Factors Impacting on the Integration of Digital Technology in Learning and Teaching in Educational Establishments

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Abstract

Digital technology is seen as a way of transforming conventional education. However, this transformation has not happened: digital technology is mainly used to support traditional learning and teaching. In order to transform, digital technology needs to be integrated into pedagogy. I research factors (enablers and inhibitors) that impact the integration of digital technology in learning and teaching in educational establishments.

Interviews were carried out with two sets of people: first, staff including teachers, in two Scottish local authorities who had undertaken professional learning on the implementation of Google G Suite, and second, those who developed and implemented the Scottish Government's (2016) Digital Learning and Teaching Strategy on Enhancing Learning and Teaching Through the Use of Digital Technology.

The findings indicate that two sets of factors, professional and institutional, impact the implementation of digital technology. The professional sub factors are teacher's perceptions and attitudes, curriculum and assessment and the impact of professional development on teachers' digital literacy skills. The institutional sub factors are connectivity, cybersecurity and hardware and ecological issues.

Professional and institutional factors are not mutually exclusive and can be enablers or inhibitors in the integration of digital technology in learning and teaching in educational establishments. This complex picture is best examined through an ecological perspective. The study outlines a series of recommendations to improve the integration, and, therefore, transformation, of digital technology in learning and teaching.

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Author's Declaration

"I declare that, except where explicit reference is made to the contribution of others, that this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution."

Noreen Phillips

Chapter 1. Introduction

1.1 Introduction: The importance of integrating digital technology in the classroom

The importance of integrating digital technology in the classroom has been emphasised by national and international policies and research. The Scottish Government's (2016:1) strategy on Enhancing Learning and Teaching through the use of Digital Technology (hereafter referred to as the national strategy) states:

> "Where our educators are supported through professional development, resources and leadership, digital technology can enrich learning and teaching, help to raise levels of attainment and close the attainment gap. The skilful deployment of digital technology in our schools and early learning settings will also ensure our learners develop a level of general and specialist digital skills that are so vital for learning, life and work in an increasingly digitised world."

This policy echoes academics including Vander Ark (2012) who argues that the use of digital technology in education is essential for children to excel in all of the three main domains of development: (1) the cognitive domain (thinking); (2) the intrapersonal domain (personal skills of drive and responsibility); and (3) the interpersonal domain (teamwork and other relational skills). Similarly, the OECD (2015:3) expresses: "Students unable to navigate through a complex digital landscape will no longer be able to participate fully in…economic, social and cultural life."

The emphasis on ensuring that learners are equipped to deal with the world today and of the future is stressed not just by educationalists but by business and political leaders who increasing asking schools to develop young people's skills such as problem solving, critical thinking, communication, collaboration, and self-management – "21st century skills" (National Research Council, 2012:1). These skills are seen as important because "digital learning will change the world" (Vander Ark, 2012:160). The digital sector is vital to Scotland's economy, contributing 82,700 jobs and £4.5 billion to Scotland's economy (Scottish Government, 2016:12). Vast sums of money are spent in Scotland and worldwide

on technology in educational establishments. The USA is predicted to spend $252 billion by 2020 (Escueta et al., 2017:2).

I use the definition of digital technology from the (Scottish Government, (2015:6) literature research commissioned from ICF Consulting Services Ltd:

> "any process in which the educator or learner uses digital equipment such as a computer (or a smart phone, tablet, MP3 player, or console) to access digital tools such as learning platforms and virtual learning environments (VLEs), and/or digital learning resources (such as lessons, tests, learning aids and games) to improve their knowledge and skills."

However, although I have defined the term digital technology the term itself can be understood and used differently in different contexts. It is not a monolithic term as it is the use by the user and the way a teacher applies the digital technology which is the most important aspect. Digital technology on its own can be described as neutral. Just like other forms of technology - the use and application which impact either positively or negatively on learning and teaching is the important issue. There are so many different digital technology devices used in educational establishments now, many such as tablets which are multifunctional, with different apps and software. Technology changes as such a fast rate that it is important to focus on the learning opportunities and the pedagogy (Higgins et al., 2012) rather than the actual digital technology. As well as changes in hardware there are also ever increasing changes in software. Depending which software is used it has a potentially different impact on learning outcomes.

The importance of pedagogy over technology was a point highlighted by Magenta (2017: 19-22) who developed his T3 framework which outlines the three different stages of using digital technology in teaching T1: Translational, T2: Transformational, and T3: Transcendent. The T3 framework allows teachers to evaluate their use of digital technology and gives them clear guidance using self-assessment guides on how to improve their use.

The national strategy's (Scottish Government, 2016:3) on digital technology objectives are:

> - "Develop the skills and confidence of educators in the appropriate and effective use of digital technology to support learning and teaching
> - Improve access to digital technology for all learners
> - Ensure that digital technology is a central consideration in all areas of curriculum and assessment delivery
> - Empower leaders of change to drive innovation and investment in digital technology for learning and teaching."

The strategy makes bold political statements and promises about digital technology transforming education. Many other government policies on digital technology make similar claims. For example, the Italian government promised its National Plan for Digital Schools (Italian Government, 2007:11) would be "a catalyser of innovation in Italian education". Sir Michael Barber in his foreword to Fullan and Donnelly (2015:6) states:

> "For years…we have heard promises that technology is about to transform the performance of education systems. And we want to believe the promises; but mostly that is what they have remained. The transformation remains stubbornly five or ten years in the future but somehow never arrives."

Given these claims, it is important to analyse the research on the actual benefits of using digital technology in the classroom. It is also important to research the factors impacting on the integration of digital technology to understand why digital technology has not had the promised impact.

The overarching research question posed by this study is: What are the factors impacting on the integration of digital technology in learning and teaching in educational establishments? This study therefore aims to research factors (enablers and inhibitors) that impact the integration of digital technology in the learning and teaching in educational establishments. The objectives of the study are to:

- Examine existing research on the topic of digital technology's enablers and inhibitors to learning and teaching
- Explore the experience of teachers and other key staff with integrating digital technology in learning and teaching
- Identify the enabling and inhibiting factors regarding the integration of digital technology in learning and teaching

- Explore the development and implementation of the national digital technology strategy on learning and teaching and make recommendations for policy

1.2 Variable benefits of using digital technology in the classroom

Digital technology can improve learning effectiveness for some children and in some skills; however, its benefits are variable and dependent on other factors such as effective pedagogy (Higgins et al., 2012). The variable benefits of technology in the classroom are felt by children and young people. As part of the national strategy, The Scottish Government commissioned Young Scot (2016) and the Children's Parliament to gather the views of children and young people on the use of digital technology in education: the general finding was that while young people believe that digital technology can make learning more fun and effective, digital resources within their schools are low, often unreliable and misused by many teachers who lacked technical knowledge.

Digital technology has clear benefits. It seems to be particularly effective in improve learning outcomes in mathematics (Li and Ma, 2010) and can build skills in interactivity, collaboration, critical skills and leadership (Archer and Savage, 2014; Higgens et al., 2012; Jewitt et al., 2011). There is also evidence that digital technology can effectively support learners with additional support needs. O'Malley et al (2013) found that there was an increase in numeracy skills with children with additional support needs using an iPad. Gonzalez-Ledo et al (2015) found an increase in literacy skills when learners with additional support needs used a computer graphics organiser. However, digital technology is not always effective on its own. Archer and Savage (2014) found that in language and literacy the gains are not as clear cut. Furthermore, Escueta et al (2017:87) conclude that just providing learners with technology leads to mixed results with: "limited impacts on learning outcomes but positive improvements in computer proficiency and other cognitive outcomes."

The benefits of digital technology are not always felt in our education establishments. Importantly, it is difficult to identify if learning improvements are directly linked to the use of digital technology or if existing effective

teaching is a factor. An OECD (2015:4) study argues that "technology can amplify great teaching but great technology cannot replace poor teaching." Similarly, on the benefit of digital technology on learning, Higgins et al (2012:3) argue:

> "more effective schools and teachers are more likely to use digital technologies more effectively…it is not whether technology is used (or not) which makes the difference, but how well the technology is integrated to support teaching and learning."

Therefore, there are variable benefits of the integration of digital technology in learning and teaching.

1.3 How digital technology is integrated in learning and teaching

While it may enhance learning and teaching, there are difficulties in directly attributing improvements in learning and teaching to just digital technology. In order to enable learning and teaching to be more effective, digital technology has to be integrated into the learning and teaching rather than being an add on.

The importance of pedagogy and the integration is highlighted by Education Scotland (2014:41) which argues that digital technology should "be given an absolutely central role in the learning process… [not] an enhancement or 'bolt-on', but … primary consideration for any planned learning." Digital technology is used by most teachers but may not be integrated into learning and teaching. In his paper which surveyed 683 teachers across the United Kingdom, Perrotta (2012:321) finds that digital technology is used mostly as "supporting the provision of learning" rather than influencing "actual learning". However, others argue that digital technology disrupts traditional pedagogical approaches professional development is key to the realisation of the pedagogical shift of integrating digital technology (Luckin, 2012; Hammond, 2013; OECD, 2015).

1.4 Does professional development of digital literacy skills make a difference?

Effective integration of digital technology in learning and teaching depends on professional learning to increase teacher's digital literacy skills and create a positive perception of technology (Peled et al., 2015; Blau, 2011). Porat et al (2018:26) argue that much traditional professional development on digital technology is "ineffective in providing future and present teachers with the kind

of experiences, knowledge and competencies for effective integration of digital technology in the classroom" and stress the importance professional development taking account of the wider context of teaching i.e. an ecological perspective.

1.5 The importance of developing an ecological perspective

Many scholars have emphasised the importance of understanding an ecology in which schools, teachers, and learners are interdependent in order for technology to produce systemic change (Zhao and Frank, 2003; Fullan and Donnely, 2013, Magenta, 2017). The national strategy on digital technology developed action plans for educational establishments, local authorities and national bodies to achieve the aim that all learners and educators can benefit from digital technology. By taking into account the national, local authority and school perspective, the strategy takes an ecological view of the implementation of digital technology.

Schools need to have accountability for the implementation of integrating digital technology in learning and teaching. As Murphy (2010:89) states "in publicly funded sectors, it is difficult to deny that a degree of accountability is inevitable, even desirable." However, as Perrotta (2012:325) highlights:

> "the social contexts that surround schools, teachers and technology use need to be considered and that we need to move beyond blaming certain groups of teachers for not making best use of technology, especially since teachers are subjected to conflicting demands and expectations in our classrooms."

1.6 Factors impacting on the integration of digital technology in learning and teaching in Scottish classrooms

As one of Her Majesty's Inspectors of Education, I have inspected educational establishments including early years, primary, secondary and special school, and have very rarely seen digital technology properly integrated into learning and teaching, despite its potential benefits. I agree with Ertmer and Ottenbreit-Leftwich (2010:256) that:

> "…it is time to shift our mindsets away from the notion that technology provides a *supplemental* teaching tool and assume, as

> with other professions, that technology is *essential* to successful performance outcomes."

The lack of reformation and transformation is attributed to a range of challenging factors both professional and institutional on teacher practice that can become barriers. I consider both the professional and institutional factors in integrating digital technology in the learning and teaching in the classroom in more detail. The professional factors are: teacher's perceptions and attitudes, curriculum and assessment and the impact of professional development on teachers' digital literacy skills. The institutional factors: are connectivity, cybersecurity and hardware, and ecological issues relating to national, authority and school perspectives.

Chapter 2. Literature Review

2.1 Introduction

The purpose of this literature review is to identify previous research on the question posed by this study which is: What are the factors (enablers and inhibitors) impacting on the integration of digital technology in learning and teaching in educational establishments? It also aims to gain clearer insight into, and explore in more depth this research question. Knowledge gained from previous research will help clarify the aims and objectives this study.

While some argue that integration of digital technology into learning and teaching can lead to transformation (Ertmer & Ottenbreit-Leftwich, 2013; Hammond, 2013), the lack of reformation and transformation is attributed to a range of challenging professional and institutional factors on teacher practice. Ertmer et al (2012:423) highlight two main types of barriers to the adoption of digital technology in the classroom:

> "first-order barriers', external to the teacher, or institutional, such as resources (both hardware and software), training, and support; and 'second-order' barriers, internal to the teacher, or professional, such as confidence, beliefs about how students learn, and the beliefs about the value of technology to the teaching."

Ertmer et al (2012:423) argue that the "second-order barriers…pose the greater challenge", a view agreed by other academics (Dexter & Anderson, 2002; Newhouse, 2001 and Zhao, Pugh, Sheldon, & Byers, 2002). Expanding on Ertmer et al (2012), Blundell et al (2016:536) use the term: "influences" rather than "barriers" because not all influences are barriers: some might be enablers." Blundell et al (2016:536) divide influences into external and intrinsic influences (which I term professional and institutional). External influences are: access to resources, institutional factors, and subject curriculum and assessment. Intrinsic influences are: attitudes and beliefs; innovation and routine; knowledge and skill; and vision and design thinking.

Building on this literature, I identify the professional factors as: perceptions and attitudes, curriculum and assessment and the impact of professional development on educators' digital literacy skills. Institutional factors are

connectivity, cybersecurity and hardware issues and ecological issues relating to school, authority and national perspectives.

2.2 Professional Factors impacting on the integration of digital technology in learning and teaching

As outlined, building on the literature and for clarity I have divided the factors (enablers and inhibitors) into professional and institutional factors. They are not necessarily mutually exclusive and at times can also be an enabler and/or an inhibitor depending on the context and use. Dividing the factors into professional and institutional will help answer my research question which is: What are the factors impacting on the integration of digital technology in learning and teaching in educational establishments? I identify the professional factors as: perceptions and attitudes, curriculum and assessment and the impact of professional development on educators' digital literacy skills. I will now outline the literature on these factors in turn.

2.2.1 Perceptions and attitudes towards digital technology

In researching the literature on perceptions and attitudes towards digital technology there were clear sub factors identified time and time again. For clarity I have divided the factor of teacher perceptions and attitudes into sub factors: professional identity; resistance; teacher authority and student control; perceived benefits of integrating digital technology; and career stage.

2.2.1.1 Professional identity

Professional identity can be defined as the way you see yourself in relation to a profession; it is created through your beliefs and attitudes, values, motives and experiences in professional life (Goodson and Cole (1994:88). Teachers are often seen by others as the person with the status, control and power who are leading others in their learning, a "sage on the stage" (Schrum et al 2016:21). However, the relationship between teachers and digital technology is contentious.

Teachers may see digital technology as a threat to their role as a teacher and a lessening of teaching as a profession with some concerned that technology will reduce or even eliminate their role (Crook, 2008). As Crook (2008:34) states, many teachers are "cautious onlookers rather than enthusiastic innovators" in

implementing digital technology in their classrooms. The disruption of existing routines by the integration of digital technology play an important role in teacher practice and attitudes. (Somekh, 2007, Ertmer, 1999). Mao et al (2014) find that teachers who first adopt new technology tools often experience a sense of loss of the familiar. The integration of digital technology can also negatively influence teacher confidence, reputation, and identity (Prestridge, 2012). The lack of confidence in using digital technology can lesson professional identity further causing doubts that they are competent professional teachers. (Prestridge, 2012:454).

The lack of confidence in digital technology can challenge their professional identity by reinforcing the concern by some teachers that there is a knowledge gap between them and their students. The notion of a generation gap between students and older adults in their attitudes to and use of digital technology was first advanced by Prensky (2001:2) who found that young people who have grown up with technology as “digital natives” think differently from their “digital immigrant” teachers. Oblinger and Oblinger (2005:1.3) call the new young, digital literate generation the “Net Generation”. The digital literacy gap creates a gap between students’ and teachers preferred learning methods which Prensky (2001:2) calls “the biggest single problem facing education today.”

Prensky has been criticised for basing these assumptions on conjecture and anecdotal accounts, rather than research (Bennett et al, 2008:776). Bennett & Maton (2010:321) and Kirschner and Van Merriënboer (2013:169) argue against the view that that education must fundamentally change to meet young people’s needs. Kirschner and Van Merriënboer (2013:169) call the claims that the younger generation possess sophisticated knowledge and skills about digital technology “Urban Legends”. Furthermore, in their research on university students’ digital skills. Waycott et al (2009:1210) found there to be significant gaps in teachers’ assumptions of how students experience digital technology and the reality. Similarly, Kirschner and Van Merriënboer (2013:173) argue: “the digital native may live in a digital age and world but cannot properly navigate that world for learning.” However, at times teachers can underestimate the

digital skills of children and young people, particularly in early years. Gray (2017).

Integrating digital technology in learning and teaching can mean a change of role for teachers as “learners” often learning from their students. This changing role for teachers and students is highlighted in the research (Ditzler et al 2016; Ertmer et al 2012). This change of role for teachers may also affect their perception of their professional identity. There is an academic consensus that student engagement and changing the role of students is vital in effectively integrating digital technology (Czerniawski and Kidd, 2011; Bovil et al., 2011; Rector-Aranda & Raider-Roth, 2015).

In their study of the attitudes and pedagogical practice of twelve effective classroom teachers who used digital technology, Ertmer et al (2012:433) found that teacher beliefs and attitudes are the “true gatekeepers” of whether teachers use technology. The perceptions and attitudes of teachers also affect the way they use digital technology in the classroom. Teachers with constructivist beliefs tended to use technology to support student-centred curricula; those with traditional beliefs used computers to support more teacher-directed curricula Hermans et al (2008:1506).

Additionally, most teachers indicated that internal factors (e.g. passion for technology, having a problem-solving mentality) and support from others (administrators and personal learning networks) played key roles in shaping their practices. Ertmer et al (2012:423). The importance of networks where teachers and learners need to be empowered to connect with other people and ideas in order to open up and broaden their learning experience and expand their professional identity is also emphasised by Brecko et al (2014).

2.2.1.2 Resistance

Some researchers blame teacher resistance towards digital technology in their learning and teaching for the lack of integration (Madsen et al, 2018; Howard, 2013). For example, Selwyn (2016:101) finds” teachers are thought to be reluctant to alter arrangements that may compromise or destabilise their authority, status or control in the classroom.”

Similarly, John and LaVelle, (2004:323) find that some teachers display outright negative reactions to the perceived threats of technology to their existing practices: "'technical' incursions into their subject areas represented a significant threat … a classroom competitor which might derogate their subject and pedagogic identity." This sense of loss and disruption to familiar routines was can lead to teacher resistance. This sense of loss was also highlighted in the literature with Mao et al (2014), Somekh, (2007) and Ertmer (1999) commenting that they found that teachers who first adopt new technology based tools and environments in their teaching often experience a sense of loss of the known and familiar by the disruption of existing routines. This in turn affects teacher practice and attitudes.

Teachers may find that fully integrating digital technology can cause significant disruption – which may be viewed as negative but can be positive. Perrotta (2012:321) finds that some teachers use digital technology in an innovative way which disrupted their learning and teaching. These teachers were not resistant and appreciated digital technology's transformative benefits.

The integration of digital technology is dependent on how it is used in the classroom with those teachers. To be effective it needs to be accompanied by a paradigm shift. Brown (2017:53) comments that as far back as 1981, Tikomirov described two possible roles for digital technologies: supplementation and transformation (or reorganisation), and argues for the latter. Similarly, the OECD (2015:3) emphasizes:

> "…we have not yet become good enough at the kind of pedagogies that make the most of technology … adding 21st century technologies to 20th century teaching practice will just dilute the effectiveness of teaching."

Notably, Luckin et al (2012:9) criticise meta-analysis studies which examine the impact of digital technology with existing teaching and learning practices rather than digital technology transformed practices.

In order to integrate digital technology effectively and work to reduce teacher resistance, professional learning will have to increase digital literacy skills to

change teachers attitudes and beliefs about ways of working in the classroom (Porat et al., 2018; Peled et al., 2015; Blau and Caspi 2009). Daggett (2003:2) argues: “The challenge for educators is not to dismiss or keep up with students’ latest technological know-how, but to create meaningful learning experiences in which students are taught how to apply their knowledge to solve real-world.”

Supporting this point, in his examination of a professional development programme for teachers in digital technology, Blundell et al (2016:547) found that teachers who had undertaken the training changed their view of classroom working from “teacher-centric” to “student-centric.”

Another reason that teachers may be resistant to the integration of digital technology is the perception that it will increase their workload and reduce the divide between their work and personal lives. A key finding of Masters’ (2018:127) research involving in-depth interviews with teachers is that “the distinction between work and personal time became blurred as the work orientated technologies became pervasive in their lives.” These beliefs around increased workload could also make teachers reluctant to further integrate digital technology in their classroom.

However, some have highlighted how technology can provide efficiencies, making daily routines like checking and grading homework quicker and easier, which helps teachers restructure their time to focus more on instructional planning and delivery (Ditzler et al 2016:206). Efficiency benefits are being promoted for learners with tools available to help students of all abilities succeed.

Madsen et al (2018:15) carried out a research project which concluded that in Norway it was teacher attitudes that impacted on the extent digital technology was integrated. New teachers are influenced by how they were taught in school. As Britzman (2003:1) stated: “Teaching is one of the few professions where newcomers feel the force of their own history as if it telegraphs relevancy to their work.” This means that if teachers have not experienced digital technology as a student it can influence their perceptions and use of digital technology

when teaching. Teacher education programmes find themselves in a position where they must challenge a self-perpetuating culture of digital technology resistance among teacher candidates (Ertmer & Ottenbreit-Leftwich, 2010). There may be a dissonance between newly qualified teachers liking the idea of using digital technology and their believe that students would not necessarily benefit from its use (Brown et al, 2016) It is therefore useful to understand student's attitudes and beliefs towards digital technology so that teacher education programmes can better prepare them to integrate digital technology in their classrooms.

In order for effective integration of digital technology, there also needs to be high performance expectancy, the degree to which a user believes that using a technological innovation will help to improve his/her job performance (Venkatesh et al., 2003). Currently teachers have varied performance expectancy (Ifenthaler et al, 2013). If teachers do not perceive digital technology as valuable, they will avoid it, even if its use is expected as part of the curriculum. (Brown 2017:63; Drijvers et al, 2010:214).

Therefore it is clear from research that teachers can hold the power in the integration of digital technology. The importance of the effect that teacher's perception and attitudes have on the integration of digital technology in learning and teaching in the classroom are significant. They can lead to either resistance or the integration of digital technology.

2.2.1.3 Teacher authority and student control

Further to teacher attitudes, their fear of loss of control and authority in the classroom is a key barrier to the integration of digital technology in teaching (Williams, 2008). In particular, teachers may lack control over what the students are accessing when using digital technology; when using personal computers it is easy for students to switch between academic and non-academic content (Blikstad-Balas, 2012; Elstad, 2016). Teachers are also concerned about the loss of control in the classroom when technology does not work. Furthermore, teachers may avoid using digital technology because of concerns of parents. (Willcocks & Redmond, 2014:403-404).

However, digital technology can make control in the classroom easier as students can be engaged in certain types of digital technology activity for a long period Perrotta (2012). Notably, Monaghan (2005:140) cautioned against digital technology as a tool used to control students without engagement.

