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UNIVERSITY OF SOUTHAMPTON

FACULTY OF SOCIAL, HUMAN AND MATHEMATICAL SCIENCES

SOUTHAMPTON EDUCATION SCHOOL

Exploring the pedagogy of tablet use and factors of influence. A case study in the United Arab Emirates.

by

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Thesis for the degree of Doctor of Education

UNIVERSITY OF SOUTHAMPTON

ABSTRACT

In this thesis I investigate the pedagogical practice of tablet use and factors of influence, in classrooms in the United Arab Emirates. The focus is on the age range 9-19 in various education systems and institutions, both private and public (Government), this research was conducted from the perspective of placing teachers, and those taking leading roles in technology integrations in schools, centrally within the research process. A mixed methods approach of an online questionnaire, interviews and lesson observations was used, 14 interviews were conducted and synthesised with 44 online questionnaire responses and four days of lesson observations, these methods were used alongside a literature review that acted as a frame around the research, which was exploratory in nature. The key findings of the study are that pedagogical practice has begun to move away from the traditional approach of existing classroom practice, the practice has changed in the areas of more personalisation of learning, a move towards more content creation over consumption and improvements in technology-supported formative assessment. The data from the influencing factors on the pedagogical use of tablets, suggests that training was the most significant impacting factor, with the data suggesting that training may be one of the most important keys to successful implementation. The findings of this study can be used to support technology integration projects as it highlights the importance of: placing the teacher at the centre of the process, effective training, and demonstrating that the most effective pedagogical practices are those that closely align with the affordances of the tablets. The research also suggests that significant changes to internal, external or national assessments would need to take place to ensure curriculum, assessment and digital pedagogy become fully aligned.

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DECLARATION OF AUTHORSHIP

I, GEMMA ANGELA ESCOTT, declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

"Exploring the pedagogy of tablet use and factors of influence. A case study in the United Arab Emirates"

I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at this University;
- 2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
- 3. Where I have consulted the published work of others, this is always clearly attributed;
- 4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
- 5. I have acknowledged all main sources of help;
- 6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
- 7. None of this work has been published before submission

Signed:	
Date:	

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Definitions and Abbreviations

ADE	Apple Distinguished Educator
Арр	Application
ATP	Apple Teacher Program
CCL	Creative Classrooms Lab
EdTech	Educational Technology
GCSE	General Certificate of Secondary Education
IB	International Baccalaureate
ICT	Information and Communications Technology
MCE	Microsoft Certified Educator
MIE/E	Microsoft Innovative Educator/Expert
SAMR	Substitution, Augmentation, Modification and Redefinition
SEND	Special Educational Needs and Disabilities
ТАМ	Technology Acceptance Model
ТРАСК	Technological Pedagogical Content Knowledge
U.A.E.	United Arab Emirates
WEF	World Economic Forum

Chapter 1: Introduction and Context

1.1 **Overview**

In 2019, 48% of the world's population had access to the world wide web on a fixed connection and 49.4% had a connection through a mobile device (Measuring Digital Development, 2019), these statistics align with the idea put forward by Sad and Goktas (2014, p. 606) a few years previously, that we are evolving into a world that exists in a 'mobigital virtual space'. The portmanteau of the words 'mobile' and 'digital' indicate that the mobile aspect of the digital world, is of equal consideration with the digital technology for Sad and Goktas (2014), this newly defined term by Sad and Goktas (2014) 'mobigital virtual space' is a facet of what is described as the fourth industrial revolution (4.0), where technological advances in a fusion of physical, digital and biological arenas, are increasing at an exponential rather than a linear rate, disrupting nearly 'every industry in every country', and leading to billions of people being connected by mobile devices with unlimited possibilities for knowledge and unprecedented processing capabilities (WEF, 2016). The fourth industrial revolution according to the World Economic Forum (WEF, 2016) is disrupting many industries and countries, but with so much exponential potential to do so, why do we not see this happening in education, an area that affects the lives of a significant part of the global population. It is from an interest in trying to understand this - that this study was incepted.

Perhaps we do not see this disruption happening in education, as there is a historical failure of technology to integrate and impact on education, as corporations and thought-leaders predicted (Apple, 2020; Microsoft, 2009). Further to this there are also impacting factors such as a need to address and equip students (and teachers), with fundamental pre-requisite skills that can impact on technology integration (OECD, 2015). Therefore, despite having impact in other industries, and with the push from those technology companies, who insist that their technology is a panacea or silver bullet, there are ongoing issues of integration of technology in education.

From here, a significant question arises as to why this is - why does technology in education seemingly fail to integrate within the school system? In order to consider this, we need to think about the overarching factors involved in the introduction of a new technology into educational processes. The central tenet of this question and this research study, is that the teacher is at the heart of any process of change in the educational system (Fullan and Quinn, 2010) therefore the key areas for this research are: the process of change with teachers as a central agent, how teachers use the technology and why they choose to use it the way they do (including influencing factors that result in success or failure of the technology use). Additional to this, consideration

needs to be made regarding the learning models that are used to underpin and support the change process and the role they play in explaining and supporting the use of the technology.

1.2 **Contextualised factors**

This study took place within the United Arab Emirates (U.A.E.) I chose to go there to complete my research and to undertake employment in the country, as the education institution I joined had a system of 1:1 iPad, across 11 campuses and were an ideal point of study for the research. During my first year I was moved to a Ministry of Education role, as part of their education reform, and this changed the scope of the research to encompass a lot more education entities, which I viewed as a positive move for this study despite elongating the time to complete.

One of the U.A.E.'s highest priorities has always been education, as His Highness (H.H.) Sheikh Zayed Bin Sultan Al Nahyan, founder of the U.A.E. noted:

> The greatest use that can be made of wealth is to invest it in creating generations of educated and trained people ... The real asset of any advanced nation is its people, especially the educated ones, and the prosperity and success of the people are measured by the standard of their education. (Education in the U.A.E., 2011)

The U.A.E. as a country, was only 42 years old when this research study began, in 2020 it celebrated its 49th year. In 1971, seven independent Emirates, along the Arabian gulf joined together under the union known as the 'United Arab Emirates', after the British-Trucial Sheikhdoms Treaty ended on the 1st of December 1971. Rich in oil and gas reserves, the U.A.E. was able to make huge investments into its infrastructure, leading to a demand for skills-based work that required a large influx of foreign workers. It soon became apparent that the Emirati people themselves, needed to take their place within this rapidly evolving environment and the Emiratisation program began, this program is designed to educate or train Emirati people, so they are able to enter multiple work sectors and be able to perform job roles, that could only be previously held by an expatriate. Thus an extensive investment in education has taken place over the last few years from Primary to Higher Education.

Due to the demographics of the U.A.E. several differing schooling systems are operational within the country. According to Global Media Insight (2019) the expat population makes up 88% of the countries' residents, and as such the private schools system reflects the needs of the various expat communities. The public government schools are administered by the Ministry of Education, and the private schools are overseen in Dubai by the KHDA (Knowledge and Human Development Authority) and in Abu Dhabi, by ADEK (Department of Education and Knowledge).

The result of this expatriate dominance in the country being that 'Overall, 17 different curricula are offered at private schools in Dubai, with the Indian, U.K. and U.S. curricula being the most popular. In Abu Dhabi, private schools offered 14 different curricula in 2015,' (WENR, 2018). There was a mix of schools from which I was able to collect data, the Ministry of Education schools following the local curriculum, federal vocational institutions following bespoke in-house curriculum, and the international schools which were following British and IB (International Baccalaureate) curriculums.

The role of the Ministry of Education is to provide an education for local Emirati students, and other Arab nationalities in KG-G12 and international schools who use the Ministry of Education Curriculum in Dubai and the Northern Emirates. There are approximately 800+ cycle 1, 2, 3 and compound schools, supporting around 280,000 students each year.

At the outset of this study as previously said, I began work at a vocational education institution that administered a group of nine schools across the Emirates, these provided vocationally orientated education, delivered through English as a medium of instruction in grades 10-12 for local Emirati students. My role was initially an eLearning specialist; however, I was assigned to work as an assessment specialist when I arrived. I came into my role with a C&G 7407 in Adult and Further Education Teaching, a Ba Hons in English Literature and Language, a PGCE (Post Graduate Certificate in Education, Secondary and F.E English 11-18) and a Master's Degree in education - with a focus on Pedagogy and Educational Psychology and the first taught year of my EdD. It was a steep learning curve to gain the skills and knowledge of the educational domains within English as a Foreign Language (EFL) and assessment. Approximately, after eighteen months in this vocational education role, my colleagues and I were brought over to the U.A.E.'s Ministry of Education, to work on the reform project that had just begun. At the start of this role I spent four months visiting schools, to report on the realities of the education in the schools and I was working on their grade 12 curriculum enrichment program. Shortly after this I was assigned the Emirate of Dubai as a 'sector' or 'council', to coordinate the initial school improvement initiatives. Our team then expanded and I progressed into working on the English language curriculum, by the end of my time at the Ministry four and a half years later, I was managing the assessment department. My duties included looking after the English curriculum assessment (with Cambridge University Press), the assessment of all the subjects taught through English as the medium of instruction and the Applied (vocational) stream. I was also running the Elite stream (the U.S. College Board AP exam stream) looking after the full academics for curriculum, assessment and teacher professional development. I also established the Research and Development Unit, who developed the MEL (Monitoring, Evaluation and Learning) frameworks starting with assessment. In addition, I worked on different projects, some revolving around the international assessments of PISA, PIRLS and TIMMS, and others were in support of the integration of educational

technology. I worked with the Digital Education Unit at the Ministry, helping them to develop their frameworks and training sessions, which I was also responsible for delivering, these were both theoretical and practical in nature. I assisted with the Microsoft Internship Program which trained local Emirati teachers to use Microsoft software in the classroom, during this time I helped evaluate and give feedback on the work that teachers submitted, I also took and passed the MCE (Microsoft Certified Educator) examination suite. I regularly engaged with the educational community within the U.A.E. as much as possible - given my work responsibilities. In addition I attended and presented at conferences and special interest groups (SIG), such as the TESOL Arabia SIG in educational technology. Working professionally in environments of educational technology meant I was able to meet the people who were actively working in my area of study. Through these connections I was able to establish professional relationships that enabled me to interview a varied selection of the implementors of educational technology roll-outs. I was given access to interview teachers in schools and a school where I was able to conduct my observations. The Ministry of Education itself did not pursue using tablets in the classroom, they were focused on 1:1 laptop use after having piloted using Windows Surface devices, this was discontinued after the short-lived pilot in which I was not involved.

