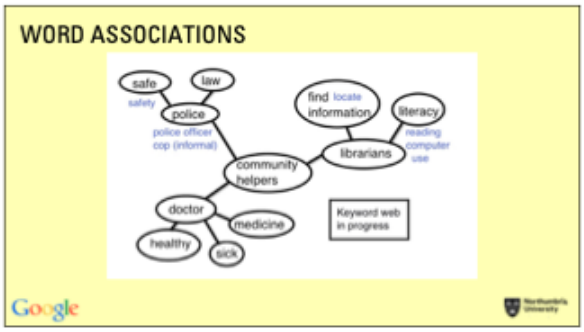
15

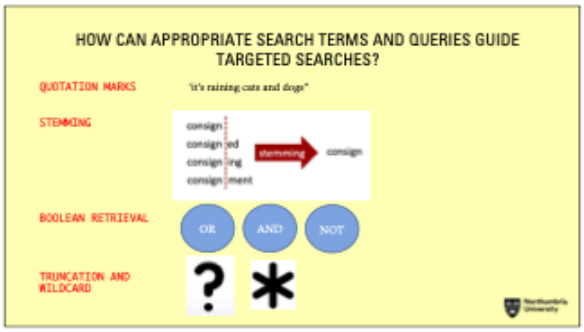
Appendix 10.7: Slides 14 and 15 from session 3



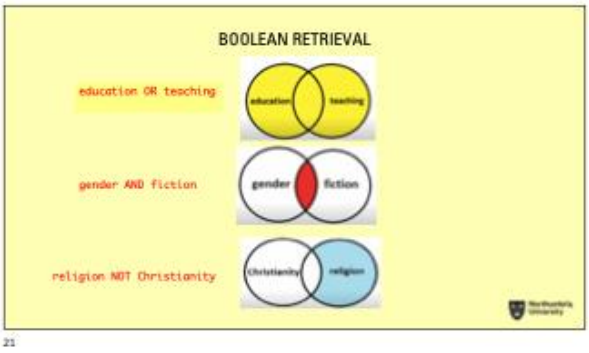
17

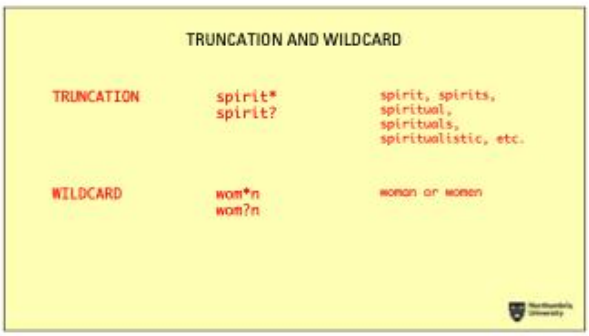
Appendix 10.8: Slides 16 and 17 from session 3



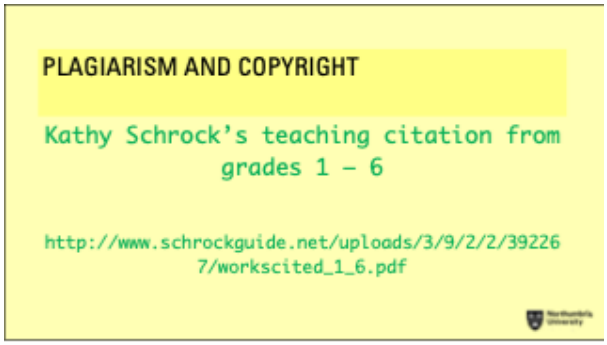


Appendix 10.9: Slides 18 and 19 from session 3

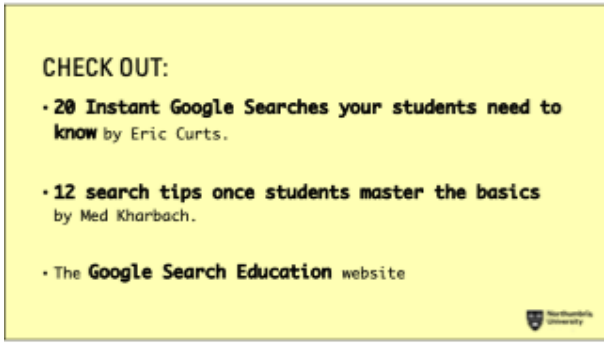




Appendix 10.10: Slides 20 and 21 from session 3



Appendix 10.11: Slides 22 and 23 from session 3



Appendix 10.12 Slides 24 and 25 from session 3

Appendix 11 Script for Slides from Session 3: Finding and selecting relevant information

SLIDE 4: I think the best way to do this is to drill information literacy skills into children from a young age and continuously build on these skills, we can do this by using mini lessons regularly. It is essential that we provide lots of opportunities in school for children to practice these skills and to give them feedback. The most important factor that teachers seek to improve their own searching skills- it's easy to stick with old habits! Thinking about using search engines, it's really important to use child-friendly ones for the younger children (activate SafeSearch on Google) but it might be an idea not to have as many school firewalls for the older children as it can provide a false sense of security. Going back to our session on e-safety perhaps we need to expose the children to some of the risks of the internet so that they'll know what to do when inappropriate information is available.

SLIDE 5: Once a task has been set then you need to identify what you're going to be looking for and refine this by using key words. Practice using this sentence: I want you to find me some information about historical dances. From this we can identify the key words are historical and dances. Need to understand that both key words need to be entered into the search engine at once. This is a very vague search area so perhaps consider using synonyms or focusing on areas or fields withing these key words. If you're setting a project task, you might consider having class discussions or groups where they can brainstorm key words, consider synonyms and mindmapping. You could also generate your own questions from this task which would focus on specific areas and help to fiter your searches. Begin a simple search using important keywords, if the results aren't what you want, make the terms more specifi- I find that you can often get clues from your initial search using those simple keywords or in the search suggestions or "people sometimes ask" section on Google. Try to use your best guess with spelling but don't worry about punctuation. Everyone's search results will be slightly different depending on their browsing history. If you want your key words in an exact order you can use quotation marks e.g. "it's raining cats and dogs."

SLIDE 6: We use more sophisticated search strategies so that we can exactly what we want faster. We use quotation marks to filter the results from the huge index of the search engine, rather than the search engine pulling results that contain the key words, it will search for the exact phrase making it easier to find what you want. Another way to filter your searches is using the Boolean retrieval method, which uses operators that connect your search terms: OR AND NOT.