2.2.1.4 Perceived benefits of integrating digital technology

As stated previously teachers are unsure about the benefits to their teaching in using digital technology which in turn affects their perception and attitude towards digital technology. Ifenthaler et al (2013) in their study looking at the acceptance of tablet-PCs in classroom instruction also reiterated the importance of teacher attitudes and the importance of performance expectancy and facilitating conditions. Performance expectancy is the degree to which a user believes that using a technological innovation will help to improve his/her job performance in and facilitating conditions is the degree to which a user believes that a technical infrastructure exists to support the use of the technical innovation in question.

According to Venkatesh et al. (2003), performance expectancy is the strongest predictor of behavioural intention and refers to the individual belief that using a specific technological innovation will help to improve job performance. Brown (2017:63) noted that if teachers do not perceive digital technology as valuable they will avoid it. She quoted - Drijvers et al. (2010:214) argue that:

> "teachers who do not perceive the use of technology in their teaching as valuable for their educational goals are able to avoid it, unless explicitly required to do so by institutional or curriculum constraints."

However, Brown (2017:63) also concluded that:

> "it appears that this avoidance is also possible where the curriculum expects technology use. Clearly, to realise …transformational use of digital technologies in educational settings, the curriculum needs to be explicit in articulating this role."

It is therefore important that when targeting and changing pedagogical beliefs and attitudes around digital technology teachers need to be convinced that using digital technology can improve their teaching in the classroom.

2.2.1.5 Career stage

The literature clearly highlights the importance of teachers' attitudes as a factor in the successful integration of digital technology in the classroom. This can be teachers at different stages in their career. However, worrying given students are our future teachers, the attitudes of student teachers may also cause a challenge in the integration of digital technology in the classroom. Many student teachers when they think about effective pedagogy they often do not relate to digital technology as they have not experienced this and this results in "conflicting the work of teaching." (Britzman, 2003:3). As a result teacher education programmes find themselves in a position where they must challenge a self-perpetuating culture of digital technology resistance among teacher candidates (Ertmer & Ottenbreit-Leftwich, 2010).

When they begin teaching they experience a sense of dissonance which was highlighted by Brown et al (2016) who stated that although the newly qualified teachers might like the idea of using digital technology they had a problem developing a schema about how the integration of digital technology would improve their teaching in the classroom. It is therefore useful to understand student's attitudes and beliefs towards digital technology so that teacher education programmes can better prepare them to integrate digital technology in their classrooms.

2.2.2 Curriculum and assessment

Digital literacy skills are part of Scotland's, and other countries', mandatory curriculum in local authority educational establishments, which means that learners and teachers may be more likely to use digital technology in the classroom. However, it is only when digital technology is properly integrated in the curriculum that it will truly transform the learning and teaching. Labbo and Place (2010:9) define digital technology curriculum integration as: "the infusion of technology as a tool to enhance learning in a content area or a multidisciplinary setting." Curriculum integration can be an enabling factor in the integration of digital technology in learning and teaching.

Academics point to Australia as a good example in which the progressive development of the new digital technologies curriculum has been embedded in all curriculum areas and has improved students' skills (Speranza, 2015; Masters, 2018). Similarly, in Scotland, the Curriculum for Excellence (2010:4) emphasises that:

> "digital literacy be placed at the heart of all learning not only the technologies area of the curriculum. Digital literacy outcomes could be met in any/all curriculum areas and so all practitioners can contribute to and reinforce them."

Digital technology can be integrated into assessment. Teachers can use technology to devise learning activities and present progress in "a rich and interactive way" (Luckin et al, 2012:16). Selwyn (2017:100) also noted that digital technology can be "labour saving…. by tracking and monitoring student progress and the provision of formative and summative assessments of students." Fullan & Docherty (2015:28) also highlighted the importance of using digital technology in assessments, stating that both summative and formative assessments "are vital for ensuring engagement, learning and progression to learning outcomes." They also emphasised that any assessments should be rigorous, proven, accurate and engage the learners. However, the most beneficial use for e-assessment is for students' self-assessment to facilitate peer, collaborative and self-guided learning, rather than teacher led activities (Luckin et al, 2012:26; Fullan & Docherty, 2015). Therefore, digital formative and summative assessments if integrated into the learning and teaching can be an enabling factor.

2.2.3 Does professional development play a role in the integration of digital technology?

Teacher's professional development of digital literacy is a major reason for the lack of integration of digital technology in the learning and teaching in the classroom. Digital literacy is defined differently in different academic disciplines. Some (Hoechsmann and DeWaard; 2015) focus on technical skills; others (Porat et al., 2018; Ng, 2013), on cognitive and social-emotional aspects. I focus on two issues: the importance of digital literacy professional development changing teacher's pedagogy, perceptions and attitudes; and professional development frameworks.

Effective professional learning targets teacher's pedagogical beliefs and attitudes about the benefits of digital technology (Ertmer et al 2012). Professional learning that only provides access to technology and technical skills is not sufficient to change teachers' practices. In order for teachers to adopt digital technology effectively in the classroom stating, professional learning needs to tackle culture change (Fisher, 2006).

As such, the model of professional learning needs to be interactive based on instilling the beliefs about the benefits of digital technology (Barron and Darling-Hammond, 2008). The lecture model, though widespread, is highly ineffective for teaching digital literacy (Scott, 2015). Professional learning models positively alters teacher's belief system about integrating digital technology if it takes into account teacher's skill level and students' possible learning benefits from technology (Hochberg and Desimone 2010; Guskey, 2002).

Professional learning is also most effective is it considers and addresses teachers' individual needs (Ottenbreit-Leftwich et al., 2010) When teachers are asked to revamp their teaching styles as Guskey (2002:6) stated:

> "…change brings a certain amount of anxiety and can be very threatening…. means to risk failure. Not only would this be highly embarrassing….but to change means to chance the possibility that students might learn less well than they do under current practices."

Furthermore, rather than one-off training, teachers require ongoing support from technology professionals and their peers to most effectively integrate digital technology into their work (Ertmer 2012, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Sugar 2005).Taking into account teacher's concerns, perceptions and attitudes is important towards developing professional development which will lead to successful integration of digital technology in the classroom.

Professional development frameworks are also important tools in changing teachers' practices. Three commonly used frameworks are: the Concerns Based Adoption Model (CBAM), Technological Pedagogical Content Knowledge (TPACK)

and Substitution Augmentation Modification Redefinition (SAMR). However, the three frameworks that, I argue, more effectively lead to a change in teacher's pedagogy, perceptions and attitudes are: Zhao and Frank's ecological perspective (2003), Fullan and Donnelly's (2013) Framework for Assessing Digital Innovations in Education, and Magenta's (2017) T3 framework.

Many researchers have used the Concerns Based Adoption Model (CBAM) as a tool for understanding teachers' perceptions and attitudes towards professional development on digital technology. However, Hosman and Cvetanoska (2013) argue that due to the lack of ongoing learning, the model was not implemented or integrated into learning and teaching. Derbel (2017) used the Technological Pedagogical Content Knowledge (TPACK) framework to devise and assess professional learning in digital technology. Similarly, Tai (2015), Koehler et all (2014) illustrated how the TPACK framework could be used to design courses and assess trainees' abilities to integrate technology skills.

Another framework is the Substitution Augmentation Modification Redefinition (SAMR), a four level, taxonomy-based approach for selecting, using and evaluating digital technology (Puentedura, 2006; Puentedura, 2014). Blundell et al (2016:541) found that the use of the SAMR model helped teachers improve their integration of digital technology in the classroom. However, Hamilton et al (2016:439) argue that while SAMR has the potential to devise effective professional learning, it "[gives] primacy to technology rather than good teaching" because of "….the absence of context, emphasis on products over processes, and rigid structure…." I agree that the emphasis of any professional learning framework should be first to design effective teaching.

The CBAM, TPACK, SAMR frameworks, I argue, do not effectively lead to a change in teacher's pedagogy, perceptions and attitudes. I agree with Koehler et al (2014) who emphasised the importance of teachers understanding the relationships between teaching and technology. In an effort to guide educators and researchers in their technology integration efforts, researchers have developed other frameworks that take into account the content and pedagogy required to effectively enhance embed digital technology in the learning and

teaching in the classroom. The emphasis is always first to design effective teaching then look at how this can be enhanced by the use of digital technology. (Koehler et al 2014).

Zhao and Frank's ecological perspective (2003) further emphasise the importance of ecology as they see schools, teachers, and learners as interdependent. This ecological perspective enables researchers and practitioners to explain the dynamic interactions between technology, teaching, and school environments. Fullan and Donnelly (2013) develop the ecological perspective in their Framework for Assessing Digital Innovations in Education by adding to the importance of technology and pedagogy the third force which is change knowledge. They argue that these three forces, pedagogy, technology and system change, must be developed and combined for the paradigm shift to happen.

Magenta (2017: 19-22) developed his T3 framework which outlines the three different stages of using digital technology in teaching T1: Translational, T2: Transformational, and T3: Transcendent. While the TPACK and SAMR frameworks do not clearly explain a pathway on how to improve the use of digital technology to have more impact, the T3 framework allows teachers to evaluate their use of digital technology and gives them clear guidance using self-assessment guides on how to improve their use. They can ask themselves questions like 'What stage am I in'? and 'What else can I do to make better use of technology?' Magenta (2017) emphasises the importance of pedagogy over technology and the use of technology being "disruptive" rather than a "distraction" to learning. He also takes into account the complexities in a school and the education system.

A challenge of implanting effective digital literacy professional development is that digital technology keeps changing and improving. Teachers will constantly need appropriate professional development to refresh their digital literacy skills and integrate digital technology into the learning and teaching in their classrooms. As such, schools can sometimes struggle to develop high-quality professional learning that are focused on the effective integration of technology into teaching practices Gaytan et al (2010).

Clearly, teacher's level of digital literacy is key to the successful integration of digital technology in learning and teaching in the classroom. Professional learning on digital literacy must take into account teacher's concerns, perceptions and attitudes and teachers individual professional learning needs. There also needs to be continual follow up and technology support for the teachers preferably in their schools as well as peer support. The professional learning frameworks can be used effectively to support the integration of digital technology in learning and teaching at a transformational pedagogical level.

2.3 Institutional factors impacting on the integration of digital technology in learning and teaching in Scottish classrooms

The Institutional factors which have been highlighted in the research are connectivity, cybersecurity and hardware issues and ecological issues relating to school, authority and national perspectives. However, these are not necessarily mutually exclusive factors as they may overlap.

2.3.1 Connectivity, cybersecurity and hardware issues

Connectivity, cybersecurity and hardware issues is the first institutional sub factor. Many researchers fail to mention the crucial role of the infrastructure in managing learning with digital technology. For example, Selwyn (2017:170) argues that "technological devices are the least important aspects of education and technology."

However, like some (Luckin et al 2012:57), I argue that digital infrastructure is one of the most important factors in the implementation of digital technology into learning and teaching. If digital technology does not work teachers are less likely to use it so it is therefore unlikely to be integrated into their learning and teaching. For example, Derbel (2017:269) found that "52% of teachers never used digital technology to teach English due to shortage of equipment, maintenance issue and unreliable internet connection." This is a view shared by Luckin et al (2012:57) who comment:

> "networks and platforms are required to manage and link the hardware and applications; they therefore perhaps warrant greater consideration. Another problem …is the difficulties of

> accessing educational sites due to security concerns. These problems will cause teachers and students to sometimes avoid using digital technology in their learning."

Luckin et al (2012:57) highlight issues for teacher's using digital technology: cost, complexity and safety. Adopting digital technology can be expensive when installation, training, upkeep and replacement are considered. Technology is often not developed by those with a teaching background, so may be too complex in practice. Luckin et al (2012:58) made a plea for "effective collaboration between developers, teachers and learners" to improve resources.

Scottish Government have zero profit contracts with both Micro-soft and Google, through GLOW, which allow free software access for education establishments Sey (2017). However, this also gives Microsoft and Google access to those purchasing other educational digital technology and raising brand awareness. Google G Suite was developed as an education software rather than a business software which in contrast to other software teachers have found useful in the classroom.

In their ecological framework, Fullan and Donnelly (2013) also examine infrastructure in improving the use of digital technology and developed an index to enable educators to systematically evaluate new companies, products and school models based on what is necessary for successful paradigm shift. Fullan and Donnelly (2015:4) argue that the forces of pedagogy, technology and change need to "work together to get the full learning potential from the technology."

Escueta et al (2017) stress the importance also of the challenges facing those who purchase digital technology. They stress that given the rapidly changing ed-tech field that research that is timely, relevant and actionable should be used to decide purchases. Escueta et al (2017:89) argur:

> "it should not be about the most popular product or even necessarily the technology itself, but about the best way to help students of all ages and levels learn."

There is a debate about the benefit of providing every learner in schools with one-to-one digital devices such as tablets and laptops Blikstad-Balaset et al (2017:327). Some, including, not surprisingly, the technology industry, that this

will give learners a range of benefits, both practical and educational. Warschauer and Ames (2010:35) found that the one-to-one devices can improve student's engagement, information literacy, writing and test scores.

Schools in developed economies across the world are increasingly spending large sums of money are spent on providing learners with one-to-one digital devices (BESA, 2015: press release; Ditzler et al., 2016:181). The iPad has dominated the UK market and the discourse about one-to-one devices in schools during the last five years or so Blikstad-Balas et al (2017:312).Many schools are also encouraging students to bring their own devices to school to use in the classroom to counterbalance the shortage of digital equipment Blikstad-Balas et al (2017:321. 15 per cent of British schools will have one-to-one access to tablet technology by 2016 and 44 percent of schools will have one tablet per child by 2020 (BESA, 2015 Press release).

However, it is too simplistic to think that just providing one-to-one devices in itself leads to educational benefits. Perrotta (2012:315) finds that even in countries who have a "systemic commitment" to digital technology, "its use in classrooms is variable and often underwhelming." Similarly, Blikstad-Balas et al (2017:311) argue

> "[while there is] practical benefit for processes of teaching and learning from the availability in schools of one-to-one devices", there is "limited evidence of concerted or systematic strategies on the part of schools for helping young people to engage profitably and wisely with the digital world."

Peluso (2012:26) and Ditzler et al (2016:183) conclude that educational benefits of providing one-to-one devices is highly ambiguous and needs further in-depth research.

2.3.2 An Ecological perspective on technology and education

The ecological perspective, that takes into account a wider social and cultural view of digital technology, is essential in its integration into teaching and learning. As Selwyn (2017:18) argues, there is a "social "milieu" of technology": "educational technology is intrinsically linked with the social, cultural, economic

and political aspects of society" so it is necessary "to situate technology within the broader social contexts and social relations that constitute education."

The ecological perspective enables researchers and practitioners to explain the dynamic interactions between technology, learning and teaching, linked to schools, local authorities and national perspectives. The education system is complex with local authorities, schools, teachers, learners interdependent (Zhao and Frank, 2003; Levin and Schrum, 2014). Furthermore, Fullan and Donnely (2013:12) argue that "there need to be policies and strategies" which might be necessary in order for technology to go to scale and to produce systemic change. Similarly, Levin and Schrum (2013:30) comment that because of complexity of the education system:

> "All parts of the system have to be addressed in concert; therefore, adding one component (e.g. technology) to a system affects other parts of the system."

2.3.3 National perspective on the integration of digital technology

The influence of national policymakers on the integration of digital technology is crucial for providing the national infrastructure GLOW and substantial funding for digital technology to educational establishments. The national digital policy (Scottish Government, 2016:1) states:

> "Digital technology can make a significant contribution… to enrich learning and teaching, help to raise levels of attainment and close the attainment gap….and ensure our learners develop a level of general and specialist digital skills that are so vital for learning, life and work in an increasingly digitised world."

These are bold political statements making strong promises. Policies can change depending on the political party in power. In British Columbia, Coupal, 2004 found that when governing political party changed from a democratic party to a more conservative party, integrating digital technology policy moved from involving and prioritising the needs of learners to deferring to outcomes set by the industry.

The Scottish Government's focus in their strategy on digital learning is fortunately more focused on integrating digital technology into learning and teaching. However, like British Columbia and other countries this could change

depending on the political party in power. The Scottish National Party (SNP) which governs Scotland has made improving education one of their key policies. SNP Press Release (2019). For example, the government has spent a large percentage of the Scottish Attainment Fund and the Pupil Equity Fund on hardware and software for schools. As Murphy et al (2013:1) argue:

> "political stakes are high on the front line of public services…the success of professional practice on the front line has implications of how governments are judged"

Some governments have made policies on digital technology in education mandatory. However, national government mandating digital technology may not be essential for implementation. Scotland's national strategy on digital technology is not mandatory nor does it attract any extra funding which might affect its implementation. Other countries, like New Zealand, have similarly not mandated implementation of digital technology in schools, whole some, like Norway, have (Madsen et al, 2018:3). In Norway, digital technology is a fundamental skill, equal to reading, writing and numeracy. However, Madsen et al (2018:15) found that positive teacher attitudes, rather than mandatory policy, is a more effective factors for implementation. Madsen et al (2018:17) and Yang (2012) argue that a top-down approach to implementation can limit progress.

2.3.4 Local authority perspective on digital technology

Local authorities have a duty to implement strategies, policies and legislation developed by the Scottish government. Therefore, local authorities are a key factor in the integration of digital technology.

Local authority digital skills coordinators may develop a local digital learning strategy from the national digital learning strategy, as in North Ayrshire and East Renfrewshire, two authorities in which I carried out my research. Their policy documents reflect the national ones. The North Ayrshire digital learning strategy (2017) purpose explicitly references the national strategy and emulates the 4 agreed objectives of the national digital learning strategy. East Renfrewshire digital learning strategy (2017) has similar statements to those of North Ayrshire and concludes in its strategy with a statement that ties in with the vision of the national strategy to close the poverty attainment gap states

In both North Ayrshire and East Renfrewshire, there are staff assigned in every educational establishment to lead the integration of digital technology in learning and teaching. All local authorities including North Ayrshire and East Renfrewshire may participate in Education Scotland's 'Digital Leaders Group' to share knowledge across local authority boundaries, one of the actions outlined in the nationally digital strategy for local authorities.

Clearly, there is an extremely strong influence nationally in local authority development and the actions to integrate digital technology in learning and teaching in their schools.

2.3.5 Schools

I have looked at both the national and local authority picture with regard to digital technology but the actual integration of digital technology in learning and teaching takes place in the school. It is the teachers who have the power to either integrate or not integrate digital technology in the learning and teaching in their classrooms. Teacher's attitudes and actions around digital technology can influence whether and how it is integrated in learning and teaching. Researchers have discussed the role of frontline workers as policy workers. Teachers are "Street-level bureaucrats" Lipsky (2010:221). This view was further expanded by Maynard-Moody and Musheno (2012:2) who reiterated "the view of the street-level worker as a policy implementer, tethered to legal, policy, and administrative constraints, who uses "discretion" to match behaviour to law, is what we call the "state-agent narrative."

Leadership in schools is crucial to policy implementation. Levin and Schrum (2014:661) suggest: "leaders use and publicly model ways to use technology and encourage, cajole, reward and publicly acknowledge others who use technology." Perrotta (2012) in their study looking at survey data from 683 teachers in 24 secondary schools in England found a strong link between supportive leadership and teacher's positive attitudes towards technology. As school are an hierarchical structure the status of staff who attend professional development on digital issues can be an issue. If they are just class teachers

they have limited power to integrate digital technology in the school. As such, Louis et al (2011:52) argue that:

> "changing a school culture requires shared or distributed leadership, which engages many stakeholders in major improvement roles and instructional leadership who take responsibility for shaping improvements at classroom level."

Given the clear benefits of the integration of digital technology in learning and teaching there had to be accountability in our schools for its implementation Murphy et al (2013). The only schools accountability mechanism in the national strategy (Scottish Government 2016:32) is a HM Inspection. Given that individual school may not be inspected for years using this as a measure of success is not useful. Also, as an HM inspector I know that the strategy does not clarify what effective use of digital technology means. It might be more useful to set up a quality assurance system within the school supported by central local authority staff which takes into account "social contexts" including teachers' conflicting demands and expectations Perrotta (2012:325).

2.4. Conclusion

In reviewing the literature I have researched the professional and institutional factors which are key to integrating digital technology in learning and teaching in educational establishments. They are not necessarily mutually exclusive and at times can also be an enabler and/or an inhibitor depending on the context and use.

The key debates which were present in the literature when discussing the professional factors were issues around the significant that perceptions and attitudes of teachers have in the integration of digital technology. The integration of digital technology leading to a loss of professional identity and a familiar routines, loss of confidence, the changing role of teachers and students from teacher centric to student centric. Other key issue highlighted in literature was blaming teachers for the slow update of digital technology in the classroom, teacher resistance due to fear of changing role, loss of personal identity and loss of actual jobs, fear of loss of control and authority in the classroom and an increase in workload and blurring of work/personal time. Effective professional learning which targets teacher's pedagogical beliefs and attitudes about the

benefits of digital technology was seen as an enabling factor. The importance of performance expectancy was highlighted in successful integration. One problem highlighted was that student teachers lack of confident in using digital technology in the classroom. Curriculum integration was highlighted as an enabling factor in the integration of digital technology in learning and teaching as was the importance of using digital technology in assessments.

In the literature review institutional factors highlighted were connectivity, cybersecurity and hardware issues and ecological issues relating to school, authority and national perspectives. However, these are not necessarily mutually exclusive factors as they may overlap. Issues which had an impact in the integration of digital technology were effective connectivity, a cybersecurity system which allowed teachers and students to access sites they needed for learning and teaching and effective and efficient hardware for the purposes of learning and teaching. There was a debate on whether students needed individual devices or not to successfully integrate digital technology. There was a strong sense that many researchers fail to mention the crucial role of the infrastructure in integrating learning with digital technology. If the infrastructure doesn't work this leads to teachers losing confidence in it and therefore leading to lack of integration of digital technology in educational establishments. Another key issue which was highlighted in the literature was the importance of taking an ecological perspective when discussing the factors that impact on the integration of digital technology. Many researchers commented on the integration of digital technology being linked with social, cultural, economic and political aspects of education. This ecological perspective enables researchers and practitioners to explain the dynamic interactions between technology, learning and teaching, linked to schools, local authorities and national perspectives. This is a view which I will focus on in my own study.

The review of the literature has allowed me to research the key debates in previous research and guided me on issues to explore in my own research. I will now describe the methodology I used in my study.

Chapter 3. Methodology

3.1 Introduction

This educational research project both explores and interrogates. It explores and broadens the understanding of the phenomena of digital technology in education. It also uses research as interrogation to examine "what lies beneath" the development and implementation of national policy.

3.2 Research question

The overarching research question is: 'What are the factors impacting on the integration of digital technology in learning and teaching in Scottish classrooms?' This question is important given the large amount of public money spent on digital technology and the transformational educational outcomes for children and young people if digital technology is effectively integrated into learning and teaching. This study researches factors, enablers and inhibitors, that impact the integration of digital technology in the learning and teaching in Scottish classrooms.