In light of my work at the Ministry of Education, previous working roles, and the involvement in presenting at, and attending educational conferences across the U.A.E. there were some aspects of the data collection and analysis that were framed by these experiences. My time at the Ministry observing in classrooms, designing interventions and training work, gave me a deep insight into the current teaching approaches in the government schools in the U.A.E. which were by comparison different to the international school I observed in. The international schools were more aligned with the teaching approaches I was taught, during my own teacher training in the U.K. and the subsequent teaching roles I held. In addition to this, attending the many conferences during my time in the U.A.E. I was exposed to what the community deemed innovative and best practice in teaching with technology. It was due to this exposure of different ideas and approaches that I expected to see certain pedagogies and approaches emerge from the data, however on occasions this was not actually the case, by utilising aspects of grounded theory, I attempted to alleviate any aspects of 'bias in expectations', in the way the data collection tools were designed, as the interviews especially were designed to be as open as possible, with prompts based on (as was the questionnaire) existing research, pedagogical approaches and the educational community of the U.A.E.

The study included a sample of teachers from both government-administered institutions and private schools, including independent, as well as those that are part of a larger group or chain of institutions that utilised tablet devices, this was in order to attempt to cover the

spectrum of educational experiences available within the United Arab Emirates, both for its Emirati population as well as its vast expat one.

The process of change with teachers as a central agent

As outlined previously the U.A.E. has multiple routes through which students are able to complete their education (WENR, 2018). In order to provide the necessary scope limitations, this study focuses on teachers working in schools in the government and private sectors, teaching in a student age range of 9-18, this range is to address the slight differences in education systems. For example the British Primary and Secondary which is just two distinctions and the U.A.E. Cycle 1-2-3 system, without unnecessary exclusion of potential sources of data. I chose not to include Higher Education or indeed focus on Higher Education, as this would limit the potential impact and use of this study, Higher Education is an area where there is the least equitable access globally (Salmi, 2018). Teachers from various educational institutions in the U.A.E. K-12 model (government, private, academic and vocational, that encompass different country curricula) took part in the data collection process and it is their experiences with using technology, including processes of change, that make up the data set that informed this research study.

How teachers use the technology

The focus on the use of the tablet device comes from the ideas introduced earlier, that we are in a globally 'mobigital' 4.0 driven world (Sad and Goktas, 2014), so therefore mobility was a central tenet of the technology in this research. The push towards tablet devices in classrooms was at its peak in the U.A.E. during the data collection phase, enabling a wide range of data sources, however as I will discuss later the use of a tablet has started to diminish in popularity. Whilst the U.A.E. context meant that the Apple iPad was the dominant device in the study, some teachers used other types of tablets such as the Samsung tablet.

The question of how teachers use the technology had a more prominent pedagogical drive, than a technical one in this study (CCL, 2015). The need to understand how teachers used the tablet revolved around pedagogically focused questions and explorations, which were in part derived from other studies in classroom tablet use, but were also explored through the openness of a grounded theory approach (Birks and Mills, 2015). The idea of teachers being central to the process (Fullan and Quinn, 2010) would therefore focus on the methods and strategies that teachers were using in the classroom with the tablets, as success or failure in the classroom may translate into success or failure of the tablet integration.

Why teachers choose to use the tablets the way they do, including influencing factors that result in success or failure of the technology use

In order to explore the influencing factors behind a teacher's pedagogical choices, the questions revolved around training, experiences, thoughts, attitudes and ideas surrounding the use of tablets in the classroom. I did not define any concrete areas to focus on and therefore I was able to get a spectrum of lived experiences and explanations of why tablets were used in the way they were, without the constraints of very narrow pedagogical foci. I was also able to explore different education systems within the U.A.E. that enabled an extra dimension of context breadth to the data.

In looking to explore the influencing factors of the teacher's experience further, data was also collected not only from teachers, but from what I refer to as 'implementers' of educational technology roll-out in schools, these 'implementers' carried the responsibility for the technology implementation, integration and sustained use of the tablets for either one or several institutions; this gave an extra layer to the data for factors of influence, yet they were not too far removed from the teachers as they all had direct influence and interaction with teaching staff.

Learning models

The use of learning models related to the use of educational technology, spanned the questions of pedagogical approaches and factors of influence. Some learning models were used and referenced almost ubiquitously, such as the SAMR Model (Romrell, Kidder and Wood, 2014), and some models of practice or influence were alluded too, without awareness or name, but could be seen within the data, such as the Diffusion of Innovation model (Rogers, 1962). Understanding the educational learning models that teachers and implementers adhered to either purposefully or otherwise, the TAM Model for example (Teo and Schaik, 2009), helped shape the development of the data collection, analysis, subsequent conclusions and model development, based on the findings of the research such as the TPACK Model (Mishra and Koehler, 2006) which is recommended for adaption as a finding of this research.

1.3 **Original Contributions**

At the outset of this research there were limited studies into using tablets in classrooms in the U.A.E. and those that existed were based in tertiary level education institutions and were outside the scope and focus of this research study, although some have been included for contextual purposes.

It is hoped that the findings, outcomes and recommendations of this research, will firstly support teachers in utilising tablets more effectively in their classrooms, by considering the effective practices that are afforded by the tablets, with the underpinning pedagogical rationales. Secondly it is hoped that educational technology integration programs can be informed, by acknowledging and acting upon the influences that impact both positively and negatively on successful tablet use in the classroom. The choice to use elements of grounded theory and not the full process, is that the intention of this research was not to construct a full theory of technology use and influences, but to explore all elements and present them in a way that they become or translate into useful data, for practitioners who wish to implement technology integrations in their institutions or classrooms, with the data reflexive and adaptable to the scenario of the institution or classroom.

It is hoped and expected that this research will contribute to the current literature on the pedagogical practice of tablet use in the classroom, alongside an understanding of the factors that influence these pedagogies, both positively and negatively. Whilst this study was conducted in the U.A.E. it is hoped that the findings can be generalised into other contexts, based on the mixed demographics and contexts of the research participants.

1.4 Research rationale and framing the problem

In consideration of the overarching question of - why does technology in education seemingly fail to integrate in the U.A.E. and the contextualised factors set out in the previous section, the research aim of this study is to explore all of these areas, through the lens of each contextualised factor: the teachers as central change agents, the how and the why of pedagogical choice, influencing factors and educational models, this is in order to gain some understanding of how and why technology integration fails or succeeds and additionally consider how to effectively integrate educational technology and avoid potential points of failure.

The question to be asked here is why to focus on this at all. There was a lack of pedagogically driven research studies when this research was originally designed, and as noted by Rushby (2012, p. 355), 'The majority of these studies do not move us significantly beyond what is already known and widely published in the field', it is necessary to contribute to this body of research in order to move pedagogical practice forward, for educational technology in the classroom. Whilst there are multiple studies available that look at the effects of technology and learning outcomes, such as the literature review provided by Wentworth and Middleton (2014), these studies focus on the use of the technology being 'in addition' to what is happening within the classroom and not the technology as a tool for learning. Furthermore, Ng and Nicholas (2013) assert that a majority of studies into learning with a mobile device, have no longevity and are

funded through sponsorship, thus resulting in technical and pedagogical support systems, that are predetermined by the sponsor in question, this results in the need for independent research away from corporate constraint and funding.

Cochrane's (2014) review of the m-learning literature indicated further specific common shortcomings in the majority of m-learning research:

- A lack of explicit underlying pedagogical theory (Traxler and Kukulska-Hulme, 2005).
- A lack of transferable design frameworks (Armstrong et al., 2008; Sharples et al., 2009).
- A general lack of evaluation of the projects (Vavoula and Sharples, 2009).
- A lack of longitudinal studies (Traxler and Kukulska-Hulme, 2005).
- A lack of the importance of pedagogical integration, i.e., aligning the unique affordances of mlearning with appropriate assessments or activities (Laurillard, 2007).
- A lack of explicit student and lecturer support and scaffolding (Attwell, 2007).
- A lack of awareness of the ontological shifts (Chi and Hausmann, 2003) required for both the learners' conception of learning and the lecturers' conception of teaching.

Often 'net-generation' skills are assumed, and most of the case studies consist of lecturers who could be described as early technology adopters (Armstrong *et al.*, 2008) both of which are not true representations of the reality in most educational systems.

Based on the shortcomings identified by Cochrane (2014) above, I propose that the next stage of the research (in a context outside of higher education where a majority of research appears to be situated) should focus on the pedagogical changes as advocated by Laurillard (2007) and Traxler and Kukulska-Hulme (2005) within the everyday classroom and the everyday curriculum that can be afforded by the use of the wireless mobile tablet device, and where these pedagogies sit on an ontological, epistemological and theoretical framework (Chi and Hausmann, 2003). Using the framework as a solid base will give credibility to the research that should give teachers, teacher educators and instructional designers, the foundation with which to integrate and develop curriculum, schemes of work and lessons that integrate the affordances of the mobile device from the start (Armstrong et al., 2008; Sharples et al., 2009). This research can further contribute to addressing these identified 'short-comings', by exploring whether pedagogical change has actually occurred in a tablet-based classroom, and if so how? Furthermore it explores the influencing factors on pedagogical change in the classroom, as according to Falloon and Khoo (2014) the pedagogical role of the teacher - is an essential part of the learning experience of the student, this can then be translated into part of the 'solid base', which practitioners can use to develop their digital strategies. Furthermore it endeavours to work within the need for more research into educational technology, as identified by Bennet et al.

(2017) who assert that reasons for limited adoption of technology are not very well understood, hence the importance in this research of the exploration of factors that influence the implementation and use of the technology.

If we consider the argument that we are in this 'mobigital virtual space' (Sad and Goktas, 2014) with the all encroaching interconnectivity that exists daily at our fingertips, it can be easy to see just how swept up in the 'technopositivist ideology' as outlined by Njenga and Fourie (2008) that we can become; they argue that there has been no time for the research to keep pace with the development of the technology, and that there has been too far of a swing towards a discussion of the technology itself within the literature, and not the impact that it has on the teaching and learning process. The researchers question whether there is too much focus on the 'e' and not the learning. I agree with the assertion of Njenga and Fourie (2008), that there is far less research on the impact of educational technology onto the teaching and learning process, and so I began to form the foundation of this research paper. However, in agreement with this particular aspect of their argument it does not follow through that the negativity towards this technopositivist ideology is justified, as it might be necessary to move the field forward successfully in terms of both practical implementation strategies and the research that accompanies them.

1.5 **Research Aims and Questions**

Through addressing the research questions outlined below this research hopes to add to the growing body of knowledge around tablet use in the classroom, this use includes pedagogical practice as well as factors that have both a potential of positive or negative influence on technological integration. The research also hopes to provide useable baseline frameworks to assist practitioners with integration of technology, within their schools or institutions by adapting existing models and through applying a robust approach to training design.

- Has the pedagogy used in the United Arab Emirates G6-12 classrooms in government and private schools changed with the use of tablets?
- 2. What are the influencing factors on the pedagogy of tablet use in this context?