SLIDE 7: where we use capitalized terms AND to filter results with combined terms e.g. "cats AND dogs," or using OR , which broadens the search more as it gives results containing either or both keywords. It's really good for synonymous words, e.g. education OR teaching. It's a great way to start a search. AND works in the opposite way, where it gives you results that contain both terms so it will give you fewer results and is really good for connecting unrelated results, e.g. gender AND fiction and will only retrieve the results that contain both terms. Finally NOT retrieves results that contain the first term and excludes results that also contain the second term so it's really good for getting rid of irrelevant results. E.g. your researching religions but aren't interested in Christianity you would search religion NOT Christianity. You do need to be careful because some results that would include Christianity might be relevant to your results but it's a good start

SLIDE 8: Truncation symbol is usually * or ? need to consult help and tips of the search engine or database you're using. The symbol can replace one letter or multiple or infinite letters. It's really good for searching related words that start with the same letters. For example spirit with an asterisk or spirit with a question mark will retrieve reults that contain spirit, spirits, spiritual, spirituals, spiritualistic, etc. Wildcard is slightly different, the symbol replaces letters within a word, e.g. wom*n or wom?n retrieves woman OR women.

SLIDE 8: So, you've entered your quality search terms and now you need to be able to filter the result given. How do you know which are quality sources? Need to look beyond the first results, the organization of results doesn't mean that they are the most relevant or useful sites because the search engine's page rank algorithm is extremely complex. Need to remind students that many websites will use search engine optimization (persuading search engines to recommend your content) to improve the visibility of their pages.

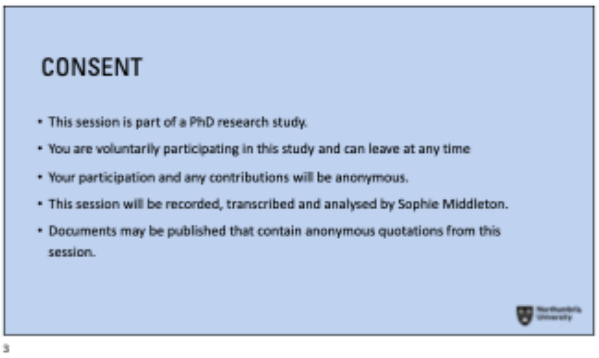
SLIDE 9: It's really important to know what each of the components of a search engine mean. Looking at the URL and the domain is one of the ways to decide whether the source seems reliable- does it look like a well-known or approved site? When looking through the results, any that stand out might want to be opened in a new tab for easy access later. You can do this by right clicking on the headline and then choosing the 'open link in new tab' option.

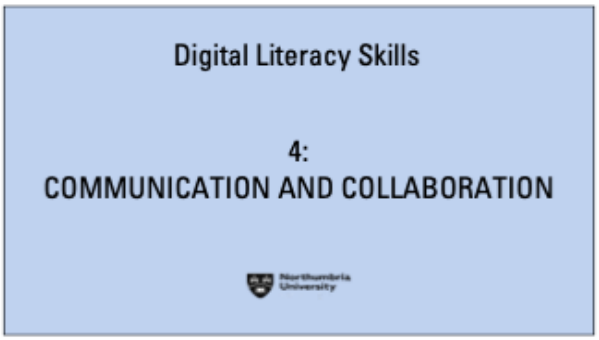
SLIDE 10: Once you have opened the link you need to evaluate the content to see if it offers the information needed. Next you need to skim read- depending on year groups and abilities, you need to make sure that your students use sites that match their reading levels. Looking back at searching methods, children should know how they can search for specific information, you can often use a search box within the website to scan the page and see if the information might answer the question. Skimming the page try to evaluate whether the site might be useful, if not, go back to the search results and alter search terms by making them more descriptive or specific. If it does answer the question, next need to look at whether the author/site is credible- check of the author is qualified, etc. Next you need to determine whether this source meets your needs, think about the design and purpose- sometimes cluttered, difficult to navigate, or sites that look amateurish might be worth avoiding. Information that is current enough might lead to other relevant sites. Remember back to our e-safety session? Remind yourselves and students not to believe everything you read! Remind children to cross-check information by looking at 2-3 different sources.

SLIDE 11: Now that you've found the required information there is a temptation just to copy and past into their own work… it isn't their work! Students need to be informed about plagiarism and copyright. Plagiarism is taking someone else's work and presenting it as their own. Perhaps talk about ethics and legalities and come up with a class definition. They can use other work as long as it is cited properly; saying who it is by and where it is from. It's best to emphasise how to put information into their own words, paraphrase or summarise. This still needs to be cited! Use this website to look at Kathy Schrock's PDF document that demonstrates how you can progressively teach citation from KS1-KS2.

SLIDE 12: Check it out! The Google Search Education site is particularly good- it's a fantastic resource with lesson plans for different stages: beginner/intermediate/advanced and also has slideshows and videos.

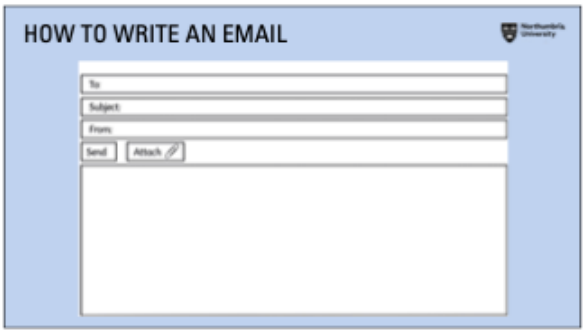
Appendix 12: Slides from Session 4: Communication and collaboration





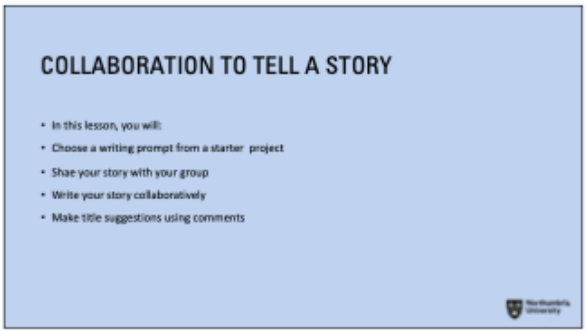
Appendix 12.1: Slides 2 and 3 from session 4