The study's objectives are to:

- Examine previous research on the topic of digital technology, its enablers and inhibitors
- Explore experience of the classroom teachers and other key staff with the integration of digital technology in learning and teaching
- Identify the enabling and inhibiting factors regarding the integration of digital technology in learning and teaching
- Explore the development and implementation of the national digital technology strategy on learning and teaching and make recommendations for policy

In particular, I analyse the result of one action in the national strategy to improve access to digital technology for all learners: encourage and facilitate the development of partnerships, including commercial partnerships, that will improve digital access and digital skills development opportunities for our learners. Scottish Government developed a partnership with Google to provide

free access for all schools and early years settings to the G suite on the national platform GLOW and offer free professional development. The research will look at the impact of the Google professional development on teachers' digital literacy skills and also use the implementation of Google G Suite as a vehicle to interview teachers and non-teachers.

3.3 Research paradigm

In deciding which key research educational paradigm to use, I researched the two key opposing paradigms, positivist and interpretivist. The positivist paradigm assumes that the researcher can and should be neutral and that data can be quantified (Curtis et al, 2014). On the other hand, the interpretivist paradigm believes that the researcher should and can empathise with subjects and that human activity cannot always be scientifically analysed (Dilthey, 1911, 1977; Miles and Huberman, 1994). I decided that I saw my research, to quote Miles and Huberman (1994:8) as "interpretive rather than a scientific act…and a "collaborated act", on the part of both parties" in the research. I believe that we need to see the world through those being studied. Therefore, I use an interpretivist point of view within a qualitative approach, in these interviews.

Using an interpretivisit point allowed me to uncover the meanings that teachers attach to digital technology in their classroom. I carried out semi-structured interviews in a non-directive way to ask teachers and other staff about the Google G Suite training/implementation and also their perceptions and use of digital technology in the classroom. Another set of interviews was conducted with the authors and those responsible for the development and implementation of the national digital strategy. The information gathered from these interviews was relevant to addressing the objectives of the study.

3.4 Researchers background beliefs and bias

As an HM Inspector of Education, I have inspected many educational establishments from early years through to colleges. I was a lead officer in the implementation of the Scottish Attainment Challenge which provided substantial funds to close the poverty attainment gap, including on providing digital

technology in schools. Academically, I have a science honours degree and a masters and doctorate in educational psychology.

In my professional and academic experiences, reflecting the literature, although digital technology has been present in the schools often, it is usually not been integrated effectively in the learning and teaching in the classroom; rather, it has been an “add on” and used for “babysitting purposes.” However, at times, I have seen it used extremely effectively to transform learning and teaching.

I, and my strategic director, were interested in understanding the key factors that impacted on the integration of digital technology in learning and teaching. Given the money spent on digital technology and my belief that it can change the outcomes for our children and young people if used effectively, I welcome the opportunity to research this topic. Having spent my career working to make a positive difference on the educational outcomes for children and young people, it is important to me to answer this question.

In the research literature Meighan and Siraj-Blatchford (1997), Ritchie and Rigano (2010) and Davies and Harre (1999) discuss the notion of research “positioning” or “stance” of the researcher which can affect the research design and process. Therefore, it is imperative that I as a researcher am self-aware of my own position or stance that I bring to my research. In carrying out my study, I was a researcher, not an inspector. For example, in one of the schools I visited, I had to refrain from asking about situation with a young person with autistic spectrum disorder who was not being fully engaged in education.

I am very well aware that my position as an HM inspector brings both positives and negatives. Positively, it allows me easy access to educational establishments and Scottish government officials. It also meant that some participants viewed as an “advocate” in which I had the power to do something positive about their situation by taking their concerns to policymakers Curtis et al (2014).However, my role may have made participants in the study hesitant to be honest in their answers given my appeared position of power. This was one of the reasons that I interviewed the participants on their experiences about Google G suite training

and implementation as it would seem a more neutral and less invasive topic than just their own views. However, in the letter to participants, I also made it clear that I was also interested in their views around the use of digital technology (Appendix 1).

3.5 Study design and population participant

I decided to use semi-structured interviews designed with sufficient structure to produce the data I needed to answer the research question for the study while leaving freedom for the participants to highlight issues and matters important to them. I felt also that semi-structured interviews would help building rapport with the participants. I could talk about my interest and experience in digital technology because, as Oakley's (1981:49) says, there is "no intimacy without reciprocity". This reciprocity also helped, particularly given the power dynamics of my role as an HM Inspector, to relax the participants and encourage them to answer the questions fully and openly. As one of the participants stated at the end of the semi-structured interview "I forgot you were an inspector", this approach seemed to work. In addition, I carried out the semi-structured interviews at a time which suited the participants, in a room at their work in which they felt most comfortable.

I considered using focus groups. Although I could see the potential for focus groups to generate useful data through participants building on one another's responses, I was concerned that a group situation may inhibit discussion and lead to one voice dominating, perhaps particularly likely in my research given that schools are extremely hierarchical institutions. I decided to work with individuals to allow the participants the freedom and space to describe their own personal experience with digital technology uninterrupted by others.

3.6 Interview questions/techniques

At the beginning of the interview, I asked the participants to sign a paper allowing me to tape the interview but promising their anonymity. I started with straightforward questions which did not put the participants under too much pressure. I was very conscious after conducting and immediately transcribing my initial interview that I might have said too much. As an inspector I regularly

discussing ways to improve educational establishments, so I am used to interviews which are equally split between participants. However, I improved so subsequent interviews involved were more focussed on participants. At the end of the interview, I always asked if there was anything else the participant wanted to add, which often gave me useful additional information. Although each interview was planned to last approximately one hour, I had left enough time to enable the interview to be extended should the participant wish.

3.7 Interview questions

I devised two sets of questions for the two parts of my study. (Appendix 2 and 3). The first part of my study investigated my fourth objective, 'to explore the development and implementation of the national digital technology strategy on learning and teaching and make recommendations for policy. 'I interviewed those responsible for the development and implementation of the national digital policy. This group were extremely well informed and were nearly all working on digital technology within Scottish Government. As part of the development of the policy, they had read literature and carried out national consultation with a wide range of stakeholders including children and young people. The interview questions addressed the development of the strategy including their involvement, its goals, its indicators of success, previous digital technology policies/strategies and the relationship between the public and private sector; the implementation of the strategy including challenges and key stakeholders involved ;and, lastly, a blue sky question of how they would change the strategy if they had total freedom.

The second part of the study investigated my second and third objectives, 'how effective was the Google G Suite training and implementation?' and 'what key conditions will lead to more effective curricular and pedagogical practice using digital technology in educational establishments? I interviewed staff who took part in the programme of training using Google G Suite for Education organised for all local authorities. Their roles were mixed: a few worked full time in digital technology, with two responsible for digital technology implementation in their local authority; the others were teachers who either extensively used or were interested in expanding the use of digital technology in their teaching.

The interview questions included examining teacher and student attitudes around the use of digital technology in the classroom, the identification of strategies to embed digital technology to improve teaching, what has to be given up as a result of the digital technology and the impact of the training they have received on Google G Suite for Education.

I used the training and implementation of Google G Suite nationally as a vehicle to examine training in digital technology, so I started the interviews focussing on G Suite. I devised these questions from d) to focus on the three key criteria of pedagogy, clarity and quality of intended outcome, quality of pedagogy and the relationship between teacher and learner, and quality of assessment platform and functioning; system change, implementation support, value for money, and whole system change potential;' and technology, quality of user experience/model design, ease of adaptation, and comprehensiveness and integration. For subsequent questions, I drew on from Magana (2017), particularly his T3 framework

3.8 Participant sampling

For the first part of the study I was able to interview all eight key players who developed and implemented the national strategy because I connected with the strategic director responsible for the implementation of the national digital strategy in my role at the Scottish Government.

For the second part of the study, I used a purposive non-probability sampling technique Curtis et al (2014). As the Google G Suite training took place in all local authorities, the number of staff who had participated was too large for me to interview them all. I interviewed twelve staff with diverse roles: five teachers in secondary schools, one librarian and one ICT specialist, two local authority representatives whose role was to promote digital technology and three teachers in primary schools. To make my sample as representatie as possible within constraints, I interviewed staff who had received the training at different times and who worked in two different authorites. In order to improve my own knowledge as a researcher I attended the same training on Google G Suite which

the participants had taken but in a different local authority, so I did not meet them before the interview.

In total, for the two parts of the study, I interviewed 20 participants which allowed me to carry out a rigorous analysis of the data collected.

3.9 Reflections on the process

Although I had prepared extensively for the interviews I was surprised by honesty of the participants and their data. They were hopeful about digital technology but disappointed about its ineffective use. Listening to the recordings immediately after the interviews was beneficial as I could still picture the participants' mannerisms and body language which communicated their meaning, and allowed me to improve my interviewing skills for subsequent interviews. For example, I became more adept at steering participants who veered off-topic and identified opportunities for follow-up questions. Reflecting on completed interviews also helped me review my research aims and maintain a standard approach.

3.10 Data analysis

This is an exploratory and inductive qualitative study which used the research questions to narrow the scope of the study and focuses on exploring and analysing the factors that impact on the integration of digital technology on learning and teaching from different perspectives.

As an exploratory qualitative study, the most appropriate form of research design, data-collection method and selection of subjects was used to help answer the research question. Qualitative research design lend itself well to exploratory research - researchers including Onwuegbuzie & Leech (2005: p. 276) suggest that the word *qualitative* being replaced by the word *exploratory*. The use of the inductive approach is also important for this study: Creswell et al (2007) define an inductive study as one which works from the "bottom-up, using the participants' views to build themes" (p. 23). This is the case with this study which uses the data from the semi-structured interviews from participants to establish themes. This is the case with this study which uses the data from the semi-

structured interviews from participants to establish themes. Thomas (2003) in his description of the purposes of the use of an inductive approach in studies further describes the way it was used in this study as a way of condensing data into a summary form which can be used to establish links between the research objectives.

In analysing the data I transcribed the interviews myself as I found that this was important to familiarise myself with the content and consider emerging themes. I read the finished transcripts several times to further confirm the themes. As Miles and Hubermann (1994:9) state, transcribing and reading transcripts helps you identify “patterns and processes, commonalities and differences.” I also used what Miles and Huberman (1994) call memos when I was transcribing and writing up the data. These were notes about thoughts, ideas questions or patterns that were emerging the data.

I took field notes both during and immediately after the interviews were added to the transcripts. As I carried out the transcription immediately after the interview I was able convey some of the non-verbal nuances. I attempted to ensure that the transcripts were as true as possible to the interview and the message that the participants were trying to convey.

What struck me very clearly when transcribing the interviews for the two separate parts of the study were their “commonalities”, which allowed me to have broadly common themes for the two parts of the study. The separate theme for the first part of the study was about the development and implementation of the strategy, although this was still mentioned by participants in the second part of the study. These shared themes affirmed my experiences and belief that national policy can have important strong messages for the whole educational community. I have outlined below the themes and sub-themes arising from the data (Table 1.).

I came up with the themes and subthemes, shown below. Not making decisions on themes prior to embarking on the research helped me avoid narrowing the responses from the participants. I found this a useful in allowing the interview to

follow its own course, albeit within the confines of a semi-structured interview. It also allowed me to keep an open mind and be alert to participant responses that were surprising.

I addressed concerns with validity through "checking, questioning and theorising throughout the entire process" (Kvale 2007:123). I sought to ensure that I was actually obtaining data to answer the research question. The interview structure was designed to answer the 4 objectives of the study both by interviewing key participants and ensuring that the questions asked were appropriate to gathering the necessary information.

The final analysis, although making use of the categorisation of themes and sub themes, also encompasses other information that I was aware of in my work as a policy officer and an HM inspector.

Table 1. Themes from Findings

Themes	Sub-themes
Digital Literacy	• Training • Perception • Attitudes • Confidence
	• Resistance to using digital technology
	• Benefits of using digital technology
Infrastructure	• Connectivity
	• Cyber Security
	• Hardware
Professional Authority and Pupil behaviour	• Professional reasons
	• Perception of pupil skills in digital technology

	• Classroom control

Pedagogical practice and digital technology	• How teachers need to use different pedagogy when teaching with digital technology?
	• How the teacher uses the technology • How digital technology makes you more efficient?
	• How the teacher uses digital technology in their teaching benefits the pupils?

Curriculum and assessment	• Need to embed digital technology in the curriculum
	• Assessment in the classroom
	• Assessment for senior exams
Leadership and the development and implementation of the national strategy on Digital Technology	• Why was the national strategy initiated?
	• Development of the strategy
	• Leadership and Implementation of strategy

3.11 Ethical considerations

As already described, I mitigated the power imbalance due to my role as an inspector as much as possible, for example making clear that I was a researcher not an inspector in this study and organising to meet participants at a time and location which suited them. I was also upfront to the participants my role in education in soliciting the interviews.

Throughout the interview process, participants were treated with respect and they were aware of my appreciation of them giving up their time to be part of the study. They were clearly told in the participants letter the voluntary nature of participation, the benefits and the promised anonymity which was sent to them before the interview (Appendix 1) which was reiterated at the interview. They were told in the letter that the data was be stored in a Scottish Government computer which is password controlled. Anonymity was an important issue in this research and allowed participants to feel confident in providing their perspectives. I privided participants with details and the aims of the research. The focus of the research was of interest to the participants and the content of the interviews posed little risk to their working practices.

Chapter 4. Findings

4.1 Introduction

The overarching research question posed by this study is: what are the factors impacting on the integration of digital technology in learning and teaching in Scottish classrooms? This study's aim is to research factors (enablers and inhibitors) that impact the integration of digital technology in the learning and teaching in Scottish classrooms.

The research also analyses the result of one of the actions outlined in the national strategy to deliver on the second of four objectives which is to improve access to digital technology for all learners. This action aims to encourage and facilitate the development of partnerships, including commercial partnerships, that will improve digital access and digital skills development opportunities for our learners. As part of the commitment to these actions Scottish Government developed a partnership with Google to provide G suite on the national platform GLOW to allow free access to all schools and early years settings. Appropriate free professional development was also delivered in partnership with Google.

The research looks at the impact of the Google professional development on teachers' digital literacy skills and also use the implementation of Google G Suite as a vehicle to interview teachers and non-teachers. This enables the researcher to carry out semi-structured interviews in a non-directive way to ask them about the Google G Suite training/implementation and also their perceptions and use of digital technology in the classroom. This then aids in the gathering information relevant to the aims of the study.

Another set of interviews took place with the authors and those responsible for the development and implementation of the national digital strategy.

All of the interviews were transcribed and analysed for common themes. There were common themes emerging across the two sets of interviews. I have taken these themes and structured them into two sets, professional and institutional

factors. However, these are not necessarily mutually exclusive factors but rather overlap at times.

In this chapter I consider both the professional and institutional factors below in integrating digital technology in the learning and teaching in the classroom in more detail. I term the institutional factors: connectivity, cybersecurity and hardware issues and ecological issues. These relate to school, authority and national perspectives. Below I will highlight each of these in turn, analysing their importance to the research question which is what are the factors impacting on the integration of digital technology.

4.2 Professional factors

For my study I have termed the professional factors:

- as perceptions and attitudes
- curriculum and assessment
- the impact of professional development on teachers' digital literacy skills

I look at each of these 3 professional sub factors below.

4.2.1 Perceptions and attitudes towards digital technology

In this section, I discuss the first factor of the professional factor which is teacher perceptions and attitudes towards digital technology. I have highlighted the important sub factors in this factor which were found in the interviews.

There are other issues at work when it comes to teachers and technology, which are not just about training, digital literacy and digital infrastructures which are sub factors in the integration of digital technology. Professional reasons that teachers gave for their reluctance to use digital technology which were stated in many interviews were the risk to professional identity the issue of teacher resistance, digital technology disrupting teaching and authority and perceptions and attitudes to digital technology as an effective pedagogical tool.

4.2.1.1 Professional identity

Teachers are used to knowing everything and teaching their pupils their knowledge. With digital technology their perception is that this may no longer be true and it can upset their professional identity. As one interviewee said:

> "…teacher power and control is as issue and teachers don't like not knowing … there is a perception that pupils know digital technology better than teachers and this puts teachers out of comfort zone … often they are not interested– and won't let children teach them."

This is a quote from a teacher which encapsulates this fear as she spoke about teacher perception and their changing role and pedagogy around digital technology. She also mentions the idea that teachers can learn from their pupils which means for some a role reversal which they may be uncomfortable with. One depute head teacher elaborated on this point by explaining the way she uses her computer club:

> "…we try so much in our training for teachers who run the computer club to tell them it is not about being better than young people it's about giving young people the tools to be imaginative and engage with the digital technology for some of us we are never going to be more expert than the children."

This perception that pupils have a greater knowledge than the teacher about digital technology is not always the case, particularly if they do not have access to digital technology at home. There is a large variability in pupil skills and confidence in using digital technology. As one teacher stated: "some students would rather handwrite and do things from books than use digital technology". This variability in pupil skills and confidence has been said by teachers to makes it even more difficult to use digital technology in the classroom.

Another challenge with the training in embedding digital technology in the classroom is getting the buy in from teachers that it is there professional responsibility to learn how to use digital technology in the classroom. Too many teachers do not see it as their responsibility. Comments from teachers include "It is not my job to embed digital technology in my teaching." Even when training is provided in the schools as one secondary teacher commented it is "very poorly attended." One local authority representative commented that:

> "[I] find that secondary school teachers are worse than primary schools saying that digital technology is not their job… they [secondary teachers)

> say they have a syllabus to cover and exams to prepare children for so they don't have time to embed digital technology."

Another local authority representative pointed out that:

> "…in order to be registered by the General Teaching Council (GTC) in the standards for teacher registration states that teachers have secure knowledge and understanding of current guidance on the use of digital technologies in schools and know how to use digital technologies competently to enhance teaching and learning."

Yet, as one teacher commented, if the (GTC) "held this requirement to the letter more than half of the teacher workforce would be out of a job." The difficulty is how to deliver on this as one of the authors of the digital strategy commented:

> "How do you make this everyone's business to embed digital technology to enhance learning and teaching? In Wales they have clearly stated that digital competence is the responsibility of all teachers. …it would be unlikely that the first minister, politically, just now given the governance review would state that digital competence is the responsibility of all. What we have just now is a curriculum statement saying that digital technology can contribute to every practitioners practice…"

There was a concern among experienced teachers that student teachers, who are the future of our education system are unable to use or integrate digital technology in their learning and teaching. Student teachers are also rarely taught digital skills in their teacher training. This is now changing with the new General Teaching Council standards to register new teachers around the importance of using digital technology in their learning and teaching. As one teacher commented:

> "…their knowledge base of digital technology is that they can use their phones but cannot use digital technology for educational use…. it is only this year digital skills have been introduced into initial teaching training."

4.2.1.2 Teacher resistance

In many of the interviews the issue of teachers being resistant to using digital technology was highlighted. However, rather than blaming teachers it is important to look at why there is a resistant which leads to the lack of impact in

digital technology in the classroom. I will look at lack of confidence, threat, loss and overload in the schools and local authorities.

The lack of skills and training and confidence in digital technology was highlighted which in turn appeared to lead to lack of confidence and variable perceptions and attitudes around using digital technology. One of the teachers who had taken part in the two part training for Google Suite commented that perception and attitudes around digital technology vary:

> "Some teachers are excited, love it and take it on board and others terrified of it….others say it is another thing being put upon us."

Some teachers felt that the confidence was lacking in teachers particularly older teachers. One interviewee commented: "older teachers are getting stuck in a rut. The move to new technology isn't going to happen with the older teachers." Another teacher interviewed said that she did not have the confidence to try and workout any problem with digital technology she would immediately send for another colleague who had more experience. Other teachers commented made the point that it wasn't the age of the teachers which mattered but their attitude to try something new. Some people are seen as resistance because they have "pigeon holed themselves as not being good with computers… The perception people have of themselves and digital technology make them resistant to trying new things…"

However, one point which came up repeatedly as a cause for the lack of confidence was not just teacher's own confidence but their lack of confidence in the hardware. Teachers commented that often it is not a lack of confidence in their skills in using digital technology in teaching but a lack of confidence in the technology itself. One of the authors of the national digital strategy commented:

> "It's not always that teachers lack confidence in themselves but their lack confidence in the technology."

One teacher commented on her perception and attitude to digital technology saying "It is probably going to be easier for them (the pupils) than me to give up pen and paper." When asked about changing perceptions and attitudes she said that this would change if "it doesn't break down" because:

> "often you have a lesson ready to go and the technology breaks down and/or the broadband is not working, hardware not charged or someone has not plugged the hardware in."

Other issues are timetabling as one teacher said: "…you don't always get the tablets when want them…not enough hardware-which causes issues and arguing about sharing."

Overload in the schools and local authorities has been mentioned in interviews. Given the amount of priorities that both schools and local authorities have to implement often digital technology is not seen as important. One of the authors of the national strategy commented:

> "…in the local authority and schools digital technology is not seen as a main priority- there are a million of other things that they would rather spend time and money on"

One of the ways to try and get the local authority and schools to buy into the use of digital technology more is to highlight the benefits. Some teachers see "digital technology as an add on and gimmicky" In order to encourage them to use digital technology one enthusiastic teacher around digital technology stated: "you need to prove it has real educational use around learning and teaching … it has a positive impact and improves engagement and learning."

4.2.1.3 Digital technology disrupting teacher authority

As well as digital technology radicalising pedagogy, teachers also saw using digital technology as disrupting their teaching and making them lose control of their classroom. As one teacher noted:

> "keeping students on task using the internet can be difficult if you want them to look at the site on atomic structure they can be looking at other sites available than the one you want them to be watching."

However, other teachers thought it was more about the teachers' ability to control their class with or without digital technology but digital technology was an excuse for them not to be in control of the class. One teacher stated:

> "It could also be an easy excuse for a teacher who doesn't want to use digital technology. I do not find using digital technology disruptive but it might be a problem with teachers who may always have a problem with disruptive behaviour in their classroom."

One teachers mentioned other countries such as Sweden where they teach students to be responsible when using digital technology and looking at sites. One class teacher also pointed out that:

> "teachers should be able to manage student who are not fitting into the level of control they are after. Having an alternate task using books when other pupils are on the computers or sending the pupil who is not on task to the head of department."

However, the reality as many teachers pointed out that sometimes digital technology does not work and can cause you to lose control of your class or disrupt your teaching. One teacher stated: "when the digital technology does not work it does disrupt the classroom…. you then lose your confidence … then tend to shy away from it."

4.2.1.4 Perceptions and attitudes to digital technology as an effective pedagogical tool

Many of those interviewed commented that perceptions and attitudes to digital technology as an effective pedagogical tool was significant. This was in both in encouraging teachers to use digital technology and also if it was used effectively impacted positively on their learning and teaching which led to improved outcomes for their pupils. This is then an important sub factor in enabling the integration of digital technology.