The subsequent chapters are as follows: chapter two presents the literature review which captures issues relevant to the pedagogy of tablet use and change processes within the classroom. Chapter three outlines the strategy and methodology for the research, data collection and analysis. Chapter four presents the findings of the study. Chapter five offers a discussion of the findings synthesised with existing literature and presents the models that have arisen from the research. Chapter six provides conclusions and closing thoughts on the research study.

Chapter 2: Literature Review

2.1 Overview

The introductory chapter of this research presented ideas and concepts, that will now be discussed more fully through the literature review. Section 2.2 will discuss the nature of teachers as central agents of change, by looking at teacher identity and teacher training both pre and inservice. The pre and inservice discussion, also includes the ideas of a teachers pedagogical practice existing as a structure of deep personal professional grammar; it is through the lens of teachers as agents of change, that this research is situated. Section 2.3 considers the use of tablets within the classroom and it will consider factors of influence that revolve around the teacher's pedagogical choices. The third section 2.4 will explore the educational models that are associated with educational technology use, as these models can explicitly and implicitly exist and influence an educational technology implementation. The sections are then brought together in section 2.5 and synthesised into the aims of the research.

2.2 Teachers as central agents of change

Teachers as agents of change

Considering the 'Faddism and Failure' (Fullan, 1982, p. 4) of attempts in the past to move the teaching profession forward, the problems of resistance may be felt within the very soul of the teacher (Pajak, 2012). In argument for the central placement of the teacher, in the push for genuine reform (Fullan, 2011), reflections should be made on to how to overcome the opposition to change experienced by teachers, especially in regard to the use of education technology in a classroom setting. Fullan (1982, p. 4) asserts, that a central issue is that teachers do not have a clear rationale of the reasons for the change to occur or how to facilitate the change effectively in their classrooms, which leads to 'misdirected resistance and misunderstood reform'.

However, has anything changed in the subsequent years since Fullan's original statement? It would seem not as there are still deep-seated problems; as Fullan (2011) further asserts, that in order to accomplish real and effective educational change you must chose the 'right driver', and he adds:

Intrinsic motivation, instructional improvement, teamwork, and 'allness' are the factors through which effective reform is achieved then there is a need to align

reform goals and the intrinsic motivation of the stakeholders and you achieve this by centrally situating the teachers and the students. (Fullan, 2011, P. 1)

The four factors that act as the 'right drivers', as defined by Fullan are: the learninginstruction-assessment nexus, social capital to build the profession and that pedagogy should match technology and systemic synergy. Unfortunately schools are less likely to choose these 'drivers' and will opt for short term fixes which will ultimately fail (Fullan, 2011).

Capacity building (Fullan, 2011; Fullan and Quinn, 2010) across the whole teaching profession is perceived to be the core of successful reform, this in turn requires coherent development from the national level through to the individual teacher. Levinson *et al.* (2017, p. 7) state that the role of teachers in educational change is fundamental if 'substantive and successful' change within a school system is to take place; they argue that teachers need to be classified as; agents (having agency), recipients (implementers) or partners (collaborators of reform) in the change process. The importance of affording teacher's autonomy is highlighted by the success of the educational reforms in Finland, Singapore and Canada, where the whole profession is constantly developed in regard to the professional capital that the teachers hold (Hargreaves and Fullan, 2012). Furthermore giving teachers a voice in centralising their position within the change reforms, allows for the issues of top-down bureaucracy to be ameliorated (Somech, 2010). Despite the Finland reform being 'atypical', the teachers welcomed the additional responsibility (Sahlberg, 2007) despite the assertions of Smylie (1992), that teachers may be resistant to change in the fact that their desire to participate in the reform is not always as strong as assumed.

Weiss's (1995) study into school reform evaluated the process of Shared Decision Making (SDM) as a method by which to improve overall teaching and learning; she notes however, that even with representatives on an SDM body; teachers will still prefer the status quo. Moreover, the teachers were unconvinced of the need to make changes and questioned if it was in the interests of themselves or the students. Weiss (1995) further asserts that teachers ignored literature and research that underpinned the proposed reforms. Weiss (1995, p. 589) concludes by stating that teachers need to see reform as 'permanent and authentic' in order to partake in the process.

In the paper by Pajak (2012) he repositions the work of sociologist Willard Waller, by developing an interesting argument regarding teachers' resistance to change. Starting from a psychoanalytic perspective he states that Waller is asserting that teacher insight - must be an underpinning agent of change, which then aligns with the requirement of teacher centrality as outlined by Fullan (2011). The issue that then arises according to Waller is that the behaviour of teachers eventually drives their personalities and they become immutable, this unconscious 'grammar' or 'deep structure' of personality, is argued to be further defined by social and political

influences and is the main reason for the 'Uniformity of practice and resistance to change' (Pajak, 2012, p. 1187). The resistance to change on a subconscious and psychological level can make access harder and reformation even more so; this change (Bjork, 2003) can be addressed by making teachers part of the process of school reform and not be seen as an obstacle to it (Levinson *et al*, 2017).

The fact that Fullan (2011) asserts that 'pedagogy matches technology' as one of the four main drivers of educational change, demonstrates the high level of importance in confirming that educational technology becomes embedded within education practice. Fullan further asserts that technology is continuously improving, however the pedagogical practice is not able to align with this evolution. The important point that Fullan (2011, p. 5) makes, is 'Technology will be a dramatic accelerator if we can put instruction and skilled, motivated teachers and students in the lead'.

As per Weiss's (1995) assertion, that any change needs to be made 'permanent and authentic' regarding all types of reform, Fullan (1991, quoted in Cox, Preston and Cox, 1999) makes a statement, that:

teachers who resist change are not rejecting the need for change, but they are often the people who are expected to lead developments when they lack the necessary education in the management of change and are given insufficient long-term opportunities to make sense of the new technologies for themselves. (Fullan, 1991 quoted in Cox, Preston and Cox, 1999, p. 2)

In the case of educational technology, this may not be achievable in some cases, as the permanency required does not reconcile with the short periods of time given to teachers to familiarise themselves with a technology. In the final discussion it appears that it is only through persistence and 'permanent and authentic' (Weiss, 1995) change, that the discourse of educational technology and pedagogy will become embedded within current and future teaching practice.

Teacher Identity

There appears to be two main influences on a teacher's career, which help to shape the self-identity of the teacher, these influences are the initial teacher training and the school / social capital scenario within which they work. Once these are established and begin to embed, changing this identity and self-belief through in-service teacher training or other forms of change, becomes problematised through the issue of teachers' deep grammar, as outlined in the previous

section, this is further complicated when the use of technology is included, as can be seen in the report from UNESCO Mobile Learning Week 2018 'Skills for a connected world' (2018, p. 5). The following are some of the concurrent themes that emerged from these presentations and discussions:

- Teachers need ongoing professional development to gain the knowledge, skills and attitudes needed to educate learners in the digital age, with major implications for education systems and institutions responsible for training teachers.
- It can be difficult for teachers to keep up with the ever-changing technologies and learning platforms. Solutions are needed to assist teachers in adapting to and embracing such transformations. (UNESCO, 2018, p. 5)

Additionally, the Horizon Report (2017) stated that education transformation cannot be cultivated through technology only, but rather through better pedagogical practice and educational models that act inclusively. The report stipulates that digital platforms and tools enable and accelerate the process, the question then arises of how to effectively provide the ongoing professional development that effects actual change on a teacher's self-identity, as the use of technology in the classroom is more than just a strategy or task that can be taken away and used, these problematised ideals of professional development are discussed in the next section, and whilst it is acknowledged that training and professional development are fundamental and essential to becoming an educational practitioner, there are many limitations that are in place when it comes to training for educational technology implementation. This limitation is illuminated by Li and Choi (2014, p. 14) who state 'the fast-evolving and short-lived nature of learning technology may restrain the availability of exemplary practices as prior knowledge of the pedagogical use of technology is often scarce'.

Pre-Service Training

Looking at pre-service teacher attitudes to using technology, Sad and Goktas (2014) studied a selection of university students training to be secondary teachers, they found that the teachers questioned were fairly positive towards laptop usage and less positive about the use of mobile phones. The researchers suggest that a more positive attitude towards m-learning needs to be fostered, they suggest that this should happen during the teacher training stage whilst at university, however this is fraught with issues, mainly faculty familiarity with the technology. In consideration of this point Shelton (2014) found that the mandatory use of technology in a Higher Education setting, could actually have a negative impact on the way that members of faculty

viewed the technology and this in turn could be counter-productive. However, Price *et al.* (2014) believe that the introduction of mobile technologies to pre-service teachers, is an essential part of integrating mobile technologies. In their study, they found that utilising the technology in context increased the confidence levels of the pre-service teachers, but it also and possibly more importantly, led to them being able to experience and consider different pedagogies. Price *et al.* (2014) align this with the work of Niess (2005) who similarly found that innovativeness of teachers increases with an increased pedagogical content knowledge base.

Yurdakul and Coklar (2014) assert that the technological training given to pre-service teachers, needs to be continually updated in-line with the technology that is being used within the classrooms, however this is problematic: not only for the reasons outlined by Li and Choi (2014), but also it needs to be made teacher training policy as a requirement of any course, otherwise it comes down to individual institutions and course facilitators, this is further problematised very specifically in the U.K. as there are several routes into teacher training: the PGCE (Post Graduate Certificate in Education), SCITT (School-Centred Initial Teacher Training) and School Direct where your training is provided by the school. If your university or school is not technology-orientated and it is not governmental policy to have a technology-based element within the teacher training provision, then this becomes a stalemate situation with regards to educational technology integration and developing a teacher's pedagogical 'deep grammar' (Li and Choi, 2014, p. 1).

Moving to the U.A.E. context the requirements for Initial Teacher Training are disparate, due to the breadth of educational models and curricula that exist within the country, each defining differing initial teacher training requirements. After arriving in the U.A.E. I found that there was a vast reluctance to engage with the technology in the school system where I worked, despite the 1:1 iPad usage and the existence of many years of research into computer-assisted language learning.

In-Service Training

According to Li and Choi (2014) teachers are disinclined to take risks within their teaching pedagogy without a sufficient network of 'social support' within the school. Archer *et al.* (2014) in their tertiary meta-analytic review of three previous meta-analyses, into ICT and technology intervention programs, found results that were significant when training and support were added as a moderator variable, they assert the importance of training and support when considering factors on implementation in programs utilising ICT and educational technology.