Appendix12.2: Slides 4 and 5 from session 4

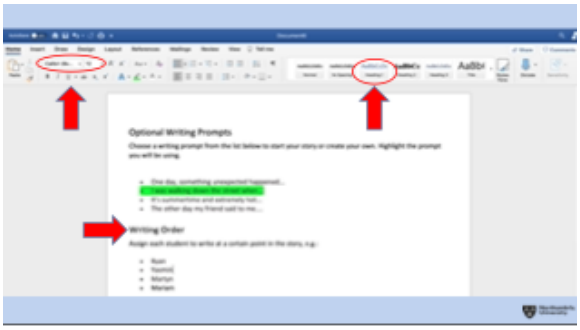


Appendix 12.3: Slides 6 and 7 from session 4

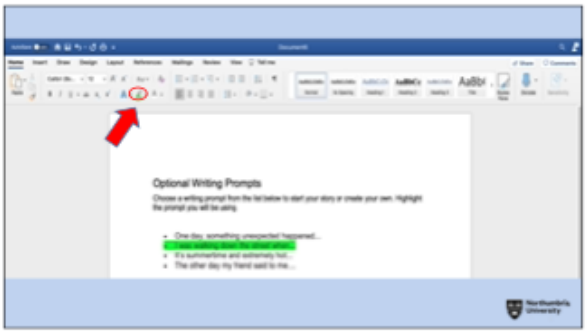
Appendix12.4 Slides 8 and 9 from session 4

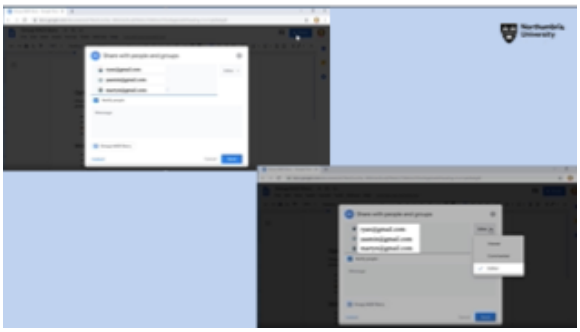


11



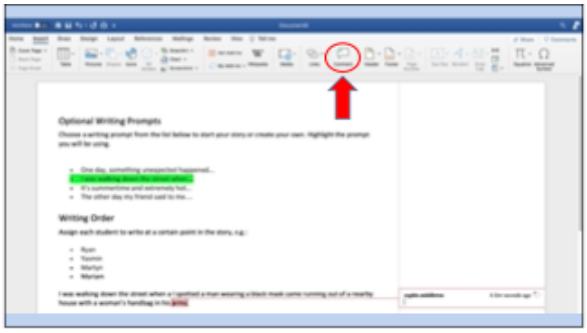
13



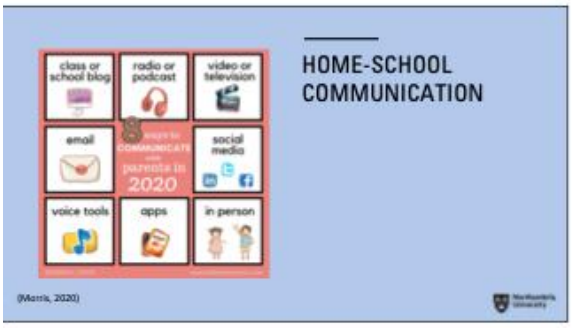


Appendix 12.5: Slides 10 and 11 from session 4

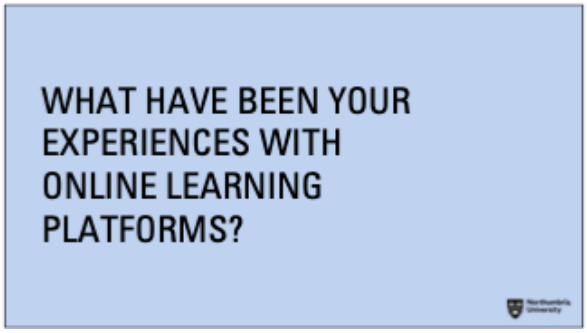
Appendix12.6 Slides 12 and 13 from session 4



15



17



Appendix 12.7 Slides 14 and 15 from session 4

Appendix12.8 Slides 16 and 137from session 4

Appendix 13: Script for Slides from Session 4: Communication and collaboration

SLIDE 4: When we think about first world communication today, most of it is now digitalised- look at us now! We are interacting using technology. And now in this global pandemic, we're grateful to be able to do so. Communicating and collaborating using digital resources has become the foundation for remote learning.
Digital communication means to effectively communicate in digital medias and spaces. We can support learning in this way through webinars and tutorials using platforms such as Zoom, Loom, Microsoft Teams and Panopto and sometimes pre-recoding lessons on these platforms. We're also contacting parents and students via, emails, messaging services like WhatsApp, phone conversations and on e-learning platforms like Purple Mash. You're also able to communicate with parents in this way.
This current climate has provided an opportunity for us to support both teachers, learners and their parents to be able to communicate effectively in academic and professional contexts and to understand the norms in different settings. I spoke to one teacher and their school amended their policy so that children had to attend their online classes in formal attire as a lot of srudents had take to wearing their pjs. I think that this amendment will help students to understand that they need to respect others in public communications and to maintain privacy in private communications.

SLIDE 5: Digital collaboration is closely related to digital communication but is more about participation in digital teams and working groups. It's about discussion, the sharing of resources, web pages, digital writing and presentations. Again, we have a perfect opportunity to support learning in collaborating using shared digital tools and media, and to work effectively across cultural and social boundaries. Hague and Payton
Say that we want our 'students to be able to work successfully with others to collaboratively create and share meaning and understanding. To develop the skills of teamwork, to be able to work together when using technology and to understand how technology can support collaboration both inside the classroom and in the outer world.' In my experience as a teacher, one of my colleagues taught a Year 5 class who were communicating with some students in a school in France. They ended up collaborating to design and deliver a music presentation/ assemble that was delivered to both schools. Not only did they work together for this project but they also worked together to develop their own language skills.