I have looked below at the following different sub-themes arising from analysing the interview around perception and attitudes. These are:-

- How teachers need to use different pedagogy when teaching with digital technology?
- How the teacher uses the technology?
- How digital technology makes you more efficient?
- How the teacher using digital technology in their teaching benefits the pupils?

I will elaborate on each of these sub-themes.

4.2.1.4.1 Teachers need to use different pedagogy when teaching with digital technology

Throughout the interviews many interviewees commented that there has to be different pedagogy when using digital technology if you want to improve learning and teaching. One commented:

> "Digital technology will change how you approach a lesson. Teachers need to have a pedagogical shift to get the best out of teaching with digital technology."

Many of the teachers spoke about using flipped learning with the pupils when using digital technology where the teacher guides pupils as they apply concepts and engage creatively in the subject matter. One teacher commented "flip learning is about giving the learning to the children before you teach them." Others also warned that giving a poor teacher lots of digital technology is not going to make their teaching any better-commenting "if you are not an effective teacher using digital technology is not going to improve your pedagogy". They also commented on the importance of how you use the digital technology:

> "Technology doesn't do the teaching- what you do with it matters and the level you work with it. If you are confident and work with digital technology well it can transform your teaching."

4.2.1.4.2 Technology use in practice

As part of the semi-structured interviews those interviewed were asked how they used digital technology in the classroom both with G Suite and other digital technology. As one teacher commented that digital technology can be "used as a "babysitting tool" just to keep children quiet…however this was now unusual."

In the literature review I have outlined the different models which look at different ways that teachers use digital technology in their teaching. The most simple way is translational when the teacher is changing tasks from analogue to digital. Examples of this is changing a pen and paper quiz to a digital quiz for pupils. An Interviewee said:

> "I use the technology to devise a fortnightly homework task that they can do online…this allows me to assess their individual learning and get an overall summary. This allows you know what you have to go back and reinforce in your teaching."

This translational use of technology does not substantially change the task. Other use the technology in a more disruptive way as transformational defined

as giving rise to a substantial change in the task and the person enacting the task. Others when discussed the role of the teacher in a transformational way using digital technology commented that "I can see the application as a teacher as a transformer but for myself I have never used it like that." One teacher gave a good example of using technology in a transformational way in her teaching in a way that could not be taught without the use of digital technology. She said:

> "she used technology in a transformational way in a lot of her science subjects using virtual reality googles and other augmented devices which can show blood flows and gas exchanges happening and allow the student to interact with it."

Other teachers have used virtual reality when teaching a travel and tourism course where the pupils:

> "have to produce a holiday brochure so I use virtual reality tools to allow them to see a certain area in Spain and they can see hotels and write their brochure … I could not teach this lesson this way without the technology."

Others teachers have used digital technology in mathematics: "I teach using digital sphere balls which help teach pupils angles, times, distance and coding." Others have mentioned the use of G suite which allows pupils and teachers to collaborate and feedback on a piece of writing together at any time or in any location in real time. This gives instant feedback and collaboration. One teacher commented that to improve learning and teaching using digital technology: "students need to make connections for different curriculum areas and it is important for teachers to help them do this."

4.2.1.4.3 Digital technology and teacher efficiency?

One of the questions in the semi-structured interviews was obtaining information on what those interviewed had being able to give up as a result of using digital technology giving them more time and making them more efficient. The time which was saved was used by many of the teacher's interviewed to spend more time on improving their teaching using digital technology. The most frequent responses on saving time was spending less time on printing, finding resources, marking and planning. As one teacher commented that she is "doing less printing and photocopying" and "If I need to show the pupils something it is in the classroom instantaneously – saving trees and money." One teacher stated that

she now saved time on planning and marking as she now uses digital technology which saves time:

> "…planning took a lot of time when I first started teaching … planning is now much easier as I use resources like twinkle and other teacher websites …Marking writing using digital technology- saves me going home with 27 jotters. Now with one ipad I can mark the children's writing."

Another spoke about the benefits of using quizzes:

> "my S2 pupils love quizzes for any subject can make on quiz online. The teacher is on the interactive board students log in and gets points on how quickly they answer … You can set the quiz up once and change it quickly again saving time."

4.2.1.4.4 How the teacher using digital technology benefits pupils?

One key point which came up again and again was the benefits for pupils when teachers used digital technology in their teaching. The main perceived benefits mentioned for the pupils were:

- increase in motivation and engagement for learning
- increase in collaboration
- increase in attainment, higher order thinking and attendance
- increase in the equality of access to learning for pupils with additional support needs
- increase in skills for learning, life and work

I will elaborate on each of these benefits. Almost all those interviewed mentioned the increase in motivation and engagement when teachers use digital technology in their teaching. One teacher commented when the pupils use the virtual reality devises it gives them a sense of joy." Others commented " it increases their(pupils) motivation and engagement as well as their commitment and confidence" One teacher made the observation than when she uses digital technology in her teaching the pupils don't see it as work: "Children enjoy it more when you use digital technology. They don't think it as work or as onerous as getting jotters out."

Almost all those interviewed also mentioned an increase in collaboration in pupils when digital technology was used in teaching. They often mentioned that Google G suite made collaboration easier. One teacher commented:

> "…there is an increase in collaboration when using Google G suite as it has better functionality than Microsoft office 365. It was developed for use in education while Microsoft office 365 was developed as a business package…Google G Suite is also accessible by all pupils and teachers in any location."

In some of the responses about collaboration there was a debate about what is real collaboration. One teacher stated:

> "Kids told to work collaboratively and all they do is split a task up 3 or 4 pieces…not sure this is collaboration for me it is working together and looking to improve different areas of what others have done. Digital technology should help the skill of collaboration but it is something teachers need to be more explicit and define to the pupils what is collaboration."

Others pointed out that they felt that digital technology did encourage real collaboration stating:

> "…pupils got instant feedback and collaboration and far better class discussion…they can see on the screen the document they are working at the same time- feel the activity is much more than just splitting things up…working this way the pupils learn about the ground rules of online collaboration–they learn about responsibility and respecting others, and it also helps increase their communication skills."

There were comments from teachers that there had been an increase in attainment as a result of them using digital technology in their teaching. As one person interviewed said:

> "…to have a robust body of evidence showing that if teachers used digital technology in their teaching pupil attainment would go up … would be the holy grail. However, although you would think that if engagement increases then attainment will go up there are so many other factors which can impact attainment."

Many of those interviewed mentioned that when teachers used digital technology it led to an increase in more efficient higher order learning skills. Teachers commented that: "using Google G Suite means [students] don't need to take notes as on google classroom so can focus on more higher order skills." Others commented that technology "increases in attendance for some pupils

who said they found the use of digital technology made learning more interesting".

Almost all those interviewed mentioned the increase in the equality of access to learning for pupils with additional support needs. One teacher stated that:

> "I teach them how to put on speech and frees me to spend time with students who need more time set things up…It also makes the world more accessible to them and increases what they can research and access."

One teacher did mention a note of caution on the overuse of digital technology for children with additional support needs stating:

> "It (digital technology) is a really good thing for less able they engage really well with the programmes but can be overused. A pupil was surprised when he had a jotter and one teacher who did a paper assessment with him saw him trying to swipe his jotter."

Many of those interviewed stated that the use of digital technology in teaching increases the skills in pupils for learning, life and work. One teacher stated "working with digital technology can inspire kids in terms of career choices." Another teacher, who worked in an area of poverty stated:

> "digital technology engages the pupils far more in their learning and means that they are more likely in life to do better than their parents…it also teaches them better skills for learning, life and work not just how to recall which they need for school exams."

4.3.2 Curriculum and Assessment

Curriculum and assessment are the second theme under the institutional factor which I will now discuss issues found in the interviews.

4.3.2.1 Curriculum

There are two areas relating to the curriculum which are integrating digital technology across all curricular areas in curriculum for excellence and the separate area of the curriculum teaching digital literacy skills. Curriculum for Excellence (2010:4). Many of those interviewed stressed that for digital technology to have the best impact on enhancing learning and teaching it has to be embedded in the curriculum and be an integral part of teaching. They commented: "digital technology skills are transferable skills… across the

curriculum and students need to make connections for different curriculum areas".

However, one of the teachers interviewed did not "see that the digital technology has a major role in learning and teaching….it is still seen as an add on." As one of the interviewees stressed: "digital technology needs to embedded…taking a class for one hour to a computer room does not embed digital technology in the curriculum." One teacher suggested "digital technology should be an integral part of interdisciplinary learning."

Almost all interviewees stressed the importance of digital skills in future careers for pupils. One teacher commented that: "Digital technology needs to be embedded in the curriculum as it so [children] can become a competent member of the work force". The authors of national digital technology strategy stressed their intent that "the national digital technology strategy be seen as an educational strategy not a digital strategy as it has to do with learning and teaching". However, some interviewees commented on that having separate digital technology and education strategies "reinforced the view that digital technology was seen as separate to STEM … [and]…went against trying to embed digital technology in the curriculum…"

The digital literacy skills were refreshed and new benchmarks were developed in 2017. This was one of the actions mentioned in the national strategy on digital technology. The pace of change in digital technology which means constant updating was an issue mentioned in interviews. Discussing development work in their cluster of schools on the curriculum one teacher commented: "when looking at curricular area pathways for digital technology it keeps changing and hard to keep up with it."

4.3.2.2 Assessment

The use of digital technology for assessment was a key feature mentioned by those interviewed. Teachers assessed using online quizzes which as well as teaching pupils digital skills also gave teachers both individual and class summaries of how well pupils were doing. One teacher mentioned that "if carrying out assessment in classes using digital technology pupils already have

the skills which can be used in all classes." Teachers also said that using digital technology "is a very useful assessment tool." Another teacher commented that while using digital technology for assessment is helpful but "effective pedagogy is going back and analysing the data" and "just digital technology by itself not going to improve the outcomes of any students need the teacher to take responsibility".

Another feature which came up particularly with secondary teacher was the way we still assess for senior exams which are probably the most important exams than many pupils take. As one teacher commented:

> …the way we assess senior exams is so different than the way we are encouraged to teach … exams are still the same usually multiple choice and/or extended answer without the use of digital technology … just now a senior chemistry class could do better without teaching with digital technology as it might be a better way to prepare students for exams.

Although the Scottish Qualification Agency is investigating the use of digital technology in assessing their senior exams until this happens it will slow the embedding of digital technology in the curriculum particularly in the senior phase in secondary schools.

4.3.3 Impact of professional development on teachers' digital literacy skills

In this section, I discuss the third sub factor of the professional factor which is the impact of professional development on teachers' digital literacy skills. Professional development was seen as a key factor in whether digital technology was integrated into learning and teaching. I have highlighted the important themes in this factor which were found in the interviews. This includes rudimentary level of professional development, timing and amount of professional development time, hierarchy of teachers on training course, pace of change, importance of support and networking opportunities.

As previously mentioned, digital technology has to be integrated into the learning and teaching to have the best impact. This is also part of the research question looking at the factors which impact on the integration of digital technology.

One of the questions asked in the interviews was to assess the level of integration of digital technology. I used Magenta (2017:21-25) T3 framework with those I interviewed to assess their level of application. There are three different levels, the first level T1 - translational is basically translating the content from analogue to digital form. Magenta concluded that classroom applications are mostly low-valued translational use of technology. The transformational technology is the second phase in the T3 framework. It changes learning and causes disruption in the classroom. The last stage in the T3 framework is transcendent use of technology. That is to "go beyond" the classroom and into real life.

The level of training in the use of digital technology in the classroom was commented by many of the teachers as rudimentary or translational and not enough to integrate digital technology in learning and teaching. One secondary teacher commented that due to a training deficit "teachers are only using digital technology in a translational way … take what you know and put it into a digital format"

In a connected point, teachers felt the timing and the amount of professional development time was not contusive to them carrying out the role expected of them. In the Google G Suite training teachers in one authority got two twilight sessions in and then two other twilight sessions in building capacity in schools. Unfortunately, because of technical difficulties the teachers were unable to use the G Suite properly before the training on how to cascade the digital technology took place meaning the training was less relevant. Training taking place in twilight session is also a problem as the participants are usually tired and may not be fully focussed. One teacher commented on the twilight training they received on G Suite was:

> "You don't get cover to attend training during the day so it has to be after school … the training that was received on G Suite was not adequate to be leaders of digital learning … I am now seen as a digital leader and feel this is too soon and it is out of my own comfort level."

Leadership of digital technology is important if it is to be successfully integrated into learning and teaching ins schools. Therefore it is important that the leadership of the school are involved in professional development. This was not the case in the staff interviewed. Only one of those interviewed was one of the senior management team in a secondary school. One teacher mentioned: “most of the teachers on the course were ordinary classroom teachers who don’t have a lot of power to implement digital technology in the school”

Many of the teachers also commented on the pace of change in digital technology which made it difficult to keep up with the professional development needs of changing digital technology. One teacher who was carrying out further google training commented: “things change all the time even educator centre in the google site is 2 years out of date”. One of the authors of the national strategy also commented:

> “Speed of change in digital technology prevents research- there is very little hardware/software research into impact on learning and teaching because by the time you have carried out the research the technology is obsolete”

The importance of having someone in the school to support the use of digital technology has been mentioned by several of those interviewed. There is a move to have a digital co-ordinator in each local authority and a digital lead in schools as a recognition of the benefit of this support. One teacher commented:

> “It’s important to have someone in the school to ask … Before there was an IT co-ordinator some teacher refused to find out about the benefits of digital technology.”

Networking opportunities both online and in person were also seen as key to integrating digital technology. In both authorities the digital leaders in schools used digital technology to network and share good practice. One authority used yammer and the other set up their own google classroom so they could talk to one another and share ideas. Many of the teachers who carried out the training mentioned the good support they received from networking within the google education group where teachers around Scotland using google are posting successes and queries. As well as someone in the school to support teachers and networking opportunities to embed digital technology in their teaching other

supports to build confidence and change mind-sets were mentioned such as: "…giving day time training to all staff", "more in-service days", "getting the kids to talk about digital technology" "senior leadership need to take a more active role"

4.4 Institutional factors

In this section, I discuss the second set of factors, the institutional factors. I have highlighted the important sub factors in this factor which were found in the interviews. This includes connectivity, cybersecurity and hardware issues and ecological issues relating to school, authority and national perspectives.

4.4.1 Connectivity, cybersecurity, and hardware and resource issues

This sub factor highlights the difficulties in connectivity, cybersecurity and hardware issues which was a recurrent theme throughout the interviews as one of the main institutional reasons that digital technology was not embedded in the classrooms. If teachers cannot connect to the internet, can't use the sites they need to teach their students and do not have appropriate hardware it will lead to a negative perception and attitude towards integrating digital technology in their learning and teaching. This will then be an inhibiting factor. One of the authors of the national digital strategy stated that:

> "the main challenge is the digital infrastructure in the schools … the broadband and therefore the connectivity and Wi-Fi are variable … There is also variability in the hardware in the schools."

Therefore, issues with connectivity, cybersecurity and hardware and resource issues can be an inhibiting factor I the integration of digital technology in learning and teaching.

4.4.1.1 Connectivity

Other European countries when improving the digital technology in the schools first improved the connectivity across the county before they wrote a national digital strategy. This did not happen in Scotland and continues to cause problems. One frustrated teacher in a secondary school stated that:

> "We spent £10,000 buying virtual reality devices only to find that we needed a stronger broadband for them to work. They are now gathering dust in a cupboard."

Others teachers mentioned the problems of "kids getting frustrated at school as Wi-Fi not working fast enough-particularly when at home got something faster"

4.4.1.2 Cybersecurity

A related challenge is cybersecurity issues causing problems with the control of access to the network and sites in schools. As the authors of the national strategy stated:

> "Part of the problem is in many local authorities the education network is controlled by the corporate IT department ….so education gets treated as another part of the entity with the same rules and regulations that apply to all council staff…. being able to turn what you want in the classroom to a set of technical requirements for a system for education is a challenge…"

As one teacher commented, "certain sites for research in which the content has nothing wrong with it educationally, for example national geographic, but IT say the students can't access"

Nationally there is ongoing work bringing representatives of the Society of IT managers (SOCITM) on the national working group tasked with implementing the national digital strategy to discuss challenges and talk about the needs of education. Some local authorities have gone down the route of having two separate networks one for corporate and the other for education which has been devised to suit the educational needs of schools more. Access to Glow has also being a problem. One of the teachers who was trying to implement G Suite stated that: "there was a problem getting permission on Glow to access the google classroom which meant the implementation after the training lost momentum."

Given that students have access to their mobile phones which have no controls there were views prevalent in the interviews that students should have

unlimited access to sites in schools using the schools network. This was a view aired by both teachers and those who have responsibility for the implementation of the national strategy. One commented:

> "Walls around students on what they can access….limit[s] them in what they can research [and] limit[s] their learning … You need a change in approach and should teach then about responsibilities and what is appropriate to look at in digital technology."

One teacher commented that "we can't control what young people look [with] 3G signal … We have a responsibility to get children to use [digital technology] responsibility. However, other teachers commented that they "wouldn't agree with free access in schools as it would cause parental complaints and the media would have a field day if something went wrong."

4.4.1.3 Hardware and resources issues

Variability in access to appropriate hardware was again a recurrent theme in the interviews. However, it would be too simplistic to believe that if there was more hardware in the schools digital technology would be integrated into learning and teaching. Scotland's schools are in line to receive a share of over £120 million next year to help close the equity gap though the Pupil Equity Funding (PEF). Already much of this money in previous years has been used to buy digital hardware. One of the teachers interviewed in a primary school had just taken delivery of 100 iPads, funded through the PEF. She stated that this meant there was "19 IPads per stage and children could now access throughout the day for personal research which was making a big difference." However, one secondary teacher commented on the use of the PEF funding to buy hardware sometimes causing problems when it was only targeted at students in SIMD 1 and 2.

The authority bought chrome books and handed them out to the students in the secondary school who lived in SIMD 1 and 2 areas-they were then teased by other students who realised that they had only got the chrome books since they were poor. This led to the students who had been offered the chrome books being reluctant to both take and use the chrome books particularly in school because of the stigma.

However, teachers have commented that hardware is a problem with comments such as “if you go to computer suite the computers are aging and slow and as they have been treated poorly they have missing keys.” Others have commented on timetabling issues: “I have tablets in my primary school on Thursday morning so I timetable digital technology activity then” but wish they had more “flexibility”.

At times when carrying out the interviews I wondered if these were excuses not to use digital technology. Spending lots of money on hardware, which is often not used, is not the answer to integrating digital technology in learning and teaching. One promoted secondary teacher commented:

> “Teachers always say they need more digital technology hardware but the important question is …is the equipment used to its best? What we sometimes finds is lots of equipment in a cupboard because of lack of training, confidence…”

The sentiment about giving students hardware for free and without any responsibility was echoed by another teacher who had worked as a teacher in Australia who commented:

> “In Australia they had 1.1 netbooks policy where the schools gave them directly to the pupils for free –they found that many of the netbooks were destroyed in a few months”

As one of the interviewees stated it is using different tools for different things “it is using the correct tool at the correct time for the correct purpose.”

In some schools as a way to get around the lack of hardware they have a bring your own device to school policy. The student’s device in then connected to the schools Wi-Fi which is usually the student’s own phones. There are different views about the success of the bring your own device policy in schools. Many interviewees commented positively on the policy saying that: “90% of secondary children are walking about with super computers in their pockets”

However there are other views in schools on the use of mobile phones where teachers “often tell students them to turn them off as they feel they cause behaviour problems and are a distraction” others comment that “if teachers gave them something purposeful to do with the phones there would not be a

problem." However at times there does appear to be a problem with a few students who find it difficult not to look at social media every few minutes. As one teacher commented in a school who has a bring your own device policy:

> "There is a daily battle with inappropriate phone use. Students download an app which bypasses the schools firewalls and means the school has no way to know what sites they are accessing ... Students looking constantly at social media is just a nightmare."

This negative view of digital technology from teachers must also have an effect on the teacher's own perception of technology use in their pedagogy.

One of the authors of the digital strategy commented on a piece of research which is often used against the use of mobile phones in the schools:

> "There is a conservative movement that headteachers should be given the powers to ban mobile phones. They quote the school of economics research say that banning mobile phones in schools could be a low cost way to raise attainment. However it never looked closely at other factors which could explain the difference in attainment in the schools."

4.4.2 Ecological issues relating to school, authority and national perspectives

Ecological issues relating to school, authority and national perspectives is the second theme under the institutional factor. As part of this I am going to look at the development and implementation of the national policy on digital technology and the relationship between national, local authority and school levels. I will now discuss issues highlighted in the interviews.

4.4.2.1 Development

The authors of the strategy stated that the "development of the national strategy began with the development of GLOW in 2007". This is the Scottish Schools National Intranet. It is a major national ICT and telecommunications programme managed by Education Scotland. The funding for Glow came from the Scottish Government and the project is a collaboration between local authorities, Education Scotland and RM Education. They also stated that "due to lack of funding over the years it was unreliable." A decision had to be made about what to do with GLOW whether to scrap it or not.

Mike Russell (2011) delivered a ministerial statement through you tube on the future of Glow. He outlined 5 ICT education objectives in this statement. In 2013 the next education minister, Michael Russell, set up the ICT Education excellent group in 2013 to look at the future of GLOW. The authors mentioned that there were "were difficulties" realising the group's ambitions and the reality of working within public spending limits but "got there in the end". In 2014 due to significant funding re-developed Glow 2014." After the significant funding which GLOW received it was imperative politically that the GLOW was seen at the forefront of digital technology in Scotland. The authors stated that the:

> "impetus for the development of the national strategy came as a result of the Gateway review October 2014 saying there were lots of stuff in place on digital technology but no real strategy."

The Gateway review (2014) which is an independent and confidential peer review process that examines programmes to assess their progress and to rate the likelihood of successful delivery of their outcomes. As a result of this review of digital technology in Scotland it was agreed to start work on the national strategy. Its main aim was "as a teaching strategy not a digital strategy it is about creating the conditions so teachers and learners can benefit from digital technology".

The four objectives came from Mike Russell's ministerial statement and the objectives from European commission policy paper written by Brecko et al (2014). This policy paper presented a set of policy recommendations about mainstreaming ICT enabled innovation in education and training in Europe. One of the authors of the strategy stated that it was felt "the objectives in the ministerial statement were not strategic enough more things we want to see rather than things we need to do." The objectives outlined in the national strategy were much more strategic.

Those interviewed also stated that as the overarching vision for Scottish Education is excellence through raising attainment and achieving equity they see this strategy as helping achieve this vision if the four objectives are met. The national strategy on digital technology aims to ensure all learners and educators are able to benefit from digital technology in their education. Other

interviewees commented on the link of the national digital strategy to other government policies that: "…relates to world of work there are now 90,000 jobs with a strong level of IT …12-13000 new jobs in [cyber resistance]" and the "curriculum for excellence around digital literacy."

4.4.2.2 Implementation

The strategy developed actions plans and expectations for educational establishments, local authorities and national bodies to achieve this aim. If the aim is to be realised interviewees repeatedly mentioned that "it requires leadership" at the three different levels educational establishments. local authorities, and national bodies.