In the research conducted by Li and Choi (2014, p. 1) they bring an additional concept to what they refer to as the 'infusion of technology' into schools, they look at in-service teachers

asserting that changing a teacher's epistemological belief or 'deep-grammar' to be more positive and accepting of educational technology, may not necessarily lead to actual change in the everyday pedagogy of the teacher. Li and Choi (2014) argue that the factor that leads to actual pedagogic change is the 'Social Capital' that is offered by the school environment, they define social capital as: mutual trust between principals and teachers, effective communication channels between senior management and teachers, shared beliefs, goal alignment, sense of belonging, willingness to take notes and their willingness to collaborate and share experience. The last element for pedagogic change as described by them, but not strictly described as Social Capital, is access to expertise – expertise defined as someone with the pedagogic know-how for educational technology; they proffer the advice that schools need to promote social capital and also internal capacity in order to make the technological 'infusion' successful. Blackwell, Lauricella and Wartella (2014) also found that teacher attitude towards the value of technology was the most significant factor in using the technology, additionally as with Li and Choi (2014) they found that confidence and support in using the technology came second. An interesting aspect of the study by Blackwell, Lauricella and Wartella (2014) found that those teachers who had more teaching experience displayed more negative attitudes towards the uptake of the technology, supporting previous affirmations that deep grammar is difficult to change. Although the data from Blackwell, Lauricella and Wartella (2014) was taken from an online questionnaire, conducted with 1,234 early years educators, the findings regarding the changing of deep grammar may be generalisable across all the teaching sectors (Early Years – Primary – Secondary – Further and Higher Education) and perhaps to vocational, work based and lifelong learning sectors.

In summary, teachers need to be placed as central to the process of change. Adherence to long-term drivers is essential as short-term fixes will ultimately fail. An acknowledgment needs to happen that a teacher's deep pedagogical structure exists and has to be addressed on a psychological level, in order to ensure a teacher's self-identity is developed in line with the technological integrations. Pre-service training is the ideal place for the formation of a teacher's digital pedagogy constructs; however it is heavily problematised, making it almost impossible to achieve effectively. For effective in-service teacher training, schools need to provide a safe and trusting environment.

2.3 **Pedagogies of classroom teaching and the baseline for comparison**

Having considered teachers as a central agent for change and the concepts around pre and in-service teacher training in the previous section, it is important to explore what good teaching is considered to be, whilst this is not necessarily the standard of every teacher training program universally, a baseline of evidenced-based good teaching practice does exist within the literature.

In the Sutton Trust report 'What makes great teaching' Coe et al. (2014) combine the evidence base of effective pedagogical practice into six overarching areas of good practice, and seven areas that are perceived to be less effective teaching and learning approaches. Coe et al. (2014), identified two areas as having the strongest evidence of impact on students learning, the first being a teacher's pedagogical content knowledge (which includes not only their own deep knowledge of a subject, but also an understanding of the way in which students think about and learn the concepts) and the second is the quality of the instruction that the teachers provide, which includes: effective questioning, modelling, scaffolding and practice time to embed skills. Moderate impact on student learning came from classroom management and classroom climate, with teacher's professional behaviours and beliefs deemed to have some impact. Coe et al. (2014) give a selection of similar effective teaching models in the classroom, starting with Danielson's Framework for Teaching (2007) which revolves around planning and preparation, the classroom environment, instruction and professional responsibilities. The CLASS model by Pianta, La Paro and Hamre (2008) focuses on emotional support, classroom organisation and instructional support, and is more focused around a humanistic approach to education. Rosenshine (2012) is a key teaching model and focuses on the structural aspects of instruction. The Creemers and Kyriakides Dynamic Model (2011) focuses on organisation and facilitation in the classroom and makes explicit, that areas such as questioning, modelling and assessment are key aspects of teaching. The last part, cognitive psychology from Bjork and Bjork (2011) highlights spacing practice, interleaving instruction, generative learning and using tests as a learning method (also known as the testing effect or retrieval practice). All of these approaches to education have influenced the design of the data collection tools of my research.

Whilst noting the evidence base for what constitutes effective approaches to teaching, it is important to state here what Coe *et al.* (2014) advocate as less desirable or 'ineffective' teaching practices, these need to be considered if they appear during the data collection phase as being associated with using the tablets in the classroom, alongside the effective teaching practices. Four of the seven strategies that Coe *et al.* (2014) highlight are: using praise lavishly with students, grouping learners by ability, encouraging re-reading / highlighting to memorise key ideas and addressing issues of confidence and low aspirations before you teach content. I have introduced these first as based on my 'positionality' within this research, the last three may have more relevance to this research specifically. In my own experience (and outside the scope of this research) working with schools and alongside the educational community in the U.A.E. I saw many examples of ineffective practice, alongside other ineffectual practices such as lecturing and working individually from textbooks, and I found that during the reform attempts to move away from this type of pedagogy were met with resistance.

From the list by Coe *et al.* (2014) I found three ineffective approaches most prevalent, these are: allowing learners to discover key ideas for themselves, presenting information to learners in their preferred learning styles and finally ensuring learners are always active, rather than listening passively if you want them to remember.

The use and approach to learning styles has been a particular challenge, this is perhaps due to the previous ubiquity of the approach across educational training programs and continuing professional development, and as we have seen in the previous section a teacher's pedagogical grammar is difficult to alter once set, even when the research has demonstrated the inefficacy of teaching to learning styles.

Active learning I found was mis-conceptualised into 'learning by doing' with disregard for the idea that memory is the residue of thought (Willingham, 2009) and 'thinking' as being an active activity. The further problematisation of these misuses of discovery learning and active learning, can be seen in the subsequent section and the discussion of Prensky's approach to teaching with technology (2010), which advocates these exact approaches. However, it was outside the scope of this research to narrowly focus on specific pedagogical alignments in the use of technology.

2.4 Using tablets in the classroom

2.4.1 Using tablets in the classroom: Approaches to pedagogy

Whilst there is a growing body of research into tablet use in classrooms more needs to be done, as Falloon (2014, p. 318) stipulates - that despite the 'rhetoric' significant studies have not emerged into student interaction with mobile devices and more significantly the impact that these devices may or may not have upon the students' learning, he points to an ungeneralisable nature to the research findings and additionally states that research seldom moves past 'anecdotal accounts', or 'qualitative perception-based narratives'. In addition Cochrane (2014) asserts that research into m-learning (mobile learning) has revolved around pilot studies into the use of the technology in the classroom and outlines that there has been little in the way of academic critique and the formation of theory. However, this can also be seen as indicative of the infancy of the research itself.

There is a continuing need to explore tablet device use in the classroom as part of the paradigm for mobile learning and in order to add to the evidence base for good practice. In synthesis with ongoing research from neuroscience into the way we learn, maybe we can end the crash and burn hype cycles that educational technology currently experiences.

In his evaluation of ICT implementation across the British Curriculum, Hammond (2014) utilises some of the study undertaken by Becta in his approach. He discusses how Becta found using certain technologies afforded specific activities within the classroom, in this case: pupil led research, project-based learning, teachers sharing resources and the use of IWBs in the classroom. The idea that the technology afforded these pedagogies supports a particular notion that technology underpins the classroom of the 21st century learner, this concept of learning in the 21st century has been explored by Prensky (2001), who discussed what constitutes the pedagogies that a student will experience in the digital age. Prensky uses a collective term for 21st century pedagogies which he refers to as 'partnering', according to Prensky 'partnering' is about the relationship that a teacher will form with their students, it is about how the teacher becomes the facilitator in order to help the students utilise the affordances of the technology, to enhance their personal learning experience. It is not about how well the teacher can use the technology, but how they engage with the technology and move their teaching towards a new form of pedagogy. In Hammond's (2014) evaluation of ICT in the British Curriculum, pupil-led research and project-based research were mentioned in his summary, this aligns with the examples that Prensky (2001) gives for the pedagogies of the learning partnership: Problem-Based Learning (PBL), Case-Based Learning (CBL), Inquiry-based Learning (IBL), Challenge-Based Learning, Student-Centred Learning, Collaborative Learning, Active Learning and Learning by Doing, this is further elaborated by the Creative Classrooms Lab Project (CCL, 2015) which was conducted as an experiment into the innovative use of tablets in education. The project was managed by European Schoolnet and supported and funded by the European Commission's Lifelong Learning Programme. The aims of the project were:

- To develop innovative teaching and learning scenarios involving the use of tablets in and out of school. The focus was on the possibilities of a 1:1 computing paradigm with the potential to be mainstreamed.
- To design and run two rounds of classroom pilots in a controlled environment as policy experimentations based on these scenarios with teachers and students from 45 classrooms in eight countries.
- To observe, document and report on the innovative use of tablets by teachers and students involved in these policy experimentations, with a particular focus on how tablets support collaboration, personalisation and active learning in creative classrooms.
- Draw lessons from the policy experimentation and provide a final set of recommendations for policy makers on what changes policy makers in Europe may need to make in their education systems and curricula in order to foster and sustain the innovative use and large-scale implementation of tablets. (CCL, 2015, p. 2)

The project worked in collaboration with various partners over eight countries, in order to conduct the pilot work with the iPad, this was alongside the University of Wolverhampton and industry partners. In this project they developed pedagogical scenarios named *learning stories* and implemented them in schools across two consecutive years – 2013, 2014, during which they completed a research study into each learning story, through lesson observations, interviews and discussions. The learning stories were: the flipped classroom, collaboration, personalisation, content creation, assessment, school to school collaboration and liberating learning. The overarching conclusion of the study was that tablets should be used for differentiation and personalised learning, followed by collaborative and active learning strategies with a focus on pedagogy rather than technology, they also stipulate that experienced lead teachers who can provide pedagogical support are a crucial part of the process, this mirrors Li and Choi's (2014) assertion that access to 'expertise' is key.

Studies that revolve around iPad use, specifically in the U.A.E.

Studies that look at the use of iPads in the classroom in the U.A.E. mainly originate in Higher or Tertiary education institutions, however despite the differences between K-12 and Higher Education, the studies may still be considered relevant to the domain of pedagogical research. From Gitsaki et al. (2013) we know that in 2012 the U.A.E. Ministry of Education launched an initiative across three federal institutions (Zayed University, United Arab Emirates University, Higher Colleges of Technology) to provide iPads to the foundation level students for the 2012 academic year. The initiative involved implementing pedagogical models including: individualised student learning, challenge-based learning and pedagogies deemed progressive methodologies. Engin and Donanci (2015) conducted their study in a Higher Education institution and reviewed the relationship between dialogic teaching and iPads in classes for 'English for Academic Purposes', what they assert in their study is that the impact of using tablets was primarily based on the existing approach to using the dialogic pedagogy and that the iPad was a tool to be used and not a methodology in and of itself. An additional point to note in this study is that opportunities and restrictions were based on the students and teacher's responses to the iPads, which links to the TAM model discussed in subsequent sections. The study by Eppard, Nasser and Reddy (2016) focused on an exploratory research methodology, designed to discern which Apps should be promoted for use in the foundation programs of Zayed University. Eppard, Nasser and Reddy (2016) found ease of use, Apps for sharing and collaborating in real time alongside content-based Apps were of high importance; they further assert that they believe that training is a vital part of the choice and use of Apps. Grigoryan's (2018) study at the Higher Colleges of Technology looked at the attitudes of Emirati students when using iPads and considered the themes that emerged from the weekly reflective journals kept by teachers on the

courses. In analysing these journals motivation was a key code, that came from the grounded theory approach adopted by Grigoryan, alongside the use of the iPad to provide timely feedback to students as compared to traditional textbook learning, this study had the use of eTexts as an integral part of the research. Similarly Rogers-Estable (2018) conducted a study into the use of iPads at one of the tertiary institutions with a specific focus on looking at implementation factors and eText books. The barriers to the implementation were found to be: technical, more efficient workloads needed and the interactive features of the eTexts, whilst it is difficult to discern the shift in focus to the iPad being used more as a connectivity tool for eTexts and materials appears more prevalent in this later research. Studies at the school level in the U.A.E. are limited, however a 2019 paper by Shanaa and Abulibdeh found that the use of iPads in a G10 ICT class at an Abu Dhabi private school, had a positive impact on student achievement as compared to a control group. The pedagogies of the iPad group are not detailed, however the study indicates that all teachers had a practical understanding of the iPads, although they needed advanced training sessions in order to enhance the learning experience for the students. Further studies into the use of iPads were also conducted around the Gulf Region. In Higher Education, Macleod (2015) studied the use of iPads in a technical college in Qatar, the study showed that the iPads were useful for interaction with course information and materials, including exploring additional materials related to course content, this relates to the later studies in the U.A.E. discussed in the previous section, where the use of eTexts and online materials appears to be more prevalent in the tertiary based research.