SLIDE 6: Online communities are great places to communicate and collaborate with people that share common interests, opinions and goals in a virtual space. These communities are really helpful for both yourselves and your students. Think about blogs and other forms of social networks you use for both personal and professional reasons. Do they support you? Do you actively participate?
In the current climate, we've realised that it can be really useful to bring your students together in one platform to discuss learning content, apply their learning and to ask questions. The online communities that schools are choosing to use allow the children to communicate with both their teachers and classmates, sometimes parents and you're able to keep a check on different needs and interests. I think COVID-19 has brought to light some of the difficulties of managing behaviour when teaching behind a screen; teachers have recognised that they need to be seen as the leader of this space and also show the children ways that they can communicate and collaborate with their classmates. How might you do this?

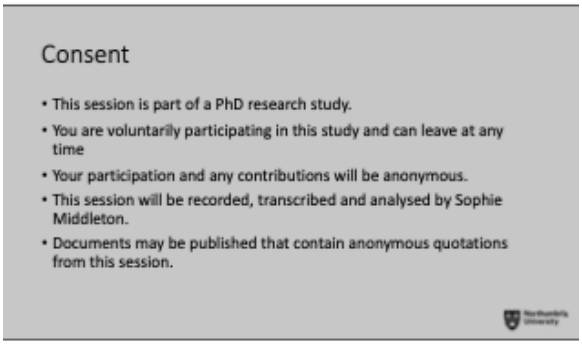
We should be trying to encourage our older pupils and ourselves to be using online learning communities, ensuring they apply their e-safety skills. Social learning communities allow us to learn from teaching others and asking questions and we can get feedback faster.

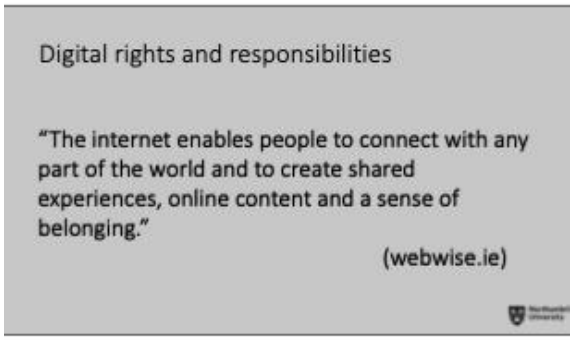
SLIDE 7: Online learning is so important, and you'll recognise that it's completely different from teaching and learning in a classroom. It requires a different set of skills. I've spent the majority of 2020 talking to practicing teachers about the strategies and tools their schools have been using to communicate and collaborate with both students and parents. They've acknowledged that there has been some thorough investigations into what the best ways to approach home-school communication.
Looking at this poster from Kathleen Morris, we need to consider using bogs- class blogs can be a virtual window into your classroom and is an easy way to connect with families. It allows parents to see what has been happening and gives them an opportunity to talk about these activities with their children. It's good to try to encourage the parents of your class to leave comments and can also provide a pathway to involving your parents in school activities and communication with other parents. You might have noticed that school blogs have become even more popular since lockdown- a lot of SLT feel that they can help to create a whole school culture that values strong lines of communication. Remember it's compulsory for British Schools to have a website and I feel that this has been a priceless opportunity to show the value of this tool.
I've not been one to use this myself, but radio and podcasting are also a great resource so that parents and students can listen to lessons on-the-go and at a time that is convenient to them. Kathleen suggests that inviting students to lead a production allows children to explore and develop literacy skills- reading, writing, speaking and listening. It's also going to develop their digital literacy skills- editing, researching information, collaboration, etc. Use search engines to see this in action!
As students, you'll have a substantial level of video learning and I think COVID-19 has placed a huge emphasis on the importance of live and pre-recorded lessons. We're using Teams and Panopto but what other platforms could you use? YouTube?
Most teachers I've spoken to have mainly been communicating with parents via email because it's one of the most used forms of communication and can be accessed or responded to at convenient times. You can send personalised emails and even newsletters.
Now, social media. Many parents do use social media and it's really common now for schools to have facebook, twitter and other social media accounts. I'd expect that as a teacher, you'd have a personal account but this would need to be privatised and be aligned with school policies and the account used to communicate with parents is a school account. It's a great way to bridge the gap between home and school BUT this is more focused on communication with parents because most platforms have a 13+ age restriction.
There are many communication apps designed for schools, I'm sure you've heard of apps like SeeSaw and Class Dojo, where your subscription allows you to message between teachers, parents and students and also measure attendance and behaviour through rewards systems and also monitor engagement and assessment through completed activities.
Finally, we need to remember that outside of this pandemic, our goal is to enhance our communication with parents that we aren't always able to see in person but we need to remember that we don't want to use technology to replace human contact!

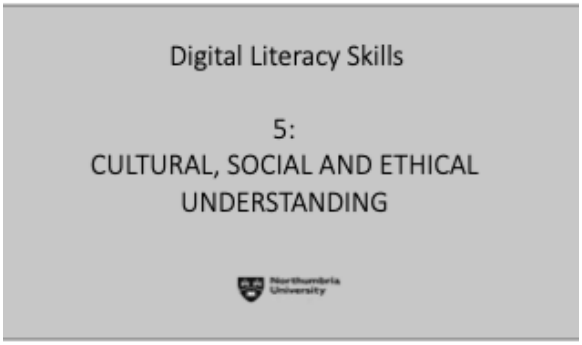
SLIDE 8: There are some amazing tools available online that aim to encourage teamwork and collaboration. I'm going to show you some example on Wabisabi learning: https://wabisabilearning.com/blogs/technology-integration/6-online-collaboration-tools-engage-students

Using these kinds of tools for online collaboration can really increase motivation and engagement. I think as a teacher, it's really important for you to keep up to date with these apps, you might be able to do this by participating in blogs and online communities!