Many of those interviewed stressed the importance of leadership in implementing the objectives of the strategy to enhance learning and teaching using digital technology. One local authority officer commented that:

> "I can tell from the schools if the headteacher is not interested which means often nothing happens in digital technology in their school. Alternatively, if the headteacher is interested lots of good things around the implementation of digital technology."

The importance of leadership in the use of digital technology in schools was repeated by a deputy headteacher in a secondary school: "leadership doesn't need to be from the headteacher –he/she needs to empower the right person…Then leaders need to model and use digital technology." One secondary teacher who was tasked with promoting Google G Suite in the school also commented on the importance of leadership in promoting a new development: "you need buy in from the leadership you need them to lead by example if in a leadership role"

Local authorities usually have a digital officer working centrally who helps implement digital technology in the educational establishments. One of the digital officers commented that "they are trying to get a digital leaning co-ordinator in every school" She has found that if there is someone onsite who can help develop digital technology in the school can be useful in embedding digital technology in teaching.

National government officers, when asked what would make the biggest difference in enhancing learning and teaching through the use of digital technology, collectively answered: “the implementation of the national strategy on digital technology by all stakeholders”. This implementation is led by the national programme board which is chaired by a strategic director from Education Scotland. The national programme board involves stakeholders who are key players in the implementation of the national strategy. One of the interviewees commented: “it is important that the programme board involves all stakeholders as it is better to get things done.” The leadership of this board is key in the implementation of the national digital strategy. Others interviewed argued: “the strong strategic leadership of the Programme Development Board leading to partnerships between IT departments, contractors, procurement boards and local authorities and schools is key.”

4.5 Conclusion

The professional and institutional factors analysed from the semi-structured interviews which impact on the integration of digital technology in learning and teaching are not mutually exclusive. They illustrate the interrelated complex picture in highlighting the factors in the integration of digital technology. Due to the interrelated nature of the factors highlighted in the interviews it would be useful to analyse them more using an environmental perspective and the different layers that are part of this picture.

Looking first at the relationship between the student and the teacher and the different roles which integration digital technology foster which as highlighted may account partly for teachers’ perception and attitudes. Both the teacher and the student are part of the school which has a curriculum and assessment process as well as deciding on those teachers who attend professional development. Connectivity, cyber security and hardware and resources are provided by the schools. Schools are part of the local authority and follow guidance from the local authority in the integration of digital technology. They in turn are guided by the national government whose strategy on digital technology is also affected by ecological issues.

In the discussion chapter I will look at the factors highlighted within an ecological perspective.

Chapter 5. Discussion

5.1 Introduction

The overarching research question posed by this study is ‘what are the factors impacting on the integration of digital technology in learning and teaching in educational establishments?’ This is an important question to answer given both the amount of money which is provided for digital technology and the benefits for children and young people if digital technology is effectively integrated into learning and teaching.

However, despite this both the academic literature and my own research illustrate that digital technology is not yet integrated into the learning and teaching in educational establishment. By researching these factors my research plans to make recommendations to improve the integration of learning and teaching in educational establishments.

The main factors highlighted in my research I have divided for the purpose of the study into professional and institutional factors. The professional factors are teacher’s perceptions and attitudes, curriculum and assessment and the impact of professional development on teachers’ digital literacy skills. The institutional factors are connectivity, cybersecurity and hardware and ecological issues relating to national, local authority and school perspectives.

However, these factors are not mutually exclusive but overlap. The question you could ask is which has more impact on the integration of digital technology. Is it professional factors or institutional factors? My research indicates that they are interconnected. For example, although perception and attitudes come out strongly both in my research and the literature as a factor which can enable or inhibit the integration of digital technology. They are affected by other issues. If your connectivity is poor and the hardware is not working this in turn affects your perception and attitudes towards digital technology integration in your classroom. It also decreases the chances that you will properly integrated digital technology into your learning and teaching.

Therefore, the integration of digital technology in the classroom is a complex issue. Based on my research I believe it is more helpful to look at a wider ecological perspective in answering the research question.

The importance of the ecological perspective, i.e. taking a holistic, contextual approach when looking at the factors was highlighted in my research and the literature (Ertmer and Ottenbreit-Leftwich, 2010; Fullan and Donnely, 2013; Kopcha, 2010; Levin and Schrum, 2013; Magenta, 2017; Zhao and Frank, 2003). For example, Levin and Schrum (2013:30) use the metaphor of a jigsaw puzzle to highlight the separate pieces and the interactive nature of the pieces as factors in the integration of digital technology in order to get a complete picture. I agree with Zhao and Frank (2003: 81) that it is necessary to look at the integration of digital technology in an ecological way as:

> "Schools exist as a complete unit necessary for functioning over a long period of time in a hierarchical structure. It is nested in a school district, which in turn is part of a state educational system that is part of a national educational system."

The interactive nature of the factors highlighted in my study is also clear in the findings with many of those interviewed highlighting the relationship between different factors.

In taking a wider ecological perspective it is important to look at what schooling or education is in terms of digital technology. Biesta (2012:5) argues that connecting the question of digital technology to that of the aims of education in the way we:

> "make decisions about the content we need (the question of curriculum) and about the kind of relationships (pedagogy) that are most conducive for achieving what we seek to achieve, Without a sense of purpose, there may be learning but not education."

These questions were highlighted in my research and I will analyse further in this discussion. Another issue which was a finding in my research the way that the integration of digital technology can change/disrupt education as an "invading species" (Zhao and Frank, 2003:810). The disruption of education using digital technology has been hotly debated by many researchers who also see the

importance of transforming and disrupting education using digital technology. Elstad (2016:20) sees the use of digital technologies as a way to “re-shape” the learning environment or disrupt education.

However, schools have not really changed since their inception and as Elstad (2016:4) states they still reflect their origins as a means to meet industrial society’s need for instrumental skills and now “must respond better to a changing world.” Park (2017:21) questions whether it is some deeply “regressive force” which keeps our education system at a standstill in which our children are being taught very similarly to their parents and grandparents. West (2012:4) quoted Joanne Weiss, U.S. Department of Education’s Chief of Staff, who stated that “the biggest challenge for us is that education has been a place that is wildly resistant to innovation”. Jarvis (2009:210) also believes that education is: “one of the institutions most deserving of disruption-and with the greatest opportunities to come of it”.

Therefore, is it surprising that the promise of digital technology to disrupt education has not yet been fulfilled? Christensen et al. (2015:47) stress the point that disruption is a “gradual process”, dependent on separate pieces and the interactive nature of the pieces to get a complete picture of the integration of digital technology. It is important, therefore, that my research which has looked at the factors which both enable and inhibit the integration of digital technology in learning and teaching adds to the body of academic knowledge researching this disruptive process.

In my research I have interviewed national, local authority and school staff and concluded also from this research that from an ecological perspective each of the personnel involved in these three levels are interrelated when looking at factors that either inhibit or enable the integration of digital technology.

Using this ecological perspective, I am going to discuss the role of the national, local authority and schools around the impact of the factors highlighted in my research.

5.2 National Perspective

My research, particularly with those interviewees who work at a national level, stressed the importance of the political perspective on education policies and strategies including the national strategy on digital technology, which reflects the literature (Murphy and Skillen, 2013:1). The SNP is constantly judged, by the media and other political parties, as failing in delivering on improvement in education. Recent senior exam results which are poorer than last year have immediately being used by the media, unions and other political parties to illustrate that the SNP is failing in improving education (Carrell, 2018). Teachers have threatened to strike over work related issues (McIvor, 2019). The government have agreed a 13% pay rise for teachers which is nearly 10% more than other public service workers have received. (McIvor, 2019). This demonstrates how important delivering on educational improvement is to the SNP government.

The integration of digital technology in learning and teaching has to take into account the social relations that constitute education nationally. As well as the political perspective, there are economic, cultural and commercial interests which are interrelated nationally. I have outlined the importance of perception and attitudes of teachers as a factor in the integration of digital technology but equally the perception and beliefs of those nationally who are involved in this are important. Their perceptions and beliefs will also affect their behaviour and actions around the integration of digital technology.

Nationally, the government has a major role in factors highlighted in my research as either enabling or inhibiting the integration of digital technology in the integration of learning and teaching. Particular factors which they have a more national role are curriculum, assessment, connectivity, cybersecurity and hardware and resource issues. I will also discuss the development and implementation of the national strategy on digital technology as this directly impacts on the integration of digital technology in learning and teaching at local and educational establishment level.

5.2.1 Curriculum

Perceptions and beliefs around the aim of education in relation to the importance of digital technology will have implications around its use in curriculum and assessment which are other factors I have highlighted in my research. The aims of education and the curriculum which is taught in our educational establishments is mandatory for local authority educational establishments and is governed at a national level. Schrum and Levin (2016) believe digital technology has a key role in delivering engagement and empowerment for students.

In my research, Curriculum for Excellence (2010), which is our national curriculum, was highlighted in my findings as a factor in the integration of digital technology in learning and teaching. Curriculum for Excellent has a separate part for outcomes for digital literacy but stresses that these outcomes could be met in any/all curriculum areas. Masters (2018:123) highlighted that the Australian curriculum also emphasises this development incorporating digital technologies as both a learning area and an essential capability across the curriculum.

Teaching digital literacy outcomes is mandatory which is an enabling factor. However, what it is clear from my research was a belief that if you wanted to transform learning and teaching digital literacy needed to be properly integrated in the curriculum. Digital technology should not be just an add on or worse a babysitting tool. Teachers also believed that it was important “to make connections for different curriculum areas” and suggested that digital technology should be an integral part of “interdisciplinary learning.”

The literature supports this statement that digital technology must be integrated into the curriculum rather than being an add on to impact. Others view the necessity of still teaching different subjects in the curriculum which is the traditional curriculum methodology as redundant. Their argument is that instead of teaching separate subjects we should be teaching 21st skills which are more relevant to student’s future employment. Elstad’s (2016:20) argument is that “Tomorrow’s pupils will increasingly compete in a transnational or global society

and so must be proficient communicators, collaborators, critical thinkers and creators”

The Apprenticeships and Skills Minister, Anne Milton has highlighted the importance of digital technology but disagreed with the move to teach the 21st skills independent of subjects. , Speaking at the 2018 Bett show she stated that:

> “There are too many examples of governments around the world that have mistaken ends with means in the hope of preparing pupils for the 21st century, damaging educational standards in the process.”

I agree with many of those interviewed in my research that using “interdisciplinary learning” allow teachers to teach subject specific skills and knowledge and also the 21st skills in the integration of digital technology. Interdisciplinary is one of the contexts of learning of our national curriculum. Many of those interviewed spoke about the increase in collaboration and creative thinking of their students when using Google Gsuite which is reiterated in the academic literature (Blau and Caspi 2009:49; Zheng et al., 2014:201).

Some researchers like Park (2017) advocate using digital technology so that the curriculum should be about teaching children how to learn, where to find information and when to be critical rather than a pre-determined curriculum. She advocates using digital technology, particularly online learning, to improve personalised learning tailoring lessons to suit each student’s strengths. Personalised learning is another key principle of curriculum for excellence and requires teachers to tailoring learning, teaching and assessment to learners’ needs. As with those interviewed in my research, Park (2017) sees the strength of using digital technology in interdisciplinary learning highlighting the collaboration benefits. Park (2017:22) also states that “emerging technologies will hopefully break boundaries that separate different study fields”

Discussing the impact of the factor of curriculum in the integration of digital technology within a national ecological perspective has illustrated that it is important to look at it holistically. Addressing what is education for in regards to the integration of digital technology and looking at other issues around the

curriculum. From my findings there is an argument to ensure that learning 21st skills are part of the delivery of the curriculum within curriculum for excellence interdisciplinary context for learning along with an increased focus on personalised learning. Park's (2017) belief that we should teach children how to learn, where to find information and when to be critical can also be taught as part of the curriculum. However, it is when digital technology is properly integrated in the curriculum will it become a true enabling factor in transforming the learning and teaching.

Although, the integration of digital technology in the curriculum was one of the key aims the national strategy on digital technology was published separately in 2016 and not as part of the national science, technology, engineering and mathematics (STEM): education and training strategy published in 2017. This gave a strong national message to education staff that digital technology was not seen as part of the curriculum either directly or indirectly. This then may highlight the perceptions and beliefs of the person (s) who made the decision around publishing separate strategies. It could also have been made for political or other reasons at this time. This stresses the importance of having a wider ecological perspective around the integration of digital technology in learning and teaching

5.2.2. Assessment

Assessment is another key factor which can either inhibit or enable the integration of digital technology in learning and teaching. Nationally, the Scottish Qualification (SQA) Agency, control the assessment of accredited exams in secondary schools. Some examinations and other forms of assessment are moving away from paper and pen form to being administered online. They have commented that this has saved time in relation to preparing for and marking assessments, moderating assessments and providing targeted feedback to learners. The use of digital technology in this way nationally is an enabling factor in the integration of digital technology in learning and teaching (Scottish Government, 2016:25).

However, a strong feature which came up in the interviews in the research was the way nationally we still assess for senior exams by using pen and paper which inhibits the use of digital technology in assessment. Teachers commented that this goes against the way that students are taught in the classroom. This was also an issue brought up in the literature of concern of many students of the need for them to balance the benefits of the digital practices and to practice their 'pen and paper' through which their senior exams will be conducted.

Many teachers mentioned their and their students concern about the risk of dependence on keyboards undermining their ability to handwrite in their senior exams Blikstad-Balasa and Davies (2017:324) in their study also commented on this dilemma of being able to write in exams. There were concern of many students of the need for them to balance the benefits of the digital practices with the necessity to maintain the traditional 'pen and paper' practices through which their national exams will be conducted. Graeme Clark Head of Digital Assessments Services in SQA (Freeman 2017; 40), stated in a conference looking at learning through technology that: "digital assessment makes things quicker and more efficient….for the assessment of senior exams nationally there are still infrastructure issues."

However, although the Scottish Qualification Agency continue to investigate the use of digital technology in assessing their senior exams until this happens it will slow the integration of digital technology in the curriculum, particularly in the senior phase in secondary schools. This will have an inhibiting factor on the integration of digital technology on learning and teaching. It also demonstrated, the ecological perspective, in that what is decided nationally, has an impact for the local authority and also schools in the integration of digital technology.

5.2.3 Connectivity, cybersecurity and hardware and resource issues

One of the key factors which was significant in my research was connectivity, cybersecurity and hardware and resource issues. In my research a recurring theme by those interviewed was problems concerning the digital infrastructure in schools which was they saw as a significant issue in preventing the integration of digital technology in learning and teacher. I have highlighted the importance

of digital technology in disrupting pedagogy but a significant finding in my research is that connectivity, cybersecurity and hardware and resource issues are also causing disruption in the integration of digital technology. This is not highlighted enough as a significant factor in the literature.

5.2.3.1 Connectivity

Connectivity in those interviewed cited this as the "main challenge" citing problems with broadband/ Wi-Fi. In other European countries, who when improving the digital technology in the schools, first improved the connectivity. Nationally, we would have been better served focusing on this initially. This is a particular issue in the northern part of Scotland where connectivity is poor with some departments taking turns in using the Wi-Fi as it is not powerful enough to serve the whole school. Schools have also bought thousands of pounds worth of hardware only to find out that it does not work properly due to poor connectivity. Schrum and LevIn (2016) stressed the importance of providing enough bandwidth for all those who require it in the school. This they commented should come before buying any digital devices.

Students also find the poor connectivity at school frustrating as often they have better connectivity at home. It makes them reluctant to use digital technology in their learning at school. In the research literature this key issue is often ignored with authors like Selwyn (2017) underplaying the importance of connectivity. Everyone who uses digital technology but especially in a classroom knows the frustration when it doesn't work which in turn makes you reluctant to use the technology again. The issue of problems of connectivity is one highlighted by both Luckin et al (2012:57) and Derbel (2017) who agree with the findings in my research that connectivity is an issue in the integration of digital technology in learning and teaching. I agree with the conclusions of the study by Luckin et al (2012:57) that issues of connectivity "warrant greater consideration."

Improving access to digital technology for all learners is one of the objectives of the national digital technology strategy therefore connectivity should be given priority. Nationally, as outlined in the literature review, the national intranet for Scottish school called GLOW was developed in 2007. At the time it was the

first such tailored service for a nation's schools anywhere in the world. Hepburn (2015:17). However, due to lack of funding it was unreliable. In 2014 due to significant funding it was re-developed. Hepburn (2015:17) commented that doubts existed about its value for money, with that Glow cost 52 million pounds between 2005 and 2011.

After the significant funding which GLOW received, those who were interviewed stated that it was imperative politically that the GLOW was seen at the forefront of digital technology in Scotland. However, although it is useful for example in accessing freely commercial products such as Google G Suite, its use is still patchy in Scottish Schools with some schools and local authorities using other intranets. (Freeman, 2017:40). Those interviewed also stated that GLOW was developed in a time before YouTube, Facebook and Twitter so it is out of date with new developments in digital technology.

The issues around connectivity illustrate the interconnectedness of decisions being made nationally with different players, politically, commercially and educationally. These decisions, in the wider ecological perspective, in turn affect local authorities and schools.

5.2.3.2 Cybersecurity

Another problem which is highlighted in my research is the difficulties of accessing educational sites due to security concerns. This is an issue which is affecting the integration of digital technology in learning and teaching. If you can't access a particular site you need to teach children it means you can't use digital technology in your teaching. Part of the problem is in many local authorities is that the education network is controlled by the corporate IT department. Getting the corporate IT department to work together with education is a challenge.

Nationally, as it is a nationwide problem, this dichotomy of trying to keep students safe and allow them appropriate access is being addressed. The national working group, which is tasked with implementing the national digital strategy has representatives of the Society of IT managers (SOCITM) on the national working group. (SOCITM) control local authority networks. The national

group as one of the actions of the national digital strategy is working on the issue of the different needs of education with SCOITM to try to broker a compromise to allow students to access appropriate educational sites nationally. This is already having a beneficial impact on access to appropriate sites emphasising the importance of tackling this issue nationally. Action Plan for the National Digital Strategy (2017).

In my research several of those interviewed advocated for unlimited access to sites in schools using the schools network. This was a view aired by both teachers and those who have responsibility for the implementation of the national strategy. Their argument, which is the one used in Norway, is you need a change in approach and should teach then about responsibilities and what is appropriate to look at in digital technology. As students have unlimited access on their phones the restrictions seem redundant. However, for others including parents it is seen as a legitimate concern that their children access inappropriate things and there should be restriction on access to sites. At the present time nationally, there is still no unlimited access in educational establishments which is unlikely to change in the foreseeable future.
In the literature cybersecurity is one which is not mentioned in any significant detail in the literature although it has a strong impact on the integration of digital technology in learning and teaching according to my research. It is therefore important that nationally this issue is rectified which will have a positive impact on the integration of digital technology in local authorities and school highlighting the ecological perspective.

5.2.3.3 Hardware and resource issues

Another issue brought up in my research is the increase and variability in access to appropriate hardware and resource issues. As highlighted in the literature review decisions which are made nationally have impacts on the integration of digital technology both in local authorities and schools. The increase in hardware has also been caused nationally by the use of extra national funding to help close the equity gap. A proportion of this has been used to buy digital technology hardware. Selwyn (2017:172) states “that technological intervention are often less likely to help those who need the help most, and more likely to advantage those individuals who are already advantaged”. However, this funding

has been used to give children living in poverty more access to digital hardware. Although in some instances due to the criteria for the funding you can have educational establishments in very similar areas having funding while others do not which at times is leading differences in students' access to hardware who may be living in poverty. In some ways national policies are therefore going against the second aim of the national digital strategy to improve access to digital technology for all learners.

The amount of digital technology hardware in the classroom show an upward trend. BESA (2015) Therefore, given that both my research and the literature indicate an increase in hardware it is important that the correct hardware is purchased to integrate digital technology in learning and teaching. However, an issue which is highlighted in my research is the dilemma of how much and what hardware you buy was a recurring theme in my research. This is an issue which is also mentioned in the literature. Escueta et al (2017) stressed the importance also of the challenges facing those who purchase digital technology. They stress that given the rapidly changing ed-tech field that research that is timely, relevant and actionable should be used to decide purchases. However, do headteachers and managers have time to do this?

In my research, to address the variability in access to digital technology, there has been comments about the benefit of providing every learner in schools with one-to-one digital devices such as tablets and laptops. There are claims, often not surprisingly, by the technology industry that this will give learners a range of benefits, both practical and educational.

One teacher who was interviewed had worked in Australia stated that there policy on one-to-one devices didn't have a positive impact. Concern about the benefits of one-to-one devices is also present in the literature with Blikstad-Balas &Davies (2017:311) commenting that providing learners with one-to-one digital devices the "opinions are still divided as to the benefits". The one laptop one child initiative (OLPC) was seen as almost above criticisms. Selwyn (2017.) However, he stresses the importance of looking at the social, political, cultural and economic contexts within which this initiative took place. Selwyn (2017). It

is important when discussing educational technology to take into account resources, knowledge, profit and political gain.

In some schools as a way to get around the lack of hardware they have a bring your own device to school policy. The student's device in then connected to the schools Wi-Fi which is usually the student's own phones. In my research there are different views about the success of the bring your own device policy in schools. Some are positive but others comment on a problem with a few students who find it difficult not to look at social media every few minutes. However, as one interviewee stated if students have £1000 worth of digital technology it is pity not to use it when in some schools there is very little hardware.

Fullan and Donnelly (2013) in their Framework for Assessing Digital Innovations in Education) developed an index to be used as an evaluative tool to enable educators to systematically evaluate new companies, products and school models, using the context of what they have seen as necessary for successful paradigm shift. This index was seen as useful for schools Docherty (2015). Luckin et al (2012:58) argue that decisions about digital technology in education should be driven by educators and those who actually use technology in the classrooms. However, at the end of the day educational digital technology is a commercial enterprise. Selwyn (2016:51) comments that:

> "It is important to recognise the influence of commercial actors….the design, production and sale is wholly dependent on commercial issues…the nature, form and governance of digital technology use in education are being influenced by the involvement of commercial firms."

This view of the involvement of commercial digital technology organisations in education is one I have highlighted in my research. One of the actions in the national strategy on digital technology which I have followed up in my research is to increase partnerships including commercial partnerships for the benefit of educational establishments. Scottish Government have zero profit contracts with both Micro-soft and Google, through GLOW, which allow free access to a range

of their software for education establishments. However, “this also develops “brand awareness” and loyalty amongst future customers.” Selwyn (2016:56).

Google is also involved in national free professional development for education staff on Google G Suite. However, this also gives Google access to those in educational establishments purchasing other educational digital technology and raising the brand awareness. Google G Suite was developed as an education software rather than a business software which in contrast to other software teachers have found useful in the classroom. Free professional development is also useful for educational establishments.

One point which came up repeatedly as a cause for the lack of confidence was not just teacher’s own confidence but their lack of confidence in the hardware. Teachers commented that often it is not a lack of confidence in their skills in using digital technology in teaching but a lack of confidence in the technology. The lack of confidence in technology is an issue which is not highlighted in the literature.