Additional research studies in similar domains

In the time that this research took place new literature has arisen that is of relevance to this study (outside of the scope of the previous section) this part of the literature review will focus on publications that are linked by elements such as geographical location (Middle East / GCC), themes and foci to this research.

The previous section used the search term of 'iPad' and 'U.A.E.', however this section will utilise a broader spectrum of search terms, with the 'Web of Science' as the database selected for this updated and expanded part of the literature review. The search terms that were utilised were: iPad / Mobile Learning in the United Arab Emirates / Middle East / GCC / AGCs / Arab / Saudi / Jordan / Qatar / Bahrain / Kuwait. The date range for this section of the literature review is 2015 to 2021, this section is grouped into the various domains and themes that were most prominent in the review of the literature, selecting papers that are representative of those key themes in order to keep this section succinct.

Frameworks and Reviews for Mobile Learning in the Middle East

In their review, Khan et al. (2015) evaluate mobile learning in countries they considered educationally advanced and framed that review around the adoption of mobile technology in the Middle East, they make five recommendations based on their findings. The first is that mobile learning objectives should be addressed at a national level with comprehensive strategies at governmental levels (for reference this was not in place at governmental level in the U.A.E. when my research study commenced). The second point in their research is the importance of developing partnerships between public and private sector entities, with their assertion being that mobile learning can be best exploited through this collaboration; this was not evident during the course of my research. In their third point Khan et al. (2015) felt that defining the characteristics and social and cultural norms of the user was important, even advocating customised content built for those needs. A user directed approach was noted in places during my research especially regarding social and cultural norms and values. The fourth point in their research study was that the existing mobile learning infrastructure should be assessed and improvements should be made where necessary. A national 'right to broadband' policy as described in their research did not exist at the commencement of my research in the U.A.E. The final point in their research was the importance of developing trust and awareness; they advocate this through the use of workshops, training and successful experiences, this was a key theme during the course of my research study - particularly the absence of them.

A few years on from the 2015 paper by Khan *et al.*, a review of mobile learning technology in Arab Gulf Countries (AGCs) was undertaken by Alsswey, Al-Samarraie and El-Qirem (2020), their review of research from 2010 through to 2018 focused on two questions, firstly the current progress in adopting mobile learning across the AGCs and secondly what recommendations could be made to policy makers in regard to the use of mobile learning in the region. Alsswey, Al-Samarraie and El-Qirem (2020) assert from the outset that mobile learning was inconsistently used across the AGCs and they believe that the adoption of mobile learning is a challenging risk, underpinned by multiple factors such as technical, social and cultural issues, causing slow progress which is further compounded by a lack of evidence on the potentials of mobile learning in the region. For their first research question regarding progression of mobile learning, they present the research papers in their review by country, showing that papers originating from Saudi Arabia had the largest percentage with 32.3%, with the U.A.E. and Kuwait following with a joint second largest percentage of 16.1%. The researchers assert that this could be attributed to in-country advances in information and communication technologies. The key areas highlighted in their review of the research were the accessibility of mobile learning services, as well as social, cultural and behavioural issues affecting the uptake of mobile learning, their review showed that

students and instructors generally had positive perceptions towards mobile learning, however the social and cultural issues may be causing a barrier to implementation. Alsswey, Al-Samarraie and El-Qirem (2020) state that whilst some universities in the region have provided training to staff on how to use technology effectively and have provided online courses for students on how to use different mediums, in general schools and universities need to have the required technological infrastructure in place for successful integration of mobile learning. Positive factors that were also reported in the study were: the flexibility of mobile learning, enjoyment of using the devices and also the economic and social aspects of mobile learning. Counter to the positives, factors that affected the use of mobile learning were found to be: student's attitudes, institutional and cultural values and gender segregation. During the course of their review they found that models used within the research were: UTAUT at 25.8% followed by TAM at 16.1% and Activity Theory at 3.1% and interestingly 54.8% of studies having no model at all utilised as part of the research. In the second part of their review they make recommendations for areas where educational policy makers and researchers need to focus. Firstly, studies are needed for capturing cultural and social influences and secondly, studies are needed for exploring motivational beliefs of students. Thirdly, and most importantly for my research study into mobile learning in the U.A.E. the authors advocate the exploration of the types of learning activities that students engage in and how those are linked to other theories of learning and mobile learning research, this recommendation is particularly relevant for my research study as it revolves around the exploration of pedagogical practices and what influences use of those practices. The final recommendation by Alsswey, Al-Samarraie and El-Qirem (2020) is that there is a need to look at student performance through methods of statistical analysis, to determine predictive significance of factors surrounding student use of mobile learning in AGCs.

Reviews into mobile learning in individual countries have also been undertaken, such as the systematic literature review on mobile learning in Saudi Arabia that was conducted by Abdulrahman and Benkhelifa (2017), they analysed literature on mobile learning from higher education institutions from 2010-2017, pertaining to nursing education, they assert that significant studies are lacking and those that do exist did not have an adequate theoretical framework if at all, their review explored similar themes to my research and looked at: what mobile learning frameworks exist, the most common factors influencing mobile-learning in higher education, development of use of mobile learning, student and instructor acceptance of mobile learning and finally how are mobile learning frameworks validated. Similarly to other studies they found TAM and Activity Theory to be predominant in the literature, however the authors state that there is little research that classifies types of learning in mobile learning frameworks and there are very few instructional design guidelines that are based on a 'solid' theoretical framework. It should be noted that they found examples of the use of Grounded Theory within
their literature review, which is part of the methodology used for this study. Influencing factors on how mobile learning is used are: inadequate technological infrastructure, lack of pedagogical skills for mobile learning and poor attitudes amongst faculty and institutional leaders, this has had a detrimental effect on mobile learning in Saudi Arabia.

Whilst these research reviews have been selected as exemplars of robust academic quality, there are other research studies that have been conducted that act as reviews of the literature on mobile learning in the region, however these were not considered of sufficient academic quality to be included here. The subsequent section will focus on Higher Education Institutions (HEI) and the main themes that are prevalent in the research.

Higher Education Institutions (HEIs) in the Middle East / GCC / AGCs

HEIs: TAM (Technological Acceptance Model) and UTAUT (Unified Theory of Acceptance and Use of Technology Model)

Research coming from Higher Education Institutions across the region had some similarities and shared scope in their focus. During the review of research on the 'Web of Science' there were a plethora of papers that used the TAM and the UTAHT models in order to explore attitudes towards and use of learning technologies, such as Alsswey, Al-Samarraie and El-Qirem (2020). The following section highlights some of the main findings from those papers, whilst the studies highlighted here cross the geographical region, countries such as Jordan, Qatar, Kuwait and Bahrain had research studies which had similar foci and outcomes regarding the TAM and the UTAHT.

Andrew *et al.* (2018) surveyed student opinions on implementation and use of technology across two universities in the U.A.E. they found that: students enjoyed learning how to use new technologies, believed they improved learning and prepared them for future employment, however books and paper were the preferred learning resources. In reference to devices students preferred laptops in the first instance, tablets and smartphones were the least preferred tools, their research showed that a combination of both digital and paper-based learning resources was the optimal way the students wished to learn. In the research by Masarweh (2018) mobile learning across six universities in Saudi Arabia was evaluated, focusing on the way that 347 faculty members (rather than students) used and engaged with mobile learning. The study found that lecturers preferred the traditional approach to teaching with the use of personal computers. Through the findings of the study, the researchers assert that mobile learning can be improved through better training and policy setting by university officials and decision makers. Andrew *et al.* (2018) and Masarweh (2018) both found that the preferred way of learning was traditional paper-based methodology.

Al-Azawei and Alowayr (2020) conducted a comparative study looking at motivation and mobile learning in two Middle Eastern countries - Iraq and Saudi Arabia, their study was conducted using a survey with university students studying for computer science degrees and was premised on the assertion that cultural, social and technical factors hinder mobile learning acceptance and the field is still yet to mature. Al-Azawei and Alowayr (2020) assert that blended, online and learning activities need to promote the idea of technological usefulness (as well as a sense of fun) to students, as this is significant for the students to begin using the mobile devices. The research by Shorfuzzaman and Alhussein (2016) also utilises the TAM model to assess students' attitudes to mobile learning, they found that users with high performance expectancy and creativity, view that the mobility of the devices improves their learning experience and they will adapt to the technology more readily than those with opposing views.

Al-Emran, Arpaci and Salloum (2020) conducted a study into the continued use of educational technologies, citing that whilst much work has been done with the 'intention to use' and acceptance of technology in models such as the TAM, there has been little work done in the area of predicting on-going technology use. Through the use of a hybrid model design, they found that when students' expectations of mobile learning are confirmed (for example being fun and easy to use) their performance and satisfaction are enhanced, the researchers further state that 'perceived ease of use' and 'perceived usefulness' have a positive impact on continuous intention to use.

The final paper included in this section is a systematic review on the Technological Acceptance Model conducted by Alsharida, Hammood and Al-Emran (2021) covering 2017 through to 2020. In their review they found that the following had the most impact (in order of importance): self-efficacy, subjective norm, enjoyment, mobile anxiety, facilitating conditions, social influence, innovativeness and finally satisfaction.

The papers in this section demonstrate common themes and findings from research methodologies using TAM and UTAHT as part of the conceptual and methodological frameworks. Throughout the research (not all) on the TAM and UTAHT, we commonly see a hesitancy from students and faculty to fully embrace mobile learning and mobile learning devices and a recommendation coming out from these findings - is for more work to be done on supporting faculty and students to make the transition into using mobile learning devices.