Appendix 14: Slides from Session 5: Cultural, social, and ethical understanding



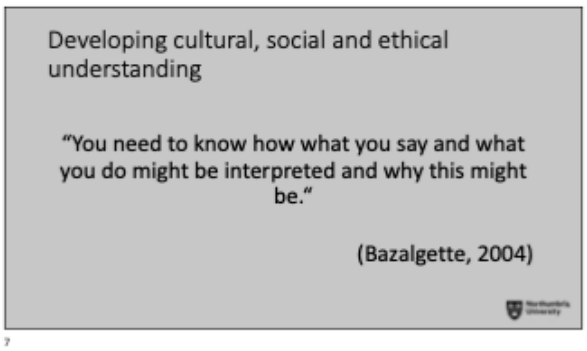




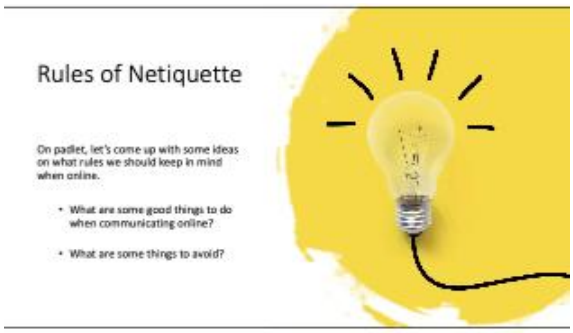
Appendix 14.1: Slides 2 and 3 from session 5

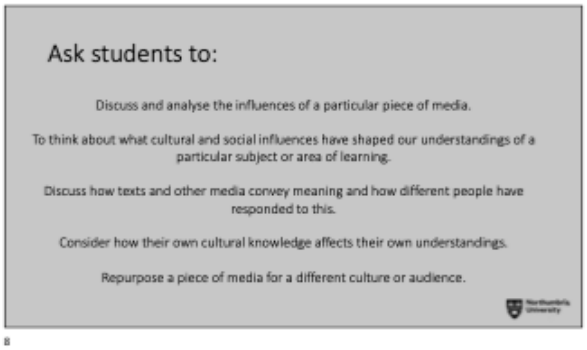
Appendix14.2: Slides 4 and 5 from session 5

Appendix 14.3: Slides 6 and 7 from session 5



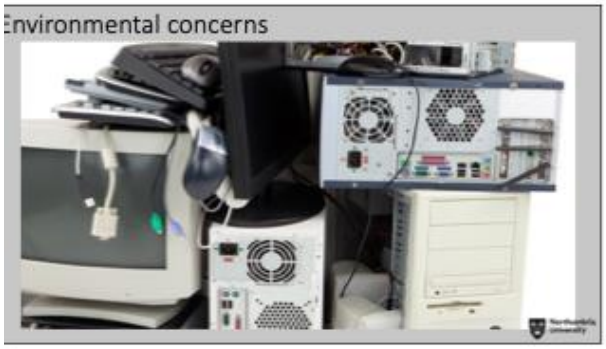
Appendix14.4: Slides 8 and 9 from session 5

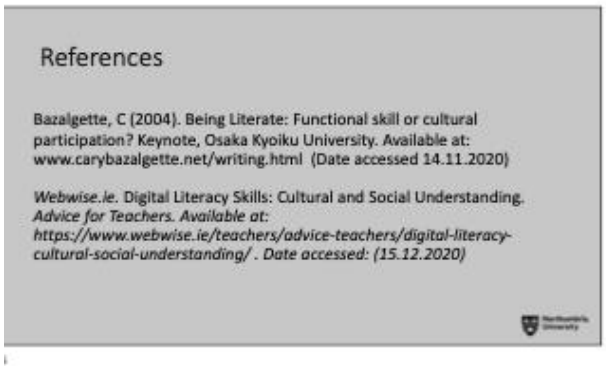




Appendix 14.5: Slides 10 and 11 from session 5

Appendix14.6: Slides 12 and 13 from session 5





Appendix 14.7: Slides 14 and 15 from session 5

Appendix 15 Scrip for Slides from Session 5: Cultural, social, and ethical understanding

SLIDE 3: Today we're going to be talking about the legal and illegal implications of technology and digital content use, understanding netiquette and the awareness of technical cultural differences between cultures when we use technology. We need to appreciate cultural limitations and boundaries.

SLIDE 4: Digital culture is a culture shaped by digital technologies and the internet. We've moved to a culture where technologies have now enabled more networked, collaborative and participatory forms of culture. When we enter a new culture and in this case we see cyberspace as a new culture and the internet as its own culture, we're all liable to commit social slip ups.
When we think about digital culture we need to think about digital responsibility. We need to remember that with great power comes great responsibility! Social media links us to the outside world; we can interact with like-minded people in forums, blogs and social media platforms.

SLIDE 5: There should be a clear distinction between the 'virtual' and the 'real' but this can often be misleading because even though virtual environments don't have a physical presence, doesn't mean that they aren't real.
If we think about our online presence, cyberbullying is very real. Just because something is said without face-to-face contact doesn't mean that the abuse has less presence. Virtual worlds are an online culture that sometimes imitate the offline world.
Virtual reality is a computer-generated simulation that can be similar to or totally different to the real world. What are your associations with virtual reality? Video games using headsets etc are a form of virtual reality and it's often used for educational purposes in military or medical training. Some schools have the resources available that you can use it in your teaching. As I'm sure you'll know there are frequent debates about the pros/cons of using VR equipment with children.

SLIDE 6: If we're thinking about digital culture and the imitation of physical reality, it's essential that we guide children so that they can understand cultural, social and ethical situations. They need to participate not just socially and culturally but also understand ethical consequences and think politically, economically and intellectually. Cultural, social and ethical skills are a component of digital literacy and so we need to equip our students with language and context for their digital literacy.
I read a really interesting analogy from Cary Bazalgette (2004) about moving to a new country. She said that if you want to fully participate in the life of this new country, you need to understand much more than the simple mechanics of the language that is spoken there. You need to know how what you say and what you do might be interpreted and why this might be. You need to understand that the same actions can have different meanings in different cultures and you need to understand the sorts of practices that take place in different cultures. You need to recognise that there are certain cultural, social and historical influences that shape your understanding and learning.
This is really important, we need to consider perceptions and how others' perspectives are informed by cultural heritage. It's important that we understand that many things that might appear to be neutral or natural are in fact created by particular social and cultural

understandings and can often influence or manipulate by positioning readers in different ways.