However, based on my research it would be too simplistic a view to think that just providing appropriate hardware for learners that digital technology would be integrated into learning and teaching. There are many other factors to take into consideration which I have highlighted in my research. I agree with the view from Masters (2018:125), Perrotta (2012:25), Ditzler (2016:181) and g (Knoebel & Kalman, 2016:158) that providing hardware whether on a one to one basis or not is only one factor which may be either an enabler or inhibitor. As Masters (2018:125) expresses, “just because teachers have access to fancy equipment, it doesn’t mean that they will then be able to use it in meaningful ways to enhance teaching and learning.”

One of the aims of the national strategy on digital technology was to improve access to digital technology for all students. Based on my research and backed up by the literature this is only one factor in the integration of digital technology in learning and teaching. National decisions and policies have also affected the equity of access to digital technology for students.

5.2.4 Development and implementation of the national strategy

The national strategy on digital technology is one of the government strategies to improve education. The national digital policy came about due to strong political pressure, economic and commercial issues. The SNP government is committed to using digital technology to improve education. However, a change of government could have a different approach. As Coupal (2004:587) commented the "significance of the political dimension" on the development of digital technology policy. She outlined the difference in the digital technology policy for education caused by the change in the governing political party in British Columbia from a democratic party to a party with a conservative government with a more market-based orientation.

As expressed by interviewees, the national strategy did not attract any extra funding for implementation and was not mandatory. Its development was top down although with wide consultation of stakeholders. The lack of funding was commented by those interviewed as a difficulty in implementing the strategy in local authorities and educational establishments. The actions which were outlined in the strategy had to be financed from existing budgets. My research concluded that this would have inhibited developments to integrate digital technology in learning and teaching. For example, in the professional development for Google G Suite there was no budget for staff cover.

In the interviewees it was discussed whether the national strategy had enough power as it was only a guidance and not mandatory. However, the general consensus was there was not the political appetite to make it mandatory. The impact of government strategies being mandatory or suggestive and their development either being top down or bottom up was researched by Madsen et al (2018:17). They carried out a research project looking at the government strategies of Norway and New Zealand. Both countries have strategies on the implementation of digital technology. However, Norway's strategy is mandatory while the New Zealand strategy is suggestive which more like Scotland's policy. Therefore although the adoption of digital technology in the classroom was mandated in Norway it was the teacher's attitude which determined the extent

it was adopted. They concluded that that mandating the use of digital technology may not be the most effective way of integrating it in the classroom. They also concluded, as does Yang (2012) and Madsen et al (2018:17) that the top-down approach to implementation can limit progress. As discussed before teacher's perception and attitudes towards digital technology are key to its integration in learning and teaching.

In my research the strong ecological perspective of involving all stakeholders in the development of the national digital strategy was seen as a key issue in the successful integration of digital technology in my interviews. The national programme board has developed plans to implement the strategy with key performance measures for the three different levels national, local authority and educational establishments. Would more accountability around the integration of digital technology in learning and teaching improve the situation?

In the national strategy the authors outlined measures of success for the implementation of digital technology. They were at very early stages at looking at measures of success and commented that there was no one single indicator that will tell us if the goal is met. One of their measures of success was that "When undertaking inspections, HM Inspectorate at Education Scotland look for the effective and appropriate use of digital technology" (Scottish Government, 2016:32). This might be useful as it is clear that what is inspected in a school inspection is usually focused on by schools and local authorities.

However, given the infrequency of school inspections it might be more useful to set up a quality assurance system within the educational establishment supported by central local authority staff assessing the integration of digital technology in the school. Given the benefits of digital technology if it is effectively integrated into learning and teaching I would suggest there has to be accountability in our educational establishments for its implementation. Of course, schools' "social contexts" (Perrotta 2012:325) must be considered.

The national strategy for digital technology developed actions plans and expectations for educational establishments, local authorities and national

bodies to achieve this aim. If the aim is to be realised interviewees repeatedly mentioned that “it requires leadership” at the three different levels educational establishments. local authorities, and national bodies (Scottish Government, 2016). As well as leadership it is also important that for implementation that the leaders have positive perceptions and beliefs towards the integration of digital technology in learning and teaching.

5.2.5 Importance of leadership nationally

Taking an ecological perspective as one of the key factors in the integration of learning and teaching leadership has a significant impact on its success. Many of those interviewed stressed the importance of leadership in implementing the objectives of the strategy to enhance learning and teaching using digital technology. The importance of leadership is acknowledged in the national digital strategy as its fourth aim is empowering leaders of change to drive innovation and investment in digital technology for learning and teaching.

The implementation of the national digital strategy is led by the national programme board which is chaired by a strategic director from Education Scotland. The national programme board involves stakeholders who are key players in the implementation of the national strategy. This also highlights the importance of distributed leadership of this board in the implementation of the national digital strategy and the eventual aim of integration of digital technology in learning and teachers. The actions of this board affects the integration of digital technology both in local authorities and educational establishments thus confirming the importance of taking a wider ecologically perspective when discussing factors which enable and inhibit integration.

5.3. Local authority level

Staff who are responsible for the education in a local authority have a key role in what happens in educational establishments. They are tasked by the national government to look after school buildings, curriculum, students and employ the staff in educational establishments and in central headquarters. They also quality assure the education that children are receiving.

Staff in local authorities, who were interviewed, were particularly interested in staff recruitment as a result of the integration of digital technology. Those interviewed spoke about using digital technology in response to difficulties in teacher recruitment, making it difficult to offer a wide subject choice to their learners. The Western Isles Council, solved the difficulty of recruiting teachers for specific subjects, by developing an e-school. This e-school links to all other secondary schools in the Western Isles. This allows entire classes or individual tuition to be delivered through online distance learning which will utilise live video streaming and a range of digital tools and services available through Glow. This is an example of a rural authority solving the problem of recruiting teachers. However, given budget deficits in local authorities it might be seen as a way to reduce the number of teachers required to teach certain subjects. This is also a view highlighted in the literature. Skarzynski and Rufat-Latre (2011:5) also note that offering services at lower cost by using digital technology enables higher student to staff ratios, meaning jobs may be threatened.

Some of those interviewed saw the integration of digital technology as a threat to teacher's professional identity but as a real threat to their actual jobs. Although this may seem an empty threat given the shortage of teachers in Scotland in the USA there are private schools using personalised online material for students who do not employ teachers. Vander Ark (2012:96) suggests there are benefits in blended learning or schooling that's divided in various measures on "the proportion of the day spent online and how much time students spend in school." West (2012:21) outlines this view of personalised learning which is based on a different approach to education that is becoming common in the USA. Although, in Scotland we are not as far along in the digital personalised learning as some of the schools in the USA there is strong direction in education in Scotland to make learning more personalised for students.

In the future will there also be a need for school buildings if learners can access teaching from their home? Vander Ark (2012:158) also questioned the continued existence of classrooms and school buildings stating:

> "life in the age of social media makes the idea that learning only takes place in room 204 from 8:00 until 9.00, five days a week, seems absolutely archaic, sure to go the way of the brick and mortar book shop or record shop….students aren't bound by time and place"

Therefore, the threat to teacher jobs and actual school buildings to teach learners by the increasing use of digital technology may not in the future be an empty threat.

My research highlights that national strategy for digital technology has a significant effect on the work of the local authorities in integrating digital technology in learning and teaching in the classroom. This is both due to being part of national networks and using the strategy to refresh or develop their own local authority strategy on digital technology. Local authorities have a digital technology officer working centrally who is responsible for helping to improve digital technology in educational establishments. They are also part of a national network led by Education Scotland's 'Digital Leaders Group' to share knowledge across local authority boundaries.

These digital officer working centrally also support digital leaning co-ordinator in educational establishment to lead and develop integration of digital technology. Those interviewed said that this has allowed distribute leadership in integrating digital technology in learning and teaching and has made a positive impact in educational establishments,

The digital technology officers in local authorities were also responsible for implementing the professional training provided by Google on Google G Suite which was one of the actions in the digital strategy. As the national digital strategy came with no funding although the training for Google G Suite was at no cost there was no money for staff cover which meant the training was after school in the staff's own time for many of those interviewed. This caused a problem for some of those who were being trained meaning that they could not attend all the sessions. Given that one of the first aims of the national digital strategy was to develop the skills and confidence of educators in the appropriate

and effective use of digital technology to support learning and teaching not funding day-time professional development went against this key aim.

Most local authorities have a digital strategy which is based on the four key national objectives from the national strategy. However, my research highlighted that there were difficulties in implementing the national strategy on digital technology. Given that the national digital strategy is not mandatory, comes with no funding and local authorities can be overwhelmed by other issues it is often difficult for the digital leaders to implement digital technology. As one of the national government interviewees stated “digital technology is not seen as a main priority”. The question is how you get the local authority and therefore the educational establishments to buy into the digital technology agenda given all the different priorities they have to deal with. Those interviewed says is difficult to “make it everyone’s business” to embed digital technology to enhance learning and teaching.

In Wales they have clearly stated that digital competence is the responsibility of all teachers. However, this is not the case in Scotland. Therefore with the national strategy not being mandatory, which as I have mentioned might not be useful, the number of other priorities, having no funding and the first minister being reluctant to make digital competence a responsibility for all teachers it can be difficult for the local authorities digital technology officers to lead the implementation of the strategy effectively in their schools.

Again, it appears that the factor of perception and beliefs either is enabling or inhibiting the integration of digital technology by those in leadership and power in local authorities. Their perceptions and beliefs then in in turn influence the actions in educational establishments around the integration of digital technology. Other factors will also affect the integration of digital technology in learning and teaching in our educational establishments illustrating the wide ecological influence.

5.4 Educational establishment level

As previously mentioned, taking an ecological perspective both the national and local authority perspective on the integration of digital technology on learning and teaching affect what happens in educational establishments. Educational establishments have their own ecology which in turn has an effect on the integration of digital technology.

As discussed earlier different researchers have taken an ecology perspective or systems-thinking approach to explain the connectedness of different parts of the educational establishments in the integration of digital technology. They often use different metaphors to describe context and the different interrelated parts. Elstad (2016), Kopcha (2010), **Ertmer** and Ottenbreit-Leftwich (2010), Zhao and Frank (2003) and Levin and Schrum (2013). Elstad (2016) described the learning contexts of educational establishments based on the Ecology of Resource Framework to illustrate the interconnectedness of environment, knowledge and skills, people and digital tools. Levin and Schrum (2013) use the jigsaw analogy and systems thinking to describe process of the integration of digital technology to improve learning and teaching in educational establishments. Rubegni and Landoni (2016:41) note the "complex ecology" of educational establishments. Lee (2015a:1) comments on the complex nature of the impact of digital technology on learning on schools which have integrated digital technology throughout the school stating:

> "the impact of digital technology on student learning is complex, far more deep-seated than previously thought, is largely non-linear in nature and appears to emanate integrated ecology found in those schools."

Given the complex picture, in discussing the factors which have been highlighted in my research either to enhance or inhibit the integration of digital technology to improve learning and teaching I will focus on an ecological perspective of educational establishments I will discuss the importance of leadership, the significance of perceptions and attitudes towards digital technology

5.4.1 Importance of leadership in educational establishments

Within the school, the leaders have a key role in actions that are taken in a school. As is true nationally and within the local authority there are many competing pressures which have to be addressed. I have already discussed the importance of leadership ecologically in the integration of digital technology arguing that the perception and beliefs of leaders around digital technology affects the integration. This was a key factor which was clear in my research and highlighted by those I interviewed. If headteachers/managers were positive about the integration of digital technology it was initiated, if they were not there was often poor integration. My research found that perception and attitudes was a key factor in either enhancing or inhibiting the integration of digital technology. This was a view also highlighted in the literature. My research agrees with Levin and Schrum (2014:641) who stated: "leadership is very important for promoting teachers' use of technology …..there is a gap in how well school leaders are prepared to lead technology initiatives."

The role of distributed leadership and a vision and a positive culture around the integration of digital technology was also highlighted in my research as important. This view was also highlighted by Louis and Wahlstom (2011:52) in their study looking at school leadership who endorsed the importance of distributed leadership in changing school culture. Many of those interviewed also stressed the importance of leaders modelling the use of digital technology one senior management team member commenting "we are the role models for teachers and pupils." Levin and Schrum (2013:31) reference Spillane (2005:150) who described distributed leadership ecologically as "a system of practice comprised of interacting components: leaders, followers and situation" which must be looked at together. Similarly, Louis and Wahlstrom (2011:52) argue that culture change needs shared leadership. I agree with Levin and Schrum (2014) who also suggested that leaders use and publicly model ways to use technology and encourage, cajole, reward and publicly acknowledge others who use technology.

However, my research findings have shown that even if there is supportive leadership in place for the integration of digital technology in learning and teaching, it is the teachers who lead and have the power to either integrate or not integrate digital technology in the learning and teaching. Teachers to use Lipsky's (2010:221) phrase can be seen as "street level bureaucrats" who have a lot of power over how policies are implemented. So, in effect, their attitudes and actions around digital technology in their classroom can influence whether it is integrated or not in learning and teaching. Maynard-Moody, S and Musheno. M (2003) reiterate the significance of street-level bureaucrats in the political process of implementing policy asserting that they actually make the "policy choices".

Ecologically, the important of leadership has a significant impact on the integration of digital technology in learning and teaching in educational establishments. However, the teacher taking into account the complex context has the power and autonomy to decide whether to integrate digital technology or not.

5.4.2 The significance of perceptions and attitudes towards digital technology

It is clear from my own research that the perceptions and attitudes of teachers towards digital technology impact on its adoption in the classroom. Ertmer et al., (2012:423) reiterated the significance of teacher's perceptions and attitudes as to whether or not teachers use digital technology in the classroom. Teachers' attitudes towards digital technology also affect how they use the technology in their teaching. West (2012).

Given the linking of the perception and attitudes of teachers in relation to the ecology and culture of the school, I will discuss this link more detail. In my research, the issues around teacher perceptions and attitudes were the relationship between student knowledge and teacher identity, the issue of resistance, teacher authority and pupil control, teacher perception and beliefs around the benefits of integrating digital technology in the classroom.

5.4.2.1 The relation between student knowledge and teacher identity

In my research, teachers in the interviews gave a strong picture of their professional identity where many see themselves as professionals, with an identity and status, who lead others in their learning. As one interviewee stated "teachers want to know everything". With digital technology their perception is that this may no longer be true and it can upset their professional identity. Elstad (2016:206) found that students' digital literacy skills are variable which was a finding in my research. However, the perception that students are better contributes to the threat to teacher's professional identity. The integration of digital technology can also negatively influence teacher confidence (Prestridge, 2012), reputation, and identity (Christensen et al, 2008).

In my research there are those interviewed who saw the use of digital technology in the classroom as enhancing the work of teachers. However, they did comment that it often meant a change of role for the teachers as students teaching teachers. For teachers to be comfortable with this they had to see themselves as "learners" as well. Ditzler et al (2016:182) and Ertmer et all (2012:434) discuss this changing role. This changing role of students assisting teachers in adopting digital technology in the classroom was highlighted in my research. It can also to students having an active role and a voice in their own learning in all educational establishments. Positive outcomes of students playing an active role in their education has been reviewed extensively in the literature (Bovil et al, 2014; Czerniawski and Kidd, 2011, Rector-Aranda&Raider-Roth, 2015). This change of role can help lead to the process of disruption of education by using digital technology. It is clear that using digital technology gives student more freedom and an active role in their education rather than relying on their teachers.

It is also interesting that although professional identity of teachers is aligned with the GTC standards for teacher registration which state they have be competent in using digital technology many teachers do not see this as their role or their responsibility. From the findings in my research this is also true of student teachers. As one of the actions in the national strategy for digital technology GTCS will now strengthen references to digital technology.

In interviews there were concerns about student teachers' digital competence and attitude towards integrating digital technology. Those involved in supervising student teachers in their schools were "shocked" at the lack of digital skills in integrating digital technology into learning and teaching. Student teachers may also not know how to integrate technology into the classroom and use it to maximum advantage. West (2012).

Others (Britzman, 2003; Ertmer & Ottenbreit-Leftwich, 2010; Brown et al 2016) also comment on this concern. Just now there are very few initial teacher education departments who directly teach digital skills. As part of one of the actions of the national digital strategy this is an area which is being addressed in consultation with the Deans of the universities who have initial teacher education departments. This is important as our student teachers are the future of education.

The challenge is how do you make this every teacher's business to integrate digital technology in their learning and teaching? Therefore, the sub factor of professional identity can either be an enabling or inhibiting factor dependent on the teacher's perceptions and beliefs. These in turn are affected by the ecology and the culture in the educational establishment they teach in. If the ecology of the school is supportive in the integration of digital technology it is likely that the concerns of teachers around professional identity and the knowledge and role of students would be dealt with to allow the integration.

5.4.2.2 The issue of teacher resistance

In the evidence from the interviews there were comments that the lack of the integration of digital technology is the teacher's fault in that they are resistance or just lazy and don't want to change. Findings from the interviews clearly indicated that there were different perception and attitudes of teachers around digital technology- some embrace it and many others are scared of it. This view of blaming teachers which I found in my research is also prevalent in the literature explained by using words such as technophobia and scepticism. (Howard, 2013, Madsen et al, 2018).

This perceived threats of technology to teachers' practices (John and LaVelle, (2004:323; Crook 2008:34) which resulted in resistance was highlighted in my research. As has been highlighted before digital technology is seen as a disruption to teacher's practice (Somekh, 2007, Ertmer, 1999) and to the education system which is resistance to change. In my research in the interviews teachers not only saw the integration of digital technology as a threat to their habitual ways of working but as a real threat to their actual jobs. I have already discussed this concern and the conclusion that it may not be an unrealistic threat.

Lack of confidence as a reason for teachers not to integrate digital was an issue that clearly came out in the interviews. This was also highlighted in the literature. (Prestridge, 2012: 454). However, one point which came up repeatedly as a cause for the lack of confidence was not just teacher's own confidence but their lack of confidence in the hardware. The lack of confidence in technology is an issue which is not significantly highlighted in the literature. This lack of confidence in the technology was seen by many as causing resistance and the negative perceptions and attitudes around digital technology

The sense of loss by using digital technology was also highlighted in my research which can also lead to teacher resistance. In my research I was given examples of teachers who were not resistance but embraced the integration of digital technology transforming their teacher. I agree with Perrotta (2012) who found that some teachers use digital technology in a disruptive which transformed their learning and teaching positively rather than supplementing their teaching which is the most common use teachers may find that fully integrating digital technology can cause significant disruption – which may be viewed as negative which leads to resistance but can be extremely positive.

Many of my interviewees mentioned overwork as a reason why teachers are resistance to adopting digital technology more fully in the classroom. It was also seen as important in teacher's perception and attitude around digital technology. There is no doubt that teacher workload is a real issue in Scottish Education. As part of the Quality and Improvement in Scottish Education (QUISE

2016) HM inspectors of Education evaluated the arrangements teachers needed to complete for curriculum, planning, assessment and reporting in schools. Their findings included comments that workload linked to planning and the production of large amounts of documentation is a big cause for concern (Scottish Government, 2016: 3). More worryingly, the review of local authorities by Education Scotland noted that only half of local authorities are now ensuring teachers' workload and unnecessary bureaucracy is being addressed well (Scottish Government, 2016: 5). Therefore, given the amount of priorities that both educational establishments have to implement often digital technology is not seen as important. Educational establishments have to be convinced that integrating digital technology will save them time and make them more efficient for it to become an enabling factor.

Some teachers commented that digital technology was "another thing being put upon us" or they see it as additional to the real learning and teaching and see "digital technology as an add on and gimmicky." However other teachers commented positively commented that digital technology was a "useful resource". One of the interview questions I asked what have you been able to give up as a result of using digital technology? This was to ascertain if using digital technology freed up teacher time and made them more efficient. The time which was saved was used by many of the teacher's interviewed to spend more time on improving their teaching using digital technology. The most frequent responses on saving time was spending less time on printing, finding resources, marking and planning. Ditzler et al (2016:182) also highlighted how technology provides efficiencies for educators and learners. Increasingly, also, efficiency benefits are being promoted for students as much as teachers.

Teachers I interviewed have also found that using digital technology can increase both their workload and the divide between work and their personal life as they are always available to their students. Some teachers commented that their partners complained about this. This was also highlighted in the literature as researches talked about the "blurring" of work and personal time (Masters, 2018:127) These beliefs around increased workload could also make teachers resist integration of digital technology in their classroom.

As discussed, although overwork has been put forward as one of the reasons that digital technology is not adopted in the classroom there is evidence that if used effectively it can save teacher time. Some teachers, who were interviewed, already see this and do not resist the integration of digital technology.

It is clear that the picture of teacher resistance is complex and the term resistance maybe too broad a term. My research suggests that the issue of teacher resistance need to be conceptualised in terms of issues such as loss, threat, confidence and overwork issues rather than blame. It also needs to be conceptualised in an ecological perspective. If the leadership and the culture of the school is positive towards the integration of digital technology this will be supportive in helping to alleviate teacher resistance in the integration. This supportive culture will then become an enabling factor in the integration of digital technology.

5.4.2.3 Teacher authority and pupil control

In the interviews many teachers mentioned the disruption that the use of digital technology caused to their authority and pupil control which was seen also as crucial to their professional identity. This finding in my research deviates from the more common view in the literature on digital technology disrupting and radicalising pedagogy my research also highlights that it also disrupts teacher authority. Teachers commented that they “lost control of their classroom” and the ability to “keeping students on task” as you were not sure what they were doing when using the internet. The use of mobile phones in classrooms for personal use was highlighted in the interviews as a “daily battle” which supports findings in the literature (Blikstad-Balas and Davies, (2012:322).

There is also an argument that has been put forward to ban mobile phones in school because they cause disruption in the classroom and threaten teacher control. However, other local authorities have taken a more positive view of mobile phones allowing them to be used for educational reasons in the classroom in the Bring your own device initiative. However, as one teacher commented

using digital technology “might be a problem with teachers who may always have a problem with disruptive behaviour in their classroom.” Others teachers spoke about ways that you can use digital technology to control the classroom; Perrotta (2012) agrees.

However, it would be important that the use of the digital technology is integrated into learning and teaching and has positive outcomes for the students. The concern is that it is sometimes used as a tool to keep students occupied particularly in poorer socioeconomic areas or to minimise disruptive behaviours (Monaghan, 2005:140).

Therefore, teacher authority and pupil control can either be an inhibitor or enhancer. If the students are meaningfully motivated and engaged by using digital technology it is not an issue. However, the reality is that sometimes the digital technology does not work and is disruptive in the classroom. Again, if the leadership and the culture of the whole school is enabling the integration of digital technology there is less likelihood of the sub factor of teacher authority and pupil control becoming an inhibiting factor in the integration of digital technology in learning and teaching.