HEIs: Professional Development

Professional development of faculty in the Middle East is a topic that unfortunately, does not appear with much frequency in the literature on mobile learning. One study that does appear and is of importance in relation to my research study is that of Psiropoulos, Barr and Eriksson (2016) where they review the effectiveness of an iPad professional development program during

the first six months of an implementation of the tablet devices in the classroom. Psiropoulos, Barr and Eriksson (2016) use a qualitative approach to evaluating the program, utilising post-session interviews, participant observation, one-to-one interviews and an online discussion forum. The key themes that emerged from the study were: anxiety, having individual needs considered, time considerations and questions about expectations in a mobile learning environment. Recommendations from the study were that faculty should attend collaborative planning and intervention sessions, as well as facilitating authentic professional learning communities, additionally asserting that faculty development needs to be timed in line with the integration of new learning tools and environments.

HEIs: Inquiry-Based Learning

In the study by Albers, Davison and Johnson (2017) they looked at a semester-long assignment utilising Inquiry-Based Learning in a U.A.E. university. The assignment allowed students the autonomy to select the most appropriate mobile learning tools for their project, rather than the tools being dictated by the course lead. The findings showed that the tool of preference was WhatsApp for student collaboration during an Inquiry-Based Learning assignment.

HEIs: Assessment

Atas and Delialioglu's (2018) study explored a question-answer system for mobile devices during lecture-based instruction at a University in Turkey. The students taking part in the study shared with the researchers that the devices used for question and answers (both ways between lecturer and student) improved their feelings of engagement in the class and enhanced their learning experience.

HEIs: Specific Apps

In the 2020 study by Johnson and Williams, they looked at the use of a mobile learning App specifically for the teaching of mathematics in a U.A.E. university. Reporting that after use - there was an 8% increase in the number of students who stated that the mobile device helped make sense of mathematics, however students who did not like the device quoted: that they preferred to use pencil, that paper and calculator were easier to use and mobile learning made learning mathematics more difficult.

English Language is commonly studied in universities in the Middle East and in the 2021 study by Mohamed, it was found that students felt using Apps had a positive impact on their learning in most areas, whereas they found speaking, listening and group discussions using devices less favourable. The study looked at the use of WhatsApp and the google suite of support.

HEIs: Covid-19

The study in the previous section by Mohamed (2021) took place during the Covid-19 pandemic, where the technology needed to replace human interaction during learning. Mohamed's findings - that the interactional aspects of language learning are harder to replace with technology are perhaps not surprising and might be more exaggerated as part of the pandemic effect of less human interaction. Alhumaid, Habes and Salloum (2021) conducted a study at their university in the U.A.E. during the Covid-19 pandemic and found that there was an additional layer of the Technology Acceptance Model, that needed to be addressed when implementing the use of educational technology, which is 'perceived fear', asserting that a student's emotional needs have to be taken into account, especially when implementation of a technology occurs in unexpected or unusual circumstance. It will be interesting to note going forward whether this (almost instant) move to online or mobile learning will have a negative effect on student and teacher perceptions on mobile learning.

Impact of mobile learning on student performance

One study that was of interest is that of Nickerson, Rapanta and Goby (2017) who compare the performance of students: based on whether they had been in a group that experienced the course through mobile learning, a conventional group or a control group. The study suggests that the mobile learning intervention actually leads to improved performance in formal assessments and has a positive impact on learning, this is one of very few studies that looked at mobile learning through its impact on performance in assessments, through a control group design in universities in the Middle East. Another study that used a control group design was Elaish *et al.* (2019) who found that a gaming App for Arab university students learning English, improved their performance and confidence and increased their motivation to learn English. One caveat to the inclusion of this study is that the groups were split into high and low performing students, whereas it might have been more valuable to explore the differences in low performing students using the App and those that did not.

In this section there are a plethora of studies that focus on the TAM and UTAHT models for research into mobile learning in Higher Education Institutions in the Middle East, there are similar findings within these studies regarding 'perceived ease of use' and 'perceived usefulness', which appear to be drivers behind the uptake and continuing use of mobile technologies. The studies that come out from the Middle East appear to concur with the framework overview studies, in that they highlight that there needs to be extensive support with training and workshops, that leads to successful experiences of mobile learning in order to achieve an effective

implementation. The next section will highlight the regional and thematic studies at the school educational level.

K-12 Educational Institutions in the Middle East / GCC / AGCs

As established throughout the literature review there are very few studies that look at the use of iPads / mobile learning in U.A.E. schools, which was the main driver for my research. In surrounding countries we see research into mobile devices beginning to emerge within the literature, however it is still very limited with regards to similarities with my research paper.

In the Saudi Arabian school context we find studies focusing on achievement, impact, integration and engagement, whilst studies into achievement are not as prevalent in iPad / mobile learning research as areas such as TAM and UTAHT, Aldossry (2020) conducted a quasiexperimental design study, looking at the impact of iPad use in tenth-grade mathematics. Aldossry (2020) found the difference between the experimental group and the control group was at a significant level and that the iPad had positively impacted on the performance of the students in a pre and post-test model. Keezhatta and Omar (2019) also looked at the use of mobile assisted language learning, using an experimental and control group and found that there was a significant difference in pre-and post-test performance between the two groups, with the experimental group performing better on the post-test than the control group. Conversely to this pre-post-test model, Al-Bogami and Elyas (2020) found that the use of iPads in ESL/EFL classrooms improved student engagement in a female middle school setting - particularly Apps for reading and vocabulary, this engagement increase was established through self-reported Likert scales and observational data. A study from Kuwait published in 2021 by AlQenaei, Khalil and Aldekheel, brings a wider scale review of a government initiative to incorporate tablet computers into highschool education in the 2015-2016 academic year, their research was initiated due to circulation of evidence, that the initiative was not progressing or achieving its goals and the researchers wished to explore the accuracy of this evidence, including the possible factors affecting the project. The findings of their research highlighted that teacher efficacy was a key factor in the project and of particular note, is the assertion that:

> it is difficult to adopt information technology into teaching where there is inadequate awareness of the role of technology in e-learning, a lack of content modules fit for information technology-assisted teaching, poor Internet connections, a lack of technical support, and a lack of adequate professional and technical training (AlQenaei, Khalil and Aldekheel, 2021, p. 529).

In consideration of the research from the Higher Education sector together with the research conducted in schools from across the Arab States, we find similar themes - that teacher self-efficacy is paramount and that technological adoption and integration is a multi-faceted endeavour that requires considerable planning in its inception and implementation.

Research from further afield

In order to explore outside of the geographical scope of this research study and in order to keep this succinct, web of science was again utilised with a search term of 'iPad review', years 2015-2021 and then further refined to educational research. The search returned a few key research studies under the given criteria that are of relevance to my study and the key themes and ideas from these reviews will be outlined in this section.

In 2016 Hassler, Major and Hennessy conducted a review of tablet use in schools, specifically looking at the evidence of impact on learning outcomes, they found that the majority of the studies in their review reported a positive impact on student learning outcomes and the affordances of the tablet were a significant factor. Conversely the systematic review by Boon, Boon and Bartle (2021) found that the use of the iPad in classrooms had not consistently improved educational outcomes, with some of the studies in the review indicating that teachers were not utilising the technology in the most effective ways.

In a Higher Education setting Nguyen, Barton and Nguyen (2015) conducted a review of iPads in order to explore how they had been adopted within the sector, they reported that from a student perspective - iPads enhanced their experience of learning, but did not automatically lead to better learning outcomes. Faculty and staff reported that the benefits of the iPads included improvements in electronic information dissemination, administration and supported with professional development. Students and faculty reported being eager to adopt the technology acknowledging the potential benefits, however neither were clear how best to integrate the technology with the course content and administration.

A study by Stevenson, Hedberg and Gordon (2017) on Apps in K-12 and Higher Education endeavoured to focus on more pedagogically driven uses of tablet computers and they advocate the ideas of 'device agnosticism' and 'App smashing' in order to provide a framework or concept overview, that allows for an ever-increasing amount of tools, platforms and ecosystems. In addition they advocate an approach of designing a learning task, that is independent of the technology in order to address issues of accessibility (lower income students having less access than higher income students) and allow students to develop their digital skills by using multiple Apps in personalised and collaborative learning environments.

2.4.2 Using tablets in the classroom: Factors of Influence

Historically computing was originally reserved for the military, government and industry, however its capacity for usage and application in other sectors has exploded exponentially relating to Moore's Law (Gustafson, 2011) which is the principle that processing power of computing will double every two years, thus increasing accessibility through application and cost. The use of technology in education especially has been through many incarnations, from overhead projectors through to Web 2.0 device connectivity. Since the release of the first mobile phone in 1983 by Motorola, a plethora of devices have been released by telecommunications giants, which at their heart aimed to keep people connected whilst mobile. This mobility was facilitated firstly through the mobile phone networks and then through providing mobile data, which is now heading towards its latest incarnation in the form of 5G, which will be able to deliver speeds of 10gbps when established. Mobile devices exist in multiple forms, from portable laptops to telephones of various sizes and functions and tablet devices capable of connecting to the internet, in addition to this we now have wearable technology such as smartwatches and head-mounted displays. Each incarnation of technology comes with it the question - how will it be applied to education.

Educational technology has been through many iterations and will continue to do so all the time that technological innovation takes place, this study focuses on the use of tablets in the classroom as opposed to including other types of mobile devices. Whilst there were earlier versions of a tablet computer such as the Palm Pilot, it was the Apple iPod touch followed by the Apple iPad released in 2010, that brought hand-held portable computing into schools, since then several tablets have been released by soft/hardware companies including the Samsung Galaxy Tab and the HP Touchpad for example.

The choice by schools to utilise tablets in the classroom may revolve around the affordances offered by the devices, these affordances are highlighted by Falloon and Khoo (2014) for the iPad as being: touch-display, portability, connectivity, large array of Apps, lay flat or propped up at a convenient angle, wide viewing range, multi-user accessible interface, promote learner collaboration (more capable than laptops and desktops) and accessible built-in keyboard. However, these features do exist on other tablets and most affordances are generalisable across other devices that are available. Portability (sometimes referred to mobility) is seen as an important aspect of the device and referring to Cook (2009) and Sharples (2010), the phase of the 'mobility of the learner' is significant when looking at tablets, as it is identified in research as being a major factor in the use of the tablets, and Bogdanovic *et al.* (2014, p. 232) describe mobility as 'a new opportunity for education in which personalisation, collaboration, and social connectivity are enhanced both within and away from a formal learning environment', this also

aligns once more to the idea of the 'Mobigital Virtual Space' we are all beginning to inhabit.

The affordances of the tablet selected and corresponding professional development support, can have an impact on the nature of the pedagogy developed with each school and subject setting. Schools have been encouraged to introduce these as tools for learning into their classrooms, professional development and recognition of status and expertise provided by the associated 'tech giants', have been put into place in order to support those schools who choose to do so. Examples of these are Apple's ADEs (Apple Distinguished Educator), Microsoft's MIE and MIEE (Microsoft Innovative Educator / Expert) and Google's Certified Educator, some even provide exams for practitioners to take, such as the MCE – Microsoft Certified Educator series, these are put in place to encourage the use of certain devices and software and can have implications on the school's choice of device and digital implementation strategy.