SLIDE 7: Cultural and social understanding underpins most of the activities we undertake to support our students' digital literacy skills and development. We are encouraging students to create their own digital content and communicate with others. In this, we are constantly drawing on cultural references and their experiences of digital media. With any type of media, you're influenced by the style of texts, the use of photographs and other images and sounds that are experienced in other cultures. Their imaginations will be rooted in cultural experience!
Using technologies in our classrooms provides an opportunity to make links between school learning and popular culture. It's part of your job to support and encourage your students to reflect on and critically examine digital media such as websites, photos, films, etc. to try to make them understand that the way we create and communicate meaning is affected by our cultural understanding and experiences.

SLIDE 8: If we're going to be respectful and ethical of different societies and cultures, we need to have network etiquette or 'netiquette.' Netiquette is a set of rules for behaving properly online. As I said earlier, when you enter into a new culture you need to be aware of social differences, misunderstandings and offences. We need to remember that even though we're communicating virtually, it is with real people! Rules should include using real life behaviour, being respectful and forgiving, respecting other's privacy. There are thousands of of examples of netiquette posters available online, it might be a lesson idea for class to create their own.

SLIDE 11: Thinking about being respectful and following rules of behaviour we also need to think about ethics. Computer use in the UK is widespread and new technologies have provided so many benefits to our society but it also raises various ethical, legal and environmental concerns. What do you think some of these might be? Issues such as cybersecurity, mobile technologies, wireless networking, cloud storage, theft of computer code, copyright and hacking.
We know that ethical are moral principles or rules that govern a person's attitudes and behaviour and these apply to use of technology as much as they do to other things in our lives. Some ethical concerns in computing include public safety concerns. For example, research into driverless cars coming to be used in the UK- the designers have not only to ensure the safety of passengers but also of other drivers and pedestrians. We also think about the security of data- we're all familiar with the data protection act. Attempts at hacking into systems to gain access to people's data for social media accounts, phone numbers and networks are all prone to phone hacking.

SLIDE 12: Computer use has brought new concerns and new crimes. With the rise of the internet, computers are increasingly being used for illegal activities and unlawful ways. Issues such as allowing someone to illegally share personal data, helping to steal financial information, such as credit card or bank account details, helping to illegally copy and distribute files, tv programmes and music and extorting information and blackmailing someone are all criminal acts!
SLIDE 13: I'm sure you're all familiar with the environmental concerns relating to technology use. The manufacturing and use of computers have had a negative impact on the environment. Metals and plastics are used to manufacture components, while energy is expended in distributing equipment and using it.

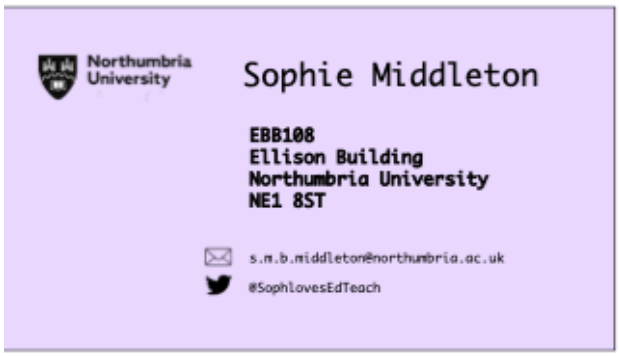
Many computers, such as web servers, domain name servers and data centres, need to be left running continuously. This requires lots of energy to maintain. Additionally, businesses, organisations, schools and homes all now have greater access to technology.
Many computer components are either hard to recycle or contain toxic materials, such as lead. Also, users discard ICT equipment quite quickly:

- people have new smartphones every couple of years
- many organisations replace computers after three or four years
- many people replace older technology before it fails simply because they perceive it to be old-fashioned or out of date.

All of this means that computers have a heavy impact on the environment, which is unlikely to decrease in the near future. However, many devices are now more power efficient than their predecessors and some companies have come up with innovative ways to save power.

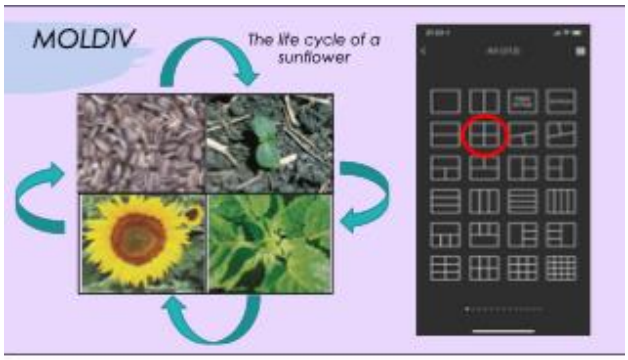
Appendix 16: Slides from Session 6: Creativity

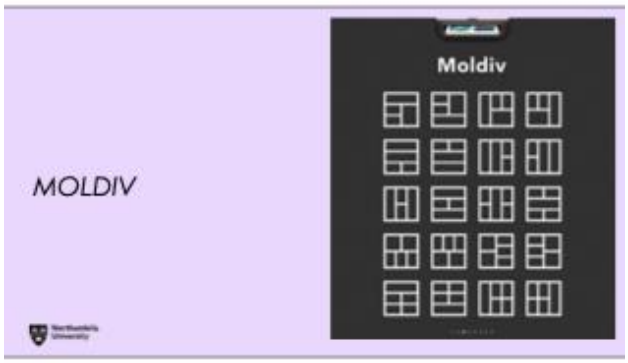
2



Appendix 16.1: Slides 1 and 3 from session 6

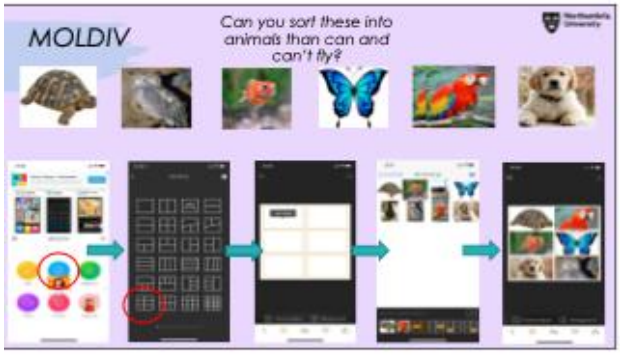
Appendix16.2: Slides 3 and 4 from session 6