5.4.2.4 Teacher perception and beliefs around the benefits of integrating digital technology

As discussed, perceptions and beliefs around digital technology are a significant factor in its integration in learning and teaching. The key question is does the perceived benefits of using digital technology help or hinder technology use? As was clear in the interviews many teachers were aware of the benefits of using digital technology but they still did not embed it in their teaching. There were a few teachers who when asked the question if using digital technology made their teaching more effective said it didn’t. This was mainly the view of secondary teachers who were preparing students for senior exams where they did not use technology but would have to write their papers.

However, most of those interviewed were clear that it was only by being aware of these benefits and also having the confidence and digital skill to implement

the technology will it change the perception beliefs around digital technology. My research strongly supports Ifenthaler et al (2013) who also reiterated the importance of teacher attitudes and the importance of performance expectancy and facilitating conditions.

In my research that teachers who do not want to use digital technology can avoid it by saying things like “I am not good with digital technology so I don’t use it.” Similarly, Brown (2017:63) noted that if teachers do not perceive digital technology as valuable they will avoid it even when the curriculum expects its use.

It is therefore important that when targeting and changing pedagogical beliefs and attitudes around digital technology teachers need to be convinced that using digital technology can improve their teaching in the classroom. Other factors such as improved digital literacy will also help to change perception and beliefs. The professional development of digital literacy is one of the themes of professional factors I will look at later in my discussion.

The main benefits mentioned using digital technology, for those interviewed, were increase in motivation, engagement, attendance, collaboration, higher order thinking, skills for learning, life and work and improved learning and access for pupils with additional support needs.

However, as I have mentioned there is a dichotomy in that although almost all the teachers interviewed perceived that integrating digital technology would improve their learning and teaching it was often not integrated. In order to answer this dichotomy, it is important to consider an ecological perspective and the culture of educational establishments.

Lee (2015a, 2015b) pathfinder schools in the United Kingdom, United States, New Zealand and Australia, where all teachers in the school had integrated digital technology in their learning and teaching. Lee (2015a) commented that when looking at the benefits of the impact of digital technology and whether digital technology was integrated you had to look at “macro scene, trend lines and school’s ecology.” Lee (2015a:1) urged:

> "The simplistic way of looking at the impact of digital technology on student learning has to fundamentally change. All associated with schools need to understand that the impact of digital technology on student learning can be profound if an apposite school ecology is created."

Therefore, just because teachers perception and attitudes around the benefits of integrating digital technology in their learning and teaching is positive, it is too simplistic to believe in a complex, ecological situation like an educational establishment this will lead to successful integration. There are other factors which are important to this successful integration.

One of the factors which has not been highlighted significantly in my research is the impact of home and community involvement in the integration of digital technology in learning and teaching. Those interviewed commented on using digital technology to connect with students at home outside school hours often collaborating on a piece of work. Teachers and students found this beneficial in the integration of learning and teaching. However, Lee (2015b:1) discussed increasing the benefits of the integration of learning and teaching using digital technology by expanding the school ecological perspective to: "educational and technological capability outside the school walls…to an authentic home–school–community collaboration." This idea was also discussed by (Lee and Finger, 2010) and (Lee and Ward, 2013) *in Collaboration in learning*. The use of digital technology expands the home-school collaboration discussed by Hattie (2009), by harnessing the power of digital technology to benefit of the integration of digital technology in learning and teaching. Moos and Johansson (2009) suggested that schools form partnerships with parents and social and cultural institutions to help with challenges in improving learning and teaching.

However, there are challenges in actually achieving a strong home-school – community link using digital technology. Many homes do not have internet access particularly in poorer areas. However, as Curran and Ribble (2017) illustrated there are ways of overcoming these challenges describing one headteacher who parked school buses with Wi-Fi routers in neighbourhoods where students needed access at home. Gurung and Rutledge (2014:99) also comment on the importance of teachers and schools align and integrate

resources across students' learning ecologies (e.g., home and school) in order to improve the integration of digital technology in learning and teaching.

In my research, there was some evidence of schools partnering with the wider community. Levin and Schrum (2013:37) highlighted the importance of schools partnering with the wider community, such as businesses, universities and college to receive financial backing and expertise to sustain digital technology initiatives.

It is clear that educational establishments can enhance the integration of digital technology by widening the ecological net beyond the educational establishment.

5.4.2.5 Digital Technology and teacher perceptions of learning outcomes

This study did not look at learner outcomes as a result of using digital technology in educational establishments but was more focused on teacher perceptions of digital technology in learning and teaching. In the last section I discussed teacher perception and beliefs around the benefits of integrating digital technology in learning and teaching. The main benefits mentioned using digital technology, for those interviewed, were increase in motivation, engagement, attendance, collaboration, higher order thinking, skills for learning, life and work and improved learning and access for pupils with additional support needs.

However, a few of those interviewed also mentioned their perceptions of benefits tied to particular curricular areas which led to improved learning outcomes. This was particularly true for STEM. One depute head teacher mentioned using virtual reality in science to improve learning outcomes for students. A maths teacher also spoke about the use of digital spheres giving students a clearer understanding of angles, times, distance and coding. Other teachers stated that they would not have been able to teach their lessons in certain curricular areas as well, leading to more positive learning outcomes, if it was not for the effective use of digital technology.

This perceptions of teachers that the effective use of digital technology can improve learning outcomes in certain curricular areas was highlighted in the

Scottish Government (2015) literature review on the impact of digital technology in learning and teaching. It stated that:

> "there is conclusive evidence that digital equipment, tools and resources can, where effectively used, raise the speed and depth of learning in science and mathematics for primary and secondary age learners. p 2."

Li and Ma (2010) also stated that digital technology seems to be particularly effective in improve learning outcomes in mathematics. In other curricular areas, like literacy and numeracy there was some evidence of benefits but it wasn't conclusive. Archer and Savage (2014) in their meta-analysis study found a relatively small average positive effect on language and learning when using digital technology. Interesting, when they discussed the context in more detail of those studies with a positive learning outcome they found that training and support of teachers was an important factor. This ties into this study which emphasises the importance of professional learning in integrating learning and teaching using digital technology.

Higgins et al (2012) also found consistent but small positive associations between digital learning and educational outcomes. Researchers such as Jewitt et al (2011) concluded that using digital technology can also provide learners with more time for active learning in the classroom thus changing the pedagogy to improve learning.

Technologies is an important curricular area in curriculum for excellence (CfE). As stated in CfE (2010) "learning in technologies enables children and young people to be informed, skilled, thoughtful, adaptable and enterprising citizens. P1". One of the organisers is the use of digital technology to enhance learning. The pace of change in digital technology which means constant updating was an issue mentioned in interviews by teachers confirming the importance of professional learning.

The transformational and disruptive action of using digital technology has been stressed by many researchers. Perrotta (2012) states that some teachers use

digital technology in an innovative way which disrupted their learning and teaching leading to transformative. As far back as 1981 Tikomirov described two possible roles for digital technologies: supplementation and transformation (or reorganisation), and argues for the latter. Many of those interviewed stressed that for digital technology to have the best impact on enhancing learning and teaching it has to be embedded in the curriculum and be an integral part of teaching. However, many teachers interviewed perceived that there were clear that there were benefits in using digital technology to improve learning outcomes for students in curricular areas.

5.5 Pedagogy, curriculum and assessment

In this section I am going to discuss the importance of pedagogy, curriculum and assessment as a factor in the integration of digital technology in learning and teaching in educational establishments.

5.5.1 Pedagogy

There are two issues with regard to pedagogy and digital technology which are not mutually exclusive. These are highlighted both in my own research findings and the literature. Firstly, the critical importance of the actual pedagogy in the classroom with the emphasis always on first to design effective teaching then look at how this can be enhanced by the use of digital technology. Secondly, the need to integrate technology in the learning and teaching if you want to transform or disrupt the teaching. This often leads to a different role for the teacher making the teaching more student centred rather than teacher centred. It also highlights the way the teacher uses digital technology. I will discuss each of these points in turn.

In my research it was clear from the interviews that effective pedagogy was key emphasising the importance of first looking at what you are wanting to teach and then using digital technology to improve the pedagogy with teachers stating “technology doesn’t do the teaching” and “for poor teachers, lots of technology makes no difference to their learning and teaching”. This view is supported in the literature (Higgins 2012:15; OECD, 2015:17).

In order to enable learning and teaching to be more effective when using digital technology my research findings highlighted that digital technology needs to be integrated into the learning and teaching rather than being an add on. This view was confirmed in the literature in that it is not whether technology is used (or not) which makes the difference, but how well the technology is integrated to support teaching and learning. As with my research, it was clear in the literature that the integration is not always integrated in the learning and teaching but has a supporting role.

In the interviews, one of the questions in my interviews looked the way the teachers used the digital technology in the classroom using the terms of Magenta's (2017) T3 framework which has previously been described. My results confirmed the findings of the academic literature that most teachers used digital technology in the classroom in a translational way. Teachers commented that they used digital technology in a translational way as it is more "time efficient". However, there were a few who did use digital technology in a transformational way commenting that they could not teach the lesson without the use of digital technology.

Teachers felt that they needed more professional learning in order to use digital technology in a more transformative way. The training they received in implementing Google Suite gave them the confidence to only use digital technology in a translational way. As discussed in the previous section professional learning is one of the key factors in inhibiting and enhancing digital technology in the classroom

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In my research and in the literature the view was present of the importance of pedagogy over technology and the use of technology being "disruptive" rather than a "distraction" to learning. Others researchers also see the importance of transforming and disrupting pedagogy using digital technology. This view as digital technology as disrupting traditional pedagogical approaches is an issue which has been discussed by many researchers in the literature on the adoption of digital technology in the classroom. The literature also agreed with this view that there needs to be a pedagogical shift (OECD, 2015).

In my research many of the teachers also commented on the need for a paradigm shift and a "different pedagogy" when using digital technology if you want to improve learning and teaching. This is the change of role for the teacher when using digital technology as one teacher commented "it is about giving the learning to the students."

In conclusion, it is clear that when digital technology is integrated into learning and teaching it can disrupt both the learning and teaching and the role of the teacher. Pedagogy has a significant role in either inhibiting or enabling the integration of digital technology in learning and teaching in the classroom. Again, taking an ecological perspective teachers need to be supported by the leadership of the educational establishment and their peers to change their pedagogy and be confident to integrate digital technology into learning and teaching.

5.5.2. Curriculum

In my research it was clear that there was a belief that if you wanted to transform learning and teaching digital literacy needed to be properly integrated in the curriculum. I have already discussed the importance of the curriculum when analysing the national perspective. As teachers have to teach the national curriculum this has a direct effect on the curriculum in the schools. However, in many cases they do have freedom in the pedagogy of how to teach this and whether they integrate digital technology and focus on teaching 21st skills (National Research Council, 2012:1).

5.5.3. Assessment

I have already discussed the importance of the curriculum when analysing the national perspective. In my research assessment using digital technology was seen as useful in the classroom. Fullan & Docherty (2015) also highlighted the importance of using digital technology in assessments. They stated that both summative and formative "are vital for ensuring engagement, learning and progression to learning outcomes." They also emphasised that any assessments should be rigorous, proven, accurate and engage the learners. Levin and Schrum

(2014:641) commented on the importance of assessment being used to by teachers to differentiate teaching.

Assessment can also be an enabling sub factor supporting digital technology integration particularly if it is used by students for self-assessment as part of their learning. Luckin et al (2012:63) conclude that most innovative work focusses on self-assessment through reflection rather than teacher-led assessment. This move to e-assessment has been highlighted as innovative in that it facilitates peer, collaborative and self-guided learning.

Therefore digital formative and summative assessments if integrated into the learning and teaching can be an enabling factor. It is also useful ecological if the whole educational establishment does this.

5.6 The Impact of Professional Development of Digital Literacy Skills

Professional development of digital literacy skills is the third theme of the professional factor of perception, attitudes and beliefs and has been highlighted as significant. This is true both in my research and in the literature. There has also been substantial amounts of professional development nationally and internationally for teachers on improving their digital literacy skills but my research agrees with other research findings that often it is not impacting on practice.

In my research those interviewed found that the training they received for Google G suite was “rudimentary” and not sufficient to allow the teachers to integrate the digital technology into the learning and teaching. This is a view shared by Archer and Savage (2014) who undertook a meta-analysis considering the impact of professional learning on digital literacy concluded that in only half of the studies there was a positive impact on the effectiveness of the digital literacy.

It is therefore important to look at how you can turn professional development of digital literacy skills into an enabler rather than an inhibitor in integrating

digital technology into learning and teaching. There appear to be key issues to attain this aim. Firstly when providing professional development to improve teacher's digital literacy skills there also must be a focus on changing teacher's perceptions and attitudes around digital technology. Secondly, ensuring that professional development leads to a change in pedagogy with digital technology being integrated into the learning and teaching or as some researchers have termed it causing a pedagogical shift or disrupting teaching.

5.6.1 Using professional development to change teacher's perceptions and attitudes

As highlighted in my research changing perception, attitudes and beliefs around digital technology is key to successful integration in the classroom. My research agrees with Ertmer (2012:434) who found that teachers "viewed their own attitudes and beliefs as facilitating technology integration, but the attitudes and beliefs of others as constraining."

Professional development of digital literacy is key to the success of this integration. There are a variety of different definitions of digital literacy possibly depending on which academic disciplines the researchers come from. Some (Hoechsmann and DeWaard, 2015) focused on more technical skills while others (Porat et al., 2018; Ng, 2013), on cognitive and social-emotional aspects. In all these definitions there is a view that perception, attitudes and social emotion factors are important.

Researchers including Blundell et al (2016:550) have shown that professional learning can change beliefs and attitudes in order to integrate digital technology in learning and teaching. He developed this tri-theory framework to allow the teachers to collaboratively contextualise the challenges of in integrating digital technology in their classroom. This allowed the teachers to transform their attitudes and beliefs as well as teachers reducing their assessment of risks associated with those transformations which allowed them to integrate digital technology in their classroom. I agree with Blundell et al (2016) and other researchers that unless you tackle changing beliefs and attitudes professional

learning of digital literacy skills may not be an enabler in integrating digital technology into learning and teaching.

Another point, to ensure professional development was an enabling factor, from my research was that professional development which led to teachers using digital technology which led to improvements for students had positive effect on integrating digital technology in the classroom. I agree with Blundell (2016), Guskey (2002) and Hochberg et al (2010) who argue that if the professional development for integrating digital technology in their learning and teaching was seen as effective and students' achievement increased it altered their belief system around digital technology positively. This led to changes in their teaching practices to integrate digital technology in their teaching.

5.6.2. Using professional development to disrupt teaching

In my research individuals discussed the use of professional development frameworks to help integrate digital technology in learning and teaching. The use of the digital technology frameworks both help devise professional learning and track the impact of integrating digital technology in pedagogy.

I have looked in detail at several of these frameworks in the literature review chapter which are the Concerns Based Adoption Model (CBAM), Technological Pedagogical Content Knowledge (TPACK), Zhao and Frank's ecological perspective (2003), Fullan and Donnelly (2013) Framework for Assessing Digital Innovations in Education and Magenta (2017) T3 framework.

I particularly like Magenta (2017) T3 framework as it allows teachers to evaluate the integration of digital technology in their learning and teaching and gives them clear guidance using self-assessment guides on how to improve their use. Magenta (2017: 27-35) also emphasises the importance of pedagogy over technology and the use of technology being "disruptive" rather than a "distraction" to learning. He also takes into account the complexities and the ecological perspective in a school and the education system when discussing the integration of digital technology in learning and teaching. It would be extremely

useful for teachers to use the T3 professional learning framework to successfully integrate digital technology in their learning and teaching.

The other key issues in successful professional development are importance of support and networking opportunities, timing, amount and seniority of staff on professional development and dealing with the pace of change with digital technology.

The importance of having someone in the school to support and collaborate on the integration of digital technology has been mentioned by several of those interviewed. In most local authorities there is a digital lead in schools as a recognition of the benefit of this support. I agree with Blundell et al (2016:550) that opportunity to collaborate and receive support from other staff is key to successful professional development to integrate digital technology.

My interviewees also mentioned the importance of networking both within their local authority and both online were also seen as key to integrating digital technology. In both authorities the digital leaders in schools used digital technology to network and share good practice. One authority used yammer and the other set up their own google classroom so they could talk to one another and share ideas. Many of the teachers who carried out the training mentioned the good support they received from networking within the google education group where teachers are posting successes and queries. Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, (2012) all commented on the importance of networking and peer support where teachers used social networking to interact and learn from their peers.

Findings in my research outlined that teachers wanted professional learning during the day not in twilight sessions after school when they were tired. For the Google training was the result of the lack of money to pay for staff cover. They also felt that as well as the timing, the amount of professional development time was not contusive to them carrying out the role expected of them. In the professional learning for Google G Suite it took place after school and there was not enough time to allow them to become confident in the role to cascade

Google G Suite throughout the school. Many teachers felt they were being rushed “into a cascade role which would lead to them being “undermined”.

In my research the importance of leadership of digital technology was seen as important. Those interviewed felt it important that the leadership of the school are involved in professional development. This was not the case in for the staff who attended the Google G Suite training as almost all of them were class teachers. Therefore, they “did not have a lot of power” to implement digital technology in the school. My research agrees with comments that leaders should prioritise ongoing professional development. Levin and Schrum (2014:661)

The pace of change in digital technology was mentioned in my research as it keeps changing and improving. Gaytan et al (2010) also commented on the importance of high-quality professional development in order to keep pace with the changes in digital technology.

My research confirms many of the points made in the academic literature around professional learning of digital literacy. This is a key theme and enabler in the successful integration of digital technology in learning and teaching.

However, my research and the literature gives a clear message that professional learning on digital literacy must take into account teacher’s concerns, perceptions and attitudes and teachers individual professional learning needs. There also needs to strong leadership be continual follow up and technology support for the teachers preferably in their educational establishments. It is also important that there is daytime training and peer support where teachers used social networking to interact and learn from their peers. Professional learning frameworks can be used effectively to support the integration of digital technology in learning and teaching at a transformational pedagogical level.

It is clear that taking a wider ecological perspective is extremely important in ensuring that the factor of professional development leads to the integration of digital technology.

5.7 Conclusion

In conclusion, my research has shown that factors that either inhibit or enable the integration of digital technology in learning and teaching in the classroom is a complex issue. I have stressed the importance of analysing the effect of these factors from an ecological perspectives as educational establishments do not stand alone but are affected by the educational establishment, local authority and national ecology. Leadership in all three of these levels is also an important factor which is key to whether factors are either enabling or inhibiting in the integration of digital technology. However, teachers in their classroom are the key players in whether digital technology is integrated into the learning and teaching in their classroom. Those interviewed are clear that if the four objectives in the national strategy on digital technology were implemented it would also make a positive difference to the integration of digital technology in educational establishments.

Chapter 6. Conclusion

6.1 Introduction

The overarching research question posed by this study is what are the factors impacting on the integration of digital technology in learning and teaching in Scottish classrooms? This study researched factors (enablers and inhibitors) that impact on the integration of digital technology in the learning and teaching in educational establishments.

The objectives of the study are to:

- Examine previous research on the topic of digital technology, its enablers and inhibitors
- Explore experience of the classroom teachers and other key staff with the integration of digital technology in learning and teaching
- Identify the enabling and inhibiting factors regarding the integration of digital technology in learning and teaching
- Explore the development and implementation of the national digital technology strategy on learning and teaching and make recommendations for policy

In order to look at these objectives I carried out semi-structured interviews with the authors and those responsible for the implementation of the national strategy on digital technology. I also carried out semi-structured interviews with a range of staff, including teachers, in two Scottish local authorities.

The staff in the local authorities were those who had taken part in the professional learning provided by Google on the implementation of Google G Suite. This training was organised through Scottish Government, with no cost to the local authority, in response to one of the actions outlined in the national strategy to deliver on the second of four objectives which is to improve access to digital technology for all learners. The research looked at the impact of the Google professional development on teachers' digital literacy skills and also used the implementation of Google G Suite as a vehicle to interview teachers and non-teachers. This enabled the researcher to interviews these in a non-directive way to ask them about the Google G Suite training/implementation and also

their perceptions and use of digital technology in the classroom. This aided in the gathering information relevant to the aim of the study.

The interviews with both sets of staff were transcribed and analysed into themes and subthemes. These findings were subsequently structured into two main factors. These are the professional and institutional factors which in my view impacted on the integration of digital technology in the classrooms. These factors are similar to those used by researchers in the literature looking at inhibitors and enhancer in the integration of digital technology, particularly Ertmer (2012) and Blundell et al (2016).However, these are not necessarily mutually exclusive factors but rather overlap at times.

In this conclusion chapter I plan to look at the conclusion to the overall research question and then the aims and objectives aligned to that question.

6.2 Overall research question

I will now look at the conclusion from my research on the overarching research question posed by this study which is what are the factors impacting on the integration of digital technology in learning and teaching in educational establishments? My own research agrees with the academic literature that digital technology is not yet integrated into the learning and teaching in educational establishment. By researching these factors I aim to make recommendations to improve the integration of learning and teaching in educational establishments.

In my research I described the two main factors as professional and institutional. The professional factors are teacher's perceptions and attitudes, curriculum and assessment and the impact of professional development on teachers' digital literacy skills. The institutional factors are connectivity, cybersecurity and hardware and ecological issues relating to national, local authority and school perspectives. I then analysed the enablers and inhibitors of these two main factors.

However, as highlighted in my discussion chapter, these factors, although I have divided them, are not mutually exclusive but rather overlap. Therefore, the

integration of digital technology in educational establishments is a complex issue. Based on my research I believe it is more helpful to look at a wider ecological perspective in answering the research question.

The importance of the ecological perspective when looking at the factors was highlighted in my research, which reflects the literature (Zhao and Frank, 2003); Kopcha, 2010; Ertmer and Ottenbreit-Leftwich, 2010; Levin and Schrum, 2013). I support Zhao and Frank (2003) comments that stress the interrelationships between school, district, which in Scotland is the local authority, and the national system. This interactive nature of the factors highlighted in my study also clear with many of those interviewed highlighting the interactive relationship between different factors.

Zhao and Frank (2003:810) description of the integration of digital technology as an "invading species" also mirrors the concept highlighted in my research as digital technology integration being disruptive to education as we know it. A few of those interviewed did give clear examples of digital technology transforming or disrupting learning and teaching but this was not common practice. The disruption of education using digital technology has been hotly debated by many researchers who also see the importance of transforming and disrupting education using digital technology.

My research agrees with other researchers that the disruption or transformation of learning and teaching using digital technology is not yet integrated. However, as noted earlier teacher resistance to the integration of digital technology has to be taken within an ecological context. As both Jarvis (2009) and West (2012) highlighted education itself is resistance to change which is a significant challenge to change.

6.3 Key Findings

As has been previously stated the promise of digital technology to disrupt education has not yet been fulfilled. My research has looked at the factors which both enable and inhibit the integration of digital technology. In my research I have interviewed national, local authority and school staff and concluded from

this research that from an ecological perspective each of the personnel involved in these three levels are interrelated when looking at factors that either inhibit or enable the integration of digital technology. It is important to remember that these factors, although I have separated them for clarification, are interactive parts of the picture of the integration of digital technology in education establishments. I will now state the key set of findings from my research.