In summary from the literature introduced in the research rationale and this section, we can discern that more needs to be done in the research paradigm of mobile learning to increase the evidence base of good practice. Technology affords digital pedagogical practice and it is important to observe the pedagogy that emerges from the affordances. However, there is an establishment of 21st Century learning pedagogical paradigms, such as the 'Partnering' extolled by Prensky and the 'Learning Stories' of the CCL project, that are explored through the literature which stipulate some assumed pedagogies of practice.

2.5 Education Models that align with tablet use

Outlined in the introduction, one of the elements of educational technology use is the application of models associated with technology 'roll-out' and integration. In consideration of 'approaches to pedagogy' and tablet use, you have the *Native / Immigrant* which is superseded by the evolution of the idea that we are in actual fact *Residents / Visitors* into the 'mobigital' space. Within the 'approaches to pedagogy' we have the views of pedagogical practice, which are contained in the *SAMR* and *TPACK* models, which by their influential nature move through into the 'factors of influence' of using tablets in a particular way. Alongside the 'approaches to pedagogy' and the 'factors of influence' are models of implementation, which are the *TAM* and *Roger's Diffusion of Innovation (RDI)* and have exploratory, as well as explanatory influence on the 'roll-out' and integration process as a whole. Each of these models is discussed in subsequent sections, however we need to note that within the findings there was either explicit or implicit reference to various models, some models are described in the findings as being used implicitly, as the functioning of the models could be seen in the data, however they were not explicitly referred to, this was particular in the case of Roger's Diffusion of Innovation (1962).

The following section will start with the *Native / Immigrant* and *Resident / Visitor*, followed by the implementation models *TAM* and *RDI* and finally the pedagogical view of the *SAMR* and *TPACK* models.

Native / Immigrant and Resident / Visitor

It has been 20 years since Marc Prensky (2001) first brought the concept of digital natives and digital immigrants into the discussion around educational technology. In 'On the Horizon' in 2001 he talked about how students in the U.S. were the first generation to be in education who had spent their lives immersed in a digital world, this world involved computers, video gaming, digital music, video cams and mobile phones. Prensky believes that due to the ubiquity of this digital arena, that students 'think and process information fundamentally differently' – something which has been critiqued profusely (McKenzie, 2007; Waycott et al., 2010). The term 'digital natives' was born from his assertion that students are 'native speakers' of the digital language inherent in the digital world. The immigrants to this world are those who still retain the analogue 'accent' of their past and adapt to the new environment in varying degrees. So the question is why is this such an important aspect to consider when looking at technology and education, the answer that Prensky gives us, is that 'immigrant' teachers are educating 'natives' with varying degrees of pre-tech 'accent' and this acts as a serious barrier to students' progression, however regardless of the arguments over the distinctions Prensky gives the two generations, this could be considered a significant issue to overcome and it links to the same issues discussed when considering a teachers' 'deep grammar'.

In contrast to this, White (2019) has a different view of the opposing dynamics, his view is that we exist on a continuum, this continuum is that of a visitor mode and a resident mode, these are defined below and can be seen in figure 1:

> When in visitor mode, individuals have a defined goal or task and select an appropriate online tool to meet their needs. There is very little in terms of social visibility or trace when online in visitor mode...When in resident mode the individual is going online to connect to, or to be with, other people. This mode is about social presence. (White, 2019)



Figure 1: Resident Visitor Model (White and Le Cornu, 2011)

The difference between Prensky's model and White's model is the demarcations are not made by age, but by usage (White and Le Cornu, 2011) despite these models not directly being used in this study, it must be kept in mind when considering teacher attitude and usage of the device when using tablets. These models are discussed in this literature review as there needs to be an awareness of the different arguments surrounding the 'profile' of the teacher, as well as the student in the digital age. The debate - as to whether the contemporary digital age student should be considered different to those born in the generation previously and which side of the debate someone sits, can affect the approach towards which educational technology is implemented; for example, those ascribing to the idea that the 'digital native' exists, may not address the need to teach digital literacy skills as thoroughly as those who do not ascribe to the digital native theory, as they believe that there is an innate ability to perform certain technology functions in the educational arena. Kirschner and De Bruyckere (2017) highlight this debate in their discussion around the myth of the digital native and multitasker, where they argue that digital natives do not exist, citing several research studies that argue that students born in the digital age, are no more digitally literate than those born before, whilst the debate between digital natives and digital residents continues, Joy et al. (2014) believe that the students' need for ubiquitous use of technology is also a matter for consideration. The usage of the mobile technologies outside of the classroom i.e. for gaming, communicating, social media and the skills and knowledge required, may not necessarily align with the know-how that is needed in an educational domain, rather than a personal one. Furthermore, Gurung and Rutledge (2014) in their research make the distinction between the educational and personal domains of the use of technology by the 'digital native', they also found that the personal engagement involved an individualised set of activities.

Joy et al. (2014) and Gurung and Rutledge (2014) demonstrate that the student capability

or digital literacy, varies greatly upon context of usage and the two sides do not necessarily translate over. Considering this, an aspect of perceived student capability, whether native, resident / visitor, personal / educational, may affect the roll-out of a technology implementation in a school and therefore may need to be addressed (as with the needs of the teaching and support staff). The scope of this study did not allow for this to be addressed in this research; however it would be a valuable variable for future study.

Implementation: TAM (Technology Acceptance Model)

The technology acceptance model (TAM) has emerged from IS (information systems) research and had roots in Fishbein and Ajzen's (1975, quoted in Davis, 1989) Theory of Reasoned Action (TRA) which was deemed able to study many aspects of human behaviour (Davis, 1989). In the original inception Davis (1986) utilised the social/psychological aspects of the theory and applied them to the evaluation process of integration of technology into business practices. The TAM model was then tested against the original TRA by Davis (1989) the results led to conclusions of a causal nature, in that they assert that the behavioural intention (BI), the perceived usefulness (PU) and the perceived ease of use (PEOU) were the determining factors in the causal outcome. The original exploratory/confirmatory factor analysis conducted by Davis (1986) confirmed, that only the perceived usefulness and perceived ease of use were factors. Thus the TAM was further developed into the causal chart below (see figure 2).



Figure 2: TAM (Technological Acceptance Model) adapted from Davis (1989)

Further iterations of the TAM have been proposed by Venkatesh *et al.* (2003) who outline a remodelling of the TAM into the UTAUT (Unified Theory of Acceptance and Use of Technology model) that includes the input from eight other models, their findings assert that the UTAUT model outperformed all other models, including the original TAM as it explained 70% of the

variance in regard to user intention, with the original TAM accounting for 63% (Davis, 1986). The additional variables that the UTAUT applied were: performance expectancy, effort expectancy, social influence and facilitating conditions and were found by Birch and Irvine (2009) during a regression analysis, to prove that 27% of the variance came from the performance expectance variable, perhaps highlighting the need for proper training and continually reflective practices for educational technology devices and their implementation in the classroom.

The study by Yuen and Ma (2008, p. 229) found that perceived ease of use (PEOU) was the sole determiner when it came to prediction of intended use, furthermore perceived usefulness (PU) was found to be significant as a determinant of intended use, they found that overall 'subjective norm, computer self-efficacy and perceived ease of us were able to explain 68% of the variance observed in users' intention to use the e-learning system'. Further to this Scherer, Siddig and Tondeur (2019) in their meta-analysis of TAM use, also found that perceived usefulness was more indicative of behavioural intentions than perceived ease of use, and they advocate that this needs to form part of teacher training and professional development. An interesting concept raised by their research is teachers past experience and use of technology as a predictor of use, if scope allowed it would have been an interesting variable to add to my research. Teo and Schaik (2009, p. 1) found that all the models they evaluated shared the same 'explanatory power' and were all indicative of 'attitude' as being the most important factor of educational technology usage. The illumination of 'attitude' as being the most important factor in educational technology uptake, connects us back to the overarching research by Fullan (2011) as already stipulated, where he states that intrinsic motivation must be aligned to goals. In this case the goal is educational technology usage in the classroom and the intrinsic motivation is equal to the attitude that the teacher holds and displays. Lim and Chai (2008) assert that issues with educational technology are apparent from policy through to district and classroom level and in their study acted as both enabler and constrainer. Teo (2008) uses the TAM and applies further variables to the scale. In his study he found that positive pre-service attitudes to computers and I.T. were indicative of positive use whilst training and that during that time the teachers had developed more strategies for use.

Having looked at the factors that influence teachers take up of educational technology in the classroom before they commenced training, I would like to look briefly at factors that affect teachers already within the profession. In the review of the literature conducted by Mumtaz (2000) she highlights that the issues are with instruction, the resources and the teacher, she argues that an institution gives little to the teachers to support ICT use in the classroom with regards to providing time and training. Furthermore, limited resources are a major inhibitor of ICT integration and are down to individual school control. Finally, she argues that the teachers were

moved by their inherent beliefs in the way their subject should be taught and there were doubts about the skills required in using the ICT.

In acknowledgment of the reluctance of some members of the teaching profession to engage with educational technology, Arbelaiz and Gorospe (2009) attempt to address the issue of 'grammar and deep structure' as discussed earlier, by raising it to a conscious level enough for a discourse to take place around its meaning, this is achieved by the use of ICT as a 'disrupting' factor in that it disrupts the discourse of the grammar and deep structure and allows this disruption to become the first step on the path to reform. In consideration of this Hoong *et al.* (2017) found that teachers were more likely to accept and integrate technology relevant to the TAM model if they (the teachers) considered themselves competent in the domains of TPACK which will be discussed in a subsequent section.

Implementation: Roger's Diffusion of Innovation Theory

The Diffusion of Innovations (Rogers, 1962) exists as a model and a theory that attempts to show the way in which ideas or technology spread throughout the communities relevant to the innovation. The theory is designed to explain the rate of spread and how and why it occurs:

- Diffusion how an innovation spreads in a social system
- Adoption process of the individual from awareness to adoption

Professor Rogers (1962) suggests that there are four aspects that can influence the uptake of any new innovation: the innovation, communication channels, time and social system. Rogers stipulates that human capital is hugely influential on the process; as well as stating that the innovation should be widely adopted to ensure a self-sustaining system. There are five categories of people in the model: innovators, early adopters, early majority, late majority and laggards, all of whom take on the innovation in question at various stages until critical mass / saturation are achieved (See figure 3). Additional roles are: gatekeepers, opinion leaders (within each community) and those who initially bring the innovations.