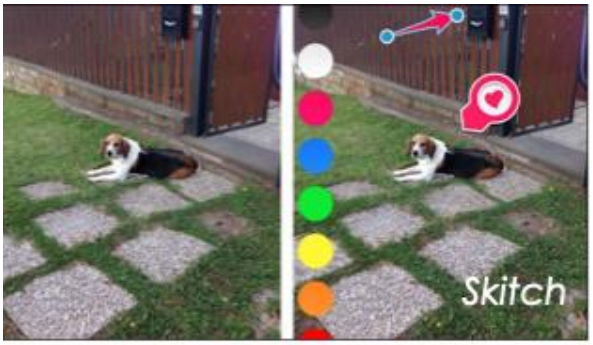


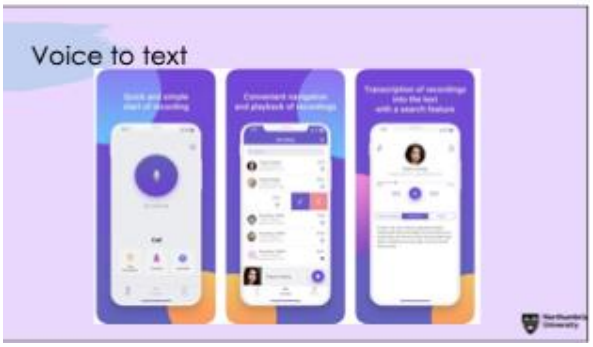


Appendix 16.3: Slides 5 and 6 from session 6

Appendix16.4: Slides 7 and 8 from session 6

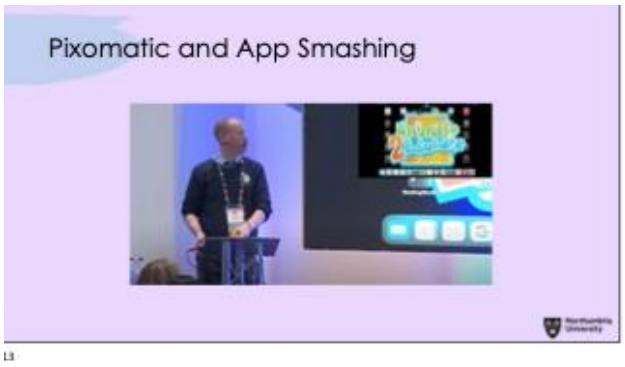






Appendix 16.5: Slides 9 and 10 from session 6

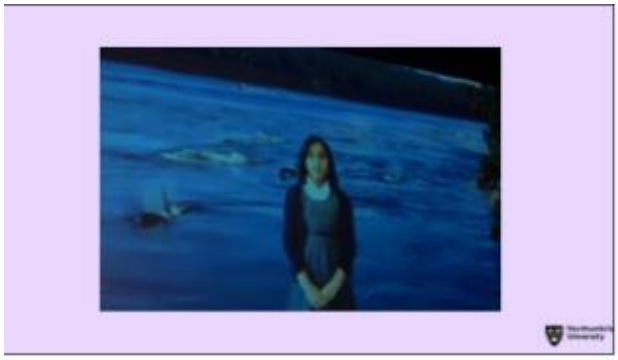
Appendix16.6: Slides 11 and 12 from session 6



Appendix 16.7: Slides 13 and 14 from session 6

Appendix16.8: Slides 15 and 16 from session 6

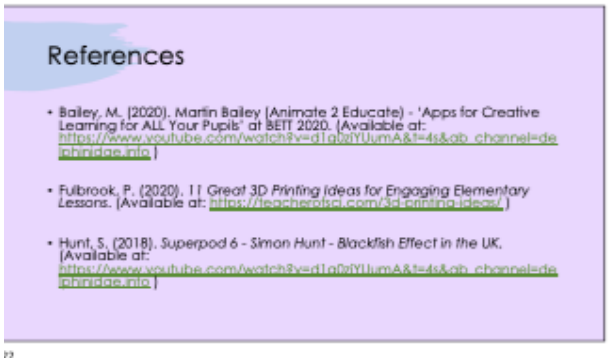
17



Appendix 16.9 Slides 17 and 18 m session 6

Appendix16.10: Slides 19 and 20 from session 6

21



23

Appendix 16.11 Slides 19 and 20 m session 6

Appendix 17 Script for Slides from Session 6: Creativity

SLIDE 4: We can use technology and involve digital resources to be more creative in our teaching practice and to try and enhance different lessons and activities. It can be really good for motivation and engagement for all learning types: visual, auditory, reading/writing and kinesthetic. I think being a more creative practitioner using digital support tools makes a really fun and memorable learning experience. We all tend to use IWB in the classroom but why not get your students to collaborate using learning apps? Get them to work on a story in a literacy lesson and then video themselves portraying the characters? Depending on the availability of resources, the possibilities can be endless.

SLIDE 5: I'm going to talk through some of the apps that are available and give you some suggestions about what you might use them for. If you have any ideas or have any good examples, I'd really appreciate if you could talk about them in our discussion or include them in our group chat once I've finished. As you can see from the images on the screen, we're going to think about collaborative activities and tools such as greenscreen.

SLIDE 6: So I'm going to start off with an app called MOLDIV, which is a photo collage app. I'm choosing this one because it's free and particularly easy to use. I'm sure you know there are huge amounts of free photo collage apps available on your apple or play stores. I'm sure you use them yourselves to create pictures that you put on your social media. There are hundreds of different templates that you can use so let's take a look at some ideas on how you can use them in teaching.

SLIDE 7: One idea is use a template for the children to demonstrate some instructions, like the life cycle of a sunflower. You could use the image of the 4 squares and your year 2 students could show the order of instructions and then write about each step beside it. It would be really good if the images could be of themselves.

SLIDE 8: You could even get some of your older students to do some research using the internet on a certain topic, such as the Victorians. You could ask the children to create a collage to show the 6 things they think are the most important results. You could take your tablets on a school trip and the children could then take pictures and present their experience after, using a collage. For younger students you might get them to take photos of pages in a book and put them into a sequence. For your younger children especially, Apps like this will not only develop digital literacy skills but can also help their motor skills. You might even want the children to go around school and find for example red

things, squares, etc. and take photos and then present them in collages. They will enjoy it because they can sometimes choose the collage template.

SLIDE 9: You could even set a task for students to search for animals that can and can't fly. They could then save images of these animals and could sort them into these categories. Get them to use the left line of a template to show animals that fly and on the right animals that don't fly, etc, etc. You can make it as simple or as complicated as you want. It is basically the same as cutting and sticking images without the mess! It's completely basic and free yet it can be used for so many things.