6.3.1 Perceptions and attitudes towards digital technology

My research findings agreed with the literature that perceptions and attitudes towards digital technology is one of the most significant sub factors in both enabling and inhibiting in the integration of digital technology.

The perception and attitudes of teachers towards digital technology is key to integration but equally important is the perception and attitudes of other key personnel involved in the integration of digital technology. These can be politicians, civil servants, local authority staff, headteachers and managers of educational establishments, parents, community and also commercial partners. A positive perception and attitude towards the integration of digital technology of key personnel, particularly leaders in national, local authority and educational establishments, will have a positive impact on the integration. Ertmer et al (2012:433).

My research also confirmed that teacher's perception and beliefs towards digital technology are both significant in whether it is adopted and whether it is either integrated in learning and teaching or just supporting learning and teaching. Prestridge (2012), West (2012) and Madsen et al 2018 also supported this view. In investigating teacher's perceptions, attitude and beliefs I looked at issues of professional identity, the issue of teacher resistance, teacher authority and student control and voice, attitudes of teachers to the benefits of integrating digital technology in the classroom.

My research shows the digital technology can change the role of teachers and students and in doing so the professional identity of the teacher. Teachers often see themselves as the font of all knowledge. However, if they are not confident

or knowledgeable about digital technology and they perceive the students having a greater knowledge this flips roles. I agree with Christensen et al (2008) about the professional identity threat that digital technology can be for some teachers. However, other teachers in my research saw digital technology as a positive opportunity to change their professional identity and learn from their students.

My research also suggests that teacher resistance maybe too broad a term and need to be conceptualised in terms of issues such as threat, loss, confidence and workload issues rather than blame. The findings of my research agree with the literature highlighting these issues particularly Mao et al (2014), Somekh (2007) and Ertmer, (1999). What is also clear in my research is that teachers may be resistance to change but if you take in a wider ecological perspective that the education system may also be resistant to change. This was a view also held by West (2012), Ertmer et al., 2012 and Perrotta (2012). These issues can be an inhibiting factor in the integration of digital technology in learning and teaching.

In my research, the threat to existing practice and also the threat to jobs was a clear message from many of those interviewed. Others saw it as not threatening but a positive challenge. The loss of confidence was also a significant issue in my research which agrees with Prestridge (2012: 454) that integrating digital technology can cause a loss of confidence with teachers. However, one point which came up repeatedly as a cause for the lack of confidence was not just teacher's own confidence but their lack of confidence in the digital infrastructure when using digital technology. The issue of threat and the loss of confidence can be an inhibiting factor which negatively affects perceptions and beliefs of teachers around digital technology.

I agree that digital technology can also disrupt pedagogy if it is integrated into learning and teaching but it can also disrupt teacher authority which is often not mentioned in the literature. The perceived disruption of teacher authority and their loss of pupil control was a significant issue in my research. However, a few saw digital technology as helping pupil control. Therefore for this issue it can therefore be an enabling or inhibiting factor in the integration of digital technology.

My research supports Ifenthaler et al (2013) who also reiterated the importance of teacher perception and attitudes and the importance of performance expectancy and facilitating conditions. In my research teachers did see benefits but it was usually in supporting their learning and teaching rather than being integrated. Teachers need to be convinced that integrating digital technology into their learning and teaching has benefits. It is therefore important that when targeting and changing pedagogical beliefs and attitudes around digital technology teachers need to be convinced that integrating digital technology in learning and teaching can improve their teaching in the classroom.

It is also clear in my research that it is important that they do not see it as increasing their workload as something "extra" they are made to do. Relevant and personnel professional development can also be key in changing perception and attitudes. Therefore, perceptions and attitudes can be an enabling or inhibiting factor in the integration of digital technology in their learning and teaching.

6.3.2 Curriculum and assessment

In my research there were three findings that were highlighted around curriculum. Firstly, the need for students to learn digital literacy skills as part of the curriculum. Secondly, the need to integrate digital technology in the curriculum in order for the curriculum to be an enabling factor in the integration of digital technology. This is a recurring theme in my research. Thirdly, the importance of developing student's critical skills or "21st Century Skills" (National Research Council, 2012:1) such as collaboration, problem solving and critical thinking using digital technology. Luckin et al (2012:55) and Park (2017) discuss the concept of moving away from a subject-based knowledge based curriculum to developing these skills.

Discussing the impact of the factor of curriculum in the integration of digital technology within a national ecological perspective has illustrated that it is important to look at it holistically. Addressing what is education for in regards to the integration of digital technology and looking at other issues around the

curriculum. From my findings there is an argument to ensure that learning 21st skills are part of the delivery of the curriculum within curriculum for excellence interdisciplinary context for learning and personalised learning. However, it is when digital technology is properly integrated in the curriculum will it become a true enabling factor in transforming the learning and teaching (Labbo and Place, 2010:9; Blikstad-Balasa and Davies, 2017:329). The integration of digital technology in the curriculum is also one of the key four aims of the national strategy on enhancing learning and teaching through the use of digital technology (Scottish Government, 2016).

From my research, this message although clearly present in the national digital strategy in 2016 was undermined by a separate guidance produced the following year on STEM. Those interviewed stressed that it would have been a clearer message on the importance of integration if there had been one joint strategy which had been suggested at the consultation on the national strategy for digital technology. In conclusion for curriculum to be an enabling factor digital technology must be integrated into the curriculum and the government must give a clear message on the importance of this.

In my research, there are many positive uses of digital technology to improve assessment highlighted. The findings agree with Luckin et al (2012), Fullan & Docherty (2015) and Selwyn (2017) who also outlined a range of different uses of digital technology to support assessment. My research also highlighted that teachers found that the focusses on self-assessment through reflection rather than teacher-led assessment could be extremely valuable. Emphasising the move away from teacher led activities has been a theme in the use of digital technology in the classroom.

One significant issue which was highlighted in my research which is an inhibiting factor in the integration of digital technology was the continued assessment of senior exams by using pen and paper I agree with Blikstad-Balasa and Davies (2017:323) who also commented on this dilemma of writing in exams. They found that senior students were stopping using digital technology as so they could maintain their pen and paper skills. The Scottish Qualification Agency

(SQA) is developing online assessment for some exams for summative unit assessments. However, at the use of paper assessment at the present time it slowing the integration of digital technology in the curriculum particularly in the senior phase in secondary schools.

In conclusion, for both curriculum and assessment issues they can be an enabler or inhibitor for the integration of digital technology in the classroom dependent on their use.

6.3.3 Impact of professional development on teachers' digital literacy skills

One of the most cited factors for the lack of integration of digital technology in the learning and teaching in the classroom is the impact of professional development of digital literacy skills for teachers. However, it would be too simplistic to conclude that if you provided all teachers with professional learning on digital literacy skills that it would directly lead to the integration of digital technology in the classroom. There are other issues to consider.

What is highlighted in my research was that professional development on teachers' digital literacy skills using a transmission or lecture model way of transferring skills is not an enabling factor in integrating digital technology. Those interviewed found that the professional development, although enjoyable, they received for Google G Suite was not sufficient to integrate it into their learning and teaching.

Given the powerful effect of teacher beliefs and attitudes around digital technology, which has been previously being stated, professional learning has to target changing these pedagogical beliefs and attitudes. This is a view consistent with research by Hoechsmann, DeWaard, (2015), Porat et al (2018), Ng (2012) and Ertmer (2012). Blundell et al (2016) wrote an informative paper on how to change perceptions, beliefs and attitudes to integrate digital learning through collaborative professional learning.

My research and the literature gives a clear message that as well as professional learning on digital literacy taking into account teacher's, perceptions and

attitudes and beliefs. It also needs to take into account teacher's individual professional learning needs and also for them to be made aware of the benefits of integrating digital technology. There also requires strong leadership, continual follow up on the implementation of digital technology and technology support for the teachers preferably in their schools. It is also important that there is daytime training with peer support where teachers used social networking to interact and learn from their peers is built into professional learning. The professional learning frameworks can also be used effectively to support the integration of digital technology in learning and teaching to transform teacher pedagogy.

In conclusion, the impact of professional development on teachers' digital literacy skills can be both an inhibitor or enabling factor in the integration of digital technology in learning and teaching in the classroom

6.4. Connectivity, cybersecurity, and hardware and resource issues

In my research effective digital infrastructure is one of the most important factors in the implementation of digital technology to improve learning and teaching. If the digital infrastructure does not work teachers are less likely to use it so it therefore becomes an inhibiting factor in the integration of digital technology in learning and teaching. In the literature the crucial role of digital infrastructure was often undermined Selwyn (2017). Labbo and Place (2010) and Derbel (2017) agreed with my research that infrastructure be considered more.

The lack of connectivity and Wi-Fi variability in my research was an issue for both teachers and students. Teachers also complained about cybersecurity with the inability to access educational sites. If you can't access a site to integrate it into your learning and teaching this becomes a major issue in using digital technology. From my research it seems that the problem in many local authorities is that the education network is controlled by the corporate IT department. Getting the corporate IT department to work together with education is a challenge.

As commented on in the discussion chapter, to try and address this dichotomy of trying to keep students safe and allow them appropriate access is being addressed at a national level with representatives of the Society of IT managers (SOCITM) on the national working group. Some local authorities have solved the issue by having their own education network separate from the corporate network.

In some countries, including Norway, there are no limitation on access to sites in the school. In my research several of those interviewed advocated for unlimited access to sites in schools using the schools network. They argued that you should teach students about responsibilities and what is appropriate to look at in digital technology, particularly as they can access any site on their mobile phone. However, for others including parents it is seen as a legitimate concern that their children access inappropriate things and there should be restriction on access to sites. Cybersecurity is an issue which is not mentioned in any significant detail in the literature although it is a factor which appears to inhibit the integration of digital technology.

In my research the variability in access to appropriate hardware and resources was an issue. The increase in hardware has in part been caused in Scotland by the use of funds from the Scottish Attainment Fund and (PEF). However, if there is no access to these funds based on the criteria this leads to a variability in the purchase of hardware across Scotland. The dilemma as to how much and what hardware you buy was a recurring theme in my research.

Escueta et al (2017) also highlighted this issue. There have been instances where all students received their own hardware. However there were concerns about the benefits of this. (Blikstad-Balas &Davies (2017:311), Masters 2017). Other schools have a policy to bring your own device to school to help with the resource issue. Fullan and Docherty (2013) developed an index to be used as an evaluative tool to enable educators to systematically evaluate new companies, products and school models, using the context of what they have seen as necessary for successful paradigm shift.

However, it is important to not lose site on the effect of commercial interests on digital technology with their emphasis on profit rather than pedagogy and theory. Selwyn (2017). The guardian (August 2014: online) stated that:

> "schools now spend £900 million on education technology every year. The global market will be worth £129 billion by 2020. Investor interest is growing as tech giants Microsoft, Google and Facebook develop their own offerings."

This view of the involvement of commercial digital technology organisations in education is one I have highlighted in my research.

One of the actions in the national strategy on digital technology, which I have followed up in my research, is to increase partnerships including commercial partnerships for the benefit of educational establishments. Scottish Government have zero profit contracts with both Micro-soft and Google, through GLOW, which allow free access to a range of their software for education establishments.

In my research teachers highlighted that commercial software was often not suitable for their educational needs. Selwyn (2017:187) has urged that the partnership with commercial institution with teachers should be increased to allow them to become more involved in the "commercial production and development of technologies, tools and applications." This would mean that they would better fit the needs of teachers.

However, based on my research it would be too simplistic a view to think that just providing appropriate hardware for learners that digital technology would be integrated into learning and teaching. There are many other factors to take into consideration which I have highlighted in my research. Digital infrastructure and digital hardware at times is both an enabling and inhibiting factor in the integration of digital technology in learning and teaching in the classroom.

6.4.2 Development and Implementation of the national strategy on digital technology in learning and teaching

In my research the findings clearly highlighted that schools are part of the local authority which are part of the national educational system. My research therefore also concludes that the ecological perspective that the national strategy on digital technology by developing actions plans and expectations for educational establishments, local authorities and national bodies was correct. As highlighted, in order to integrate digital technology into learning and teaching you must take into account a wider ecological perspective of national, local authority and school and the interrelatedness of these three levels.

The national digital policy came about due to strong political pressure from the then education minister, the surplus of staff who had to be deployed and an independent review which criticised the existing guidance for not being strategic enough as well as commercial and other pressures. When looking at the development and implementation of government policy, in this case the national digital strategy, I have highlighted it is important to look at the economic, social and political contexts within which the strategy took place. Perrotta (2012) also agrees with this view.

My research, particularly with those interviewees who work at a national level, stressed the importance of the political stakes on education policies and strategies including the national strategy on digital technology. This is also emphasised by the research by Murphy and Skillen (2013) and Coupal (2004). However, the strategy did not attract any extra funding to help with its implementation which some interviewees saw as a difficulty in its success. It was clear in my research that national strategy for digital technology has a significant effect on the work of the local authorities in integrating digital technology in learning and teaching in educational establishments. This is both due to being part of national networks and using the strategy to refresh or develop their own local authority strategy on digital technology. The digital technology worker in local authorities were also responsible for implementing the professional training provided by Google on Google G Suite which was one of the actions in the digital strategy.

Leadership in all three of these levels was also highlighted as an important factor in my research which is key to effective integration of digital technology in learning and teaching in the classroom which is reflected in other literature (Levin, 2014; Perrotta, 2012).

However, teachers in are ultimately the key players who have the power to decide whether digital technology is integrated into the learning and teaching in their classroom (Lipsky, 2010; Maynard-Moody, 2003, 2012; Brecko et al., 2014).

In conclusion, my research has highlighted the importance of analysing the factors relevant in the integration of digital technology in learning and teaching an ecological perspective as educational establishments do not stand alone but are affected by the establishment, local authority and national politics. This can either inhibit or enable the integration of digital technology in learning and teaching in the classroom. Leadership at all three levels is also an important factor which is key to effective implementation. If all the actions in the national strategy were implemented it would make a positive difference to integration of digital technology in the schools. However, teachers are the key players in whether digital technology is integrated into the learning and teaching in educational establishments.

6.6 Recommendations

The recommendations which have been highlighted in my research, aligned with the professional and institutional factors, to improve the integration of digital technology in the classroom in learning and teaching in Scottish is as follows:

- devise a clear vision involving all stakeholders for what, why and how technology will be used
- involve all partners in the stratgic planning for the integration of digital technology for learning and teaching
- devise professional development on digital technology which focuses on improving digital literacy skills and changing positively the perceptions, and attitudes of all stakeholders on the integration of digital technolgogy

- integrate digital technology effectively into the learning and teaching rather than being used as supporting learning and teaching
- integrate digital technology across the whole curriculum
- devise assessment which is used effectively encouraging ownership of assessment from teachers to learners
- improve access to effective connectivity, hardware and appropriate educational sites for learning and teaching for educators and students
- encourage leaders at all levels of education drive the integration of digital technology in learning and teaching in educational establishments
- encourage the research on the integration of digital technology in learning and teaching which involves educational professionals and commercial institutions working together

My recommendation based on my research have similarities to the objectives of the national strategy which are as follows:

- Develop the skills and confidence of educators in the appropriate and effective use of digital technology to support learning and teaching
- Improve access to digital technology for all learners
- Ensure that digital technoloy is a central consideration if all areas of the curriculum and assessment delivery
- Empower leaders of change to drive innovation and investment in digital technology for learning and teaching

6.7 Conclusion

Digital technology has been seen as a way of transforming conventional education or “blowing up” schools allowing for “better” learning on an any-time, any-place, any –pace basis. Papert (1984:38), Bennet et al (2008:780) and Vander Ark (2012:158). The debate is also about what is education for and the belief that digital technology can help sort major educational issues like closing the poverty attainment gap. The belief that digital technology can make this difference is evidenced in the national strategy, my research and the literature.

However, based on my research and a review of the literature this transformation has not happened and in reality, although there are clear

benefits, much of the use of digital technology has been in supporting traditional learning and teaching. Classroom teaching and educational establishments have not changed significantly in decades. The education system itself is resistance to change which includes the disruption of education by the use of digital technology which may be seen as a threat by those involved in our present education system.

My research researched this by asking what are the factors impacting on the integration of digital technology in learning and teaching in educational establishments? It is a complex picture with no one magic solution. However, what was clear was that digital technology had to be integrated into learning and teaching to make a positive impact on educational outcomes. Teachers are also the people with the ultimate power to either integrate or not digital technology into their learning and teaching.

It is also clear that educational digital technology is a commercial enterprise involving political issues at different levels of education. Educational professionals could become more involved in the production and development of digital technology so it fits better with the needs of educational establishments. They could also be involved in more research on digital technology in education. I have highlighted recommendations which have addressed other issues found in my research.

My research could be expanded to look at the factors I have highlighted as relevant in the integration of digital technology in educational establishments. The research could analyse where these educational establishments are in relation to these factors and what requires to be carried out to make the factors enabling ones in the integration of digital technology.

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Appendices

1. Participant Information Letter

University of Glasgow

College of Social Sciences

Participant Information Sheet

The Benefits of Digital Technology in Enhancing Learning and Teaching-Dr Noreen Phillips, HM Inspector of Education

Dear colleague

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

The purpose of this research is to look at the benefits of digital technology in enhancing learning and teaching. Often the local authorities and schools have spent significant sums of money on digital technology hardware. However, the impact of the use of the digital technology on enhancing learning and teaching is variable in our early year's centres and schools. The research aims to look at the reasons for this and highlight strategies to embed digital technology more effectively in learning and teaching in the classroom.

Participation in this study is voluntary and will involve an interview lasting no more than one hour. The benefits of participations in the research is to improve the use of digital technology in our schools. There are no risks involved in participation. However, you have the right to withdraw at anytime without providing a reason.

Data from the interview will be anonymised and your personal details will be destroyed.

Please note that assurances on confidentiality will be strictly adhered to unless evidence of wrongdoing or potential harm is uncovered. In such cases the University may be obliged to contact relevant statutory bodies/agencies.

The data will be stored in a Scottish Government computer which is password controlled. All paper copies of data will be locked in a filing cabinet in a Scottish Government building.

This project has been considered and approved by the College Research Ethics Committee. Any further information can be provided by Dr Noreen Phillips, email: **noreen.phillips@educationscotland.gov.gsi**

If you would like to make a complaint this should be directed to the College of Social Sciences Ethics Officer, Dr Muir Houston, email**:** **Muir.Houston@glasgow.ac.uk**

Thank you for reading this.

Dr Noreen Phillips

2. Questions for semi-structure interview for teachers who have carried out G Suite training

Please answer these questions in relation to Google G Suite? They are under three headings system change, technology and pedagogy . They are adapted

from Fullan and Donnelly (2013) article Alive in the Swamp index for assessing the use of digital technology.

System Change

- Tell me why you decided to carry out the G Suite training and your views on the implementation? What are the benefits and challenges
- What is the nature of the implementation support provided? Does it ensure the technology functions (all parts including software, hardware, maintenance, electricity and connectivity)?
- How long is the implementation support in place for?
- Does the innovation include professional development on how it ties in with your teaching in the classroom?
- Will clusters of schools learn from each other?
-

Technology

- How is the technology for the user? Is it easy to use, intuitive and effective?
- Can the technology be accessed on any device?
- Can it be accessed any time

Pedagogy

- Clarity and quality of intended outcome- When using G Suite How clearly are the learning outcomes of the teaching to the learner when using G suite in the classroom? Describe
- Pedagogy -How is your role as a teacher when using G Suite? Is the role reflective of a 'teacher as activator' relationship?
- Quality of assessment platform- Is it clear how the outcomes will be measured?

These questions are adapted from Sonny Magenta book Disruptive Classroom Technologies.

The rest of the questions should be answered by considering all the technology you use in the classroom?

1. Can you give me an example of the uses of digital technology in your classroom? (Is the use translational, transformational or transcendent?)

2. Tell me what is your dominant emotional reaction when you experience new digital technology. In your view what is the perception and attitude of teachers around the use of digital technology in the classroom? How would you go about changing perception and attitudes?
3. What are the benefits of using digital technology in the classroom- What can you give up if you use digital technology which makes you more efficient.
4. What are the challenges around using digital technology in classrooms? - (follow up –professional issues and power, authority and control in the classroom.)
5. In your view what is the perception and attitude of students around the use of digital technology in the classroom? What are the benefits and challenges for them?
6 How can you evaluate the role that digital technology plays in improving learning and teaching? What is effective pedagogy when combined with digital technology?
7. What are the key skills learners learn more effectively with digital technology?
8. How can digital technology make teaching and learning practices more efficient or effective which in turn should lead to better attainment?
9. What do you think needs to happen to improve the both impact and how embedded digital technology in the curriculum?
10. Would a classroom without technology do better or worse?

3. Enhancing Learning and Teaching through the Use of Digital Technology: A Digital Learning and Teaching Strategy for Scotland

Questions for those who developed and are implementing the strategy

Personal Involvement in Policy

1. What was your involvement in developing the digital learning and teaching strategy for Scotland?

Goal of strategy

1. What are the main aims of the strategy? In the strategy they mention that the aim of the strategy is 4 essential and interrelated objectives. Why these 4 and not others?
2. Why this strategy now?
3. What previous digital technology policies/strategies or guidance is this strategy built on?
4. How does it relate to other government policies/strategies? E.g. World of work
5. The overarching vision for Scottish Education is excellence through raising attainment and achieving equity? Does this strategy help achieve this vision?
6. Is there robust evidence that digital technology does raise attainment for children and young people living in poverty?

Challenges in implementation of the strategy

1. What would you see as the main challenges in the implementation of the strategy?
2. How would the government plan to deal with these challenges?
3. The strategy set out key objectives, roles and action plans to ensure the success of digital technology enhancing learning and teaching. What would you consider the most crucial element in achieving this success?
4. How would you ensure that this crucial element is met?

Main stakeholders in the implementation of the strategy

1. Who are the main stakeholders who will implement the strategy?
2. In the strategy there are roles for the Scottish Government and National Bodies, the local authorities and educational establishments under the objectives. Whose role is the most important and why? How do the different roles fit together?

3. In the strategy there are action plans for the key players in Scottish Education? Which key players in your view would have the most significant role to play in ensuring that the strategy was successful?
4. What would be the key role for our teacher education establishments?
5. What is the relationship between public and the private sector in the success of this strategy?

Measuring Success

1. There are a series of indicators that are put forward as the kind which will help build a picture of success? Why were these indicators chosen? Are they robust enough to show success?
2. How do these indicators measure the statement at the message from the deputy first minister that digital technology will raise levels of attainment, close the poverty gap and improve life chances of all our children and young people? There appears to be no direct link to his statement and the indicators to measure success.
3. How will the indicators take account of context schools have different teachers, pupils, parents, different socio economic situations, rural, city etc.?

Blue Sky Thinking

1. If you had total freedom how would you have done things differently in the development of the strategy?
2. What do you think needs to be done in the future to enhance learning and teaching through the use of digital technology?