SLIDE 10: I'm a big fan of a QR code treasure hunt and it was something I often did in my own teaching practise. Why not use a QR code reader to link to questions and hide the images throughout the classroom or throughout the school. This treasure hunt can be used for the children to answer topic questions, like I said or suggest activities the children need to complete. It's great for both mental stimulation and physical activity. You don't even need to use them in treasure hunts, you can use them just on a worksheet. There are loads of different apps to generate QR codes but I suggest using Flowcode or classtools.net.

SLIDE 11: Now we're going to look at Skitch. This an app that allows you to annotate, or doodle all over photos. (Show app). You don't just need to use it to annotate images, you could take a photo of a text document and the children could use the app to highlight areas of text, like identifying adverbs, inserting adjectives, etc. Looking this image, you might want to change your highlighter colour, you might was to insert text, change the size of the text, etc. I'm sure you know how to do this but these are great skills that we need to show our students. It's a great tool because we might have some children that aren't able to type, perhaps due to age group, SEN or EAD. Next to the text box is a microphone which you can do voice to text. (Demonstrate). This is a tool available on lots of different apps.

SLIDE 12: Voice to text is a great tool and there are many apps available, it often has to be paid for but when you're struggling in a classroom with a child with letter formation difficulties and you don't have a TA supporting you, you could have that child using voice to text and then copying the text. Yes it's time consuming but is often helpful in the long term.

SLIDE 13: Ok, so now I'm going to show you a quick video where Martin Bailey from the North-East company Animate 2 Educate talks about using the app Pixomatic and about app smashing. **6 mins.**

SLIDE 14: There are so many apps available to practice phonics and reading. I know some of you mentioned using apps like Oxford Owl and Book Club and BBC Bitesize has some great videos, activities and lessons for teaching phonics. You can find videos on youtube that model mouth movements, you can present interactive powerpoints and practice using digital phonics activities.

SLIDE 15: Has anyone tried a webquest yet? Webquest.org describes a webquest as an inquiry-oriented lesson format in which most or all of the information that learners work with comes from the web. Webquests provide structured lines of inquiry which teach a range of skills and enable, self, peer and teacher assessment. A simple webquest will outline the aims and objectives of the task, provide details of the processes that the pupils will need to work through in order to complete the inquiry and make the criteria for success clear to learners.
An example of a webquest that you could use is asking pupils to create an interactive poster about any given topic, using a tool such as glogster.com. The process could involve them going to sites that provide different interpretations, or which have conflicting information. They determine what the actual facts are about the person or topic they're looking at, developing their critical reading skills, and then complete their work. The evaluation checks whether they have double checked facts, whether they've determined what is fact and what is opinion, checks how they've designed and developed their presentation etc. Its a very simple example but already its clear that there is a clear focus for the learner, that there would be objectives relating to both content and skills and that cross curricular issues relating to Literacy are developed.
If you type Webquest into google you'll find a bunch of WebQuests that are perfect for exploring and learning more, such as teachingenglish.org.uk and educationworld.com explains how to create your own webquest.

SLIDE 16: There has been an explosion of 3D printing in schools across the world. If you go to work in a school that has a 3D printer or perhaps in a nearby library, you might be able to print something off in 3D and I'm sure that your students would love it! In these sorts of lessons, the children will be encouraged to design, create and explore possibilities that most of us didn't think possible. Children can create 3D objects either by scanning a drawing or photo of something that exists such as the skull of a T-Rex.
or downloading a template of one of the thousands of objects that are already designed and put online.
Or they could design an original object using a computer-aided (CAD) modelling program.
Gone are the days of drawings and cut outs! Today, they can create the real thing. Here are some of the best activities I've found online:

- Geography lessons- printing a physical map to show landforms- such as showing the sage, the tyne and Newcastle city centre. Or different areas that surround the school.
- History lessons- creating a castle using geometric shapes- it involves measuring, geometry and coding. You could also create a model of a Shakespearean character in full attire. https://teacherofsci.com/3d-printing-ideas/
- Science lessons- if you were studying the anatomy of insects and arachnids, children would identify the features and then design a bug that would adhere to the required features of each.

You could create lessons that are about human organs, dinosaurs and create puzzles.

SLIDE 17: I've attended a conference called ICT for Education annually for the last 5 years, it's usually held at St. James' Park and it's wonderful for getting ideas about hardware and software and also guest speakers tend to share ideas about their use of digital literacy skills in the classroom. It's where I met Martin Bailey and another teacher called Simon Hunt. He talked about a terrific learning plan he formed from watching a documentary about Blackfish effect.

Simon had seen the documentary Blackfish and thought it fit in with his topic work on Oceans. He showed snippets of the documentary and asked his Year 6 class about their experience with whales and SeaWorld (a lot of them had been to Florida) and their opinions on what they'd seen. He asked whether they knew how the whales had gotten there and then showed them a video discussing the capturing of orcas from their natural habitat, using bombs and been taken away from the pack; their families and how they shouldn't really be taken away and put into tanks. This was a good discussion topic because it was relatable.

Simon got in touch with the whale and dolphin conservation (WDC) and the children did online research to find data, information and posters, etc. The class talked about how they could raise awareness about this mistreatment, starting just within school and it developed from there.

SLIDE 18: They started by writing personification poetry by watching videos to be able to think about their situation. The children worked together sharing ideas and created a poem together. They used a green screen and different children wrote out different parts of the poem.

SLIDE19: After they had collaborated as a class and written the poem, they created a video. **2.5 mins.**

I've mentioned it before and I think lots of children get excited at creating a video because it can be so much fun and incorporates an array of skills. Apps like iMoviePoem clip. From there, they put it on their school website YouTube channel and they got responses from all over the world and a aquamarine park in France got in touch and asked if it could be translated into French. From this, it was shown in schools all over the world. This lead to a class skype with one of the researchers from the documentary and created questions to ask them. 10 children from the class went to the European Parliament and had gathered signatures from a petition to present to the Parliament in support of a bill to protect orcas in Europe!

SLIDE 20: Now I know that's a hard act to follow… but would anyone like to share any of their ideas or experiences with using technology creatively in lessons?