Figure 3: Diffusion of Innovation Model (Rogers, 1962)

Innovations can of course be unsuccessful and this is a failed diffusion, this can be caused by: weakness in the innovation, competition, lack of awareness, rigidity of networks, no local / community involvement, degrees of homophily and heterophily. Therefore, there are a lot of influencing factors that affect diffusion and adoption. In relating all of this to an educational perspective and the use of tablets in the classroom, we can see the pathway within this theory that should enable tablets to be adopted within the classroom successfully, however many of the components of a failed diffusion exist within education systems and unless explicitly addressed could be precursor to failure (See table 1 below).

Weakness in the innovation	Tablets are not specifically designed for education,
	Infrastructure issues, device management issues and
	traditional ubiquitous IT features are not useable.
Competition	Several types of tablets on the market all offering different
	ecosystems, this affects things such as function and flow.
Lack of awareness	
Rigidity of networks	Inflexible Curriculum and Assessment – National and
	International.
No local / community	
involvement	

Degrees of homophily and	Teachers of such diverse experience both professionally and
heterophily	personally may result in high levels of heterophily resulting in
	poor diffusion.

Table 1: Issues affection diffusion of innovation

In addition to this: communication channels, time and the social system within education, affects the implementation and may be a significant barrier due to the heterogenous nature of schools and education systems.

SAMR

The SAMR model identifies how an emerging technology is being applied within a classroom as compared with traditional strategies and pedagogical practices. It is a framework for evaluating teaching practice, designed by Dr Ruben Puentedura (2009), it has been used ubiquitously across educational technology implementations and is utilised by Apple as a model for evaluating iPad use in the classroom, and also as a guide for practitioners using Apple products, therefore it has become the model that most practitioners / teachers are familiar with in the U.A.E. where iPads are the main tablet used in schools.

There are four parts to the SAMR model which fall into two classifications; enhancement and transformation and this can be seen in the model below (See figure 4).



Figure 4: SAMR Model (Puentedura, 2009)

The classification within the SAMR model acts as a guide for teachers or practitioners, to be able to evaluate or assess the tasks they are designing when planning activities with the tablets and when the activities have been completed. A description of each of the parts of the model is in figure 4 above. Substitution and augmentation are viewed as only enhancements to practice, however it is questionable if direct substitution can be described as an enhancement to the learning. Modification and redefinition are described as transformative to the learning process, although in effect, activities and processes may span all four parts of the model. Romrell, Kidder and Wood (2014, p. 12) discuss mobile learning or m-learning as being personalised, situated and connected and argue that 'The use of the SAMR framework can assist in decision making when evaluating potential instructional designs that use mobile technologies'.

In the tablet / App based lesson, teachers are encouraged within the SAMR model to produce a flows and ladders learning journey for the students to follow, this involves moving from one App to the next in order to create a learning journey that ultimately culminates in the 'creation' of an outcome, this outcome is ideally achieved in the redefinition stage, reaching a place in the learning that could not exist without the usage of the emerging technology, this creation aligns the outcome with the HOTS (Higher Order Thinking Skills) associated with Blooms Taxonomy of learning (Krathwohl, 2002). However, as with Blooms taxonomy (Bokhove and Campbell, 2020) the SAMR model should not be seen as a ladder, because as with everything in teaching and learning, every pedagogy has its place and should be used where most appropriate.

ТРАСК

Technological Pedagogical Content Knowledge (TPACK) – Underlying truly meaningful and deeply skilled teaching with technology, TPACK is different from knowledge of all three concepts individually. Instead, TPACK is the basis of effective teaching with technology, requiring an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones. (Koehler and Mishra, 2009).



Figure 5: TPACK Model (Mishra and Koehler, 2006)

The TPACK framework (see figure 5) developed by Mishra and Koehler (2006) is an amalgamation of the differing aspects that work together when teachers develop their use of technology in the classroom (Baran *et al.*, 2017). TPACK acts as a guide as well as an evaluation tool, Mishra and Koehler (2006) state that there exists a 'nuanced' and complex blend in the three parts of the model: Technology, Content and Pedagogy, and it is because of this fluid aspect that researchers are moving more towards using TPACK as a model for exploring technological integration and utilising various methods to do so (Baran *et al.*, 2017).

On his personal webpage Koehler (2012) succinctly explains the complexity around why this area of research is so nuanced, which perhaps explains why there is the dearth of research around the topic:

Effective technology integration for pedagogy around specific subject matter requires developing sensitivity to the dynamic, transactional relationship between these components of knowledge situated in unique contexts. Individual teachers, gradelevel, school-specific factors, demographics, culture, and other factors ensure that every situation is unique, and no single combination of content, technology, and pedagogy will apply for every teacher, every course, or every view of teaching. (Koehler, 2012) Considering each of these factors it could easily become an unwieldly set of dynamics, so providing focus for each of these aspects is important for the parameters of the research. The TPACK Model with its focus on content and pedagogy, most closely aligns to the teaching and learning domain within which my research is situated and therefore is the model chosen to provide a lens and focus for the research. Additionally, as this research study is exploring pedagogy the TPACK model helps provide the narrow beam onto the pedagogical aspect of the model that fits with the limited scope of this research. The pedagogical aspect of the model helps to underpin the exploration whilst not becoming a limiting factor as the model is broad in scope.

In summary the natives and immigrants' idea (Prensky, 2010) has proved to be too dichotomous and as per White and Le Cornu (2011) - we are all characterised by our digital usage as visitors or maintaining residency. In addition we see from research surrounding the Technological Acceptance Model (Venkatesh *et al.*, 2003) the perceived ease of use and perceived usefulness are key significant factors in introducing technology. The uptake of tablet use either by individuals or organisations may align with the curve advocated by the Diffusion of Innovation model (Rogers, 1962). The SAMR model (Romrell, Kidder and Wood, 2014) helps to classify types of digital activities, however it is the TPACK model by Mishra and Koehler (2006) that more fully supports the conceptual and therefore pedagogical use of tablets.

2.6 The Research Aims and Questions

Across the course of the literature review we have looked at several concepts that revolve around educational change, under the overarching idea of why technology integration has not had the same effect in education as it does in other areas of the 4.0 evolution. The first being the idea of teachers as central agents in the process of educational change. The second set of ideas discussed the pedagogical approaches of tablet use in the classroom, including influencing factors. The third area considered some of the models of explanation or practice that are utilised during the roll-out of an educational technology integration.

From the literature review we see that teachers can be considered central to the change process and with the concept that a teacher's deep grammar, regarding their pedagogical practice is difficult to influence or change, the first question set out for this research is **'Has the pedagogy used in the U.A.E. G6-12 classrooms in government and private schools changed with the use of tablets?'** this question looks to see if using tablets has changed pedagogical practice amongst teachers, based on the ideas in the literature review that pedagogical practice has to adapt / change in order for the tablet use to be successfully integrated.

In the second set of ideas in the literature review of how and why the tablets are used in the classroom, including what potential influences exist, we can see that teachers are being

steered towards or using the tablets in a particular pedagogical style, these styles mainly come from the descriptions of Prensky's Partnering (Prensky, 2010) classifications and from longitudinal studies, such as the CCL project (CCL, 2015) both of which advocate student-centred, personalised and collaborative learning activities. The question of how tablets are used falls under the first question, where teachers are asked about how they use the tablets and if this use is based on a different way of teaching to their pedagogy without tablet use. The 'why' of the tablet use and influencing factors falls under the second question in this research, which is **'What are the influencing factors on the pedagogy of tablet use in this context?'** this is important to explore as it can potentially give insight into how a teacher's pedagogical deep grammar may be influenced, also their reasons for adopting the technology in the way they do. One factor in the second question that arose from the literature review, is the idea of school and social capital influencing the 'why' and 'how' of tablet use, these ideas of school capital revolve around: trust, communication, beliefs, collaboration, access to expertise and how this can impact on how the teacher's lived experience within the school.

The literature review also looked at the models of use and through some of these models we can also frame our questions, for example the SAMR and TPACK models, that institutions and teachers use to help guide their professional practice with the technology, are part of the 'how' teachers use the technology. For the 'why' we look at teacher's attitudes towards (and value of) the technology with the TAM framework and also take into consideration the Diffusion of Innovation model, that we can compare against for the adoption patterns within educational settings.

In order to answer the two research questions, a lens of a 'teacher's lived experience' is adopted and the teacher is placed at the heart of the process. The idea of teacher identity and pedagogical grammar becomes part of the framework of questions and are explored both inductively and deductively as part of the data collection and analysis. In the following methodology we will see the development of this focal lens into the design of the tools, through which access to this lived experience of the teacher (in relation to the use of tablets in the classroom) is viewed.

Chapter 3: Methodology

3.1 Overview

In the literature review, educational change through the lens of teachers as central change agents was outlined. The review provided a frame of the 'how' and 'why' of tablet use in U.A.E. classrooms, this included: key elements such as placing teachers at the centre of the change (and therefore the research process), pre and in-service teacher training and models of technology use. The concepts from the literature review are investigated through their inclusion in the data collection methodology. Firstly, deductively through the construction of the data collection tools. Secondarily, through a complementary inductive approach taken at the data analysis stage, where elements of a grounded theory approach are utilised to explore additional themes that emerge from the data.

This methodology section describes a framework for exploring the research questions as set out previously 'Has the pedagogy used in the U.A.E. G6-12 classrooms in government and private schools changed with the use of tablets?', and 'What are the influencing factors on the pedagogy of tablet use in this context?'. Using the lens of teachers as central agents of change, this research places them as the focal point of the study. Placing teachers centrally, the research seeks to understand the multiple facets of a teachers experience of using tablets in the classroom, which further includes teachers' attitudes towards and value of the technology. In question one the research looks to understand how teachers use the tablets by discerning changes in pedagogy, before and after the use of the tablets. The research explores decisions that impact on the teachers use of tablets, which are designated as influencing factors in question two. This methodology utilises three data collection tools within a mixed methodology approach, these three tools are: an online questionnaire, interviews and classroom observation. In order to gain a wider perspective, people responsible for tablet integration programs in schools were also interviewed. The design of the tools, data collection and analysis, utilises elements of a grounded approach to allow for findings to emerge (inductive), alongside the data which is based in the parameters of the framework from the literature review (deductive). The subsequent sections of this methodology chapter will begin with discussion of the research paradigm and approach, along with the methods of data analysis in the research design. Each of the data collection tools are then presented, followed by a discussion of the data analysis process. The chapter concludes with a section on the ethics of this research.

3.2 The pragmatic approach and a mixed methodology

The research approach within which this thesis is situated is that of pragmatism. According to Cameron (2011, p. 101) 'Pragmatism in its simplest sense is a practical approach to a problem' and further asserts that pragmatism may be considered as a bridging point between 'paradigm and methodology'. Furthermore Saunders, Lewis and Thornhill (2012) assert that in the pragmatist approach there are differing ways of interpreting the world and one viewpoint cannot show the whole picture. Pragmatism has emerged as a paradigm, that offers a middling position both in philosophical terms as well methodological (Johnson, Onwuegbuzie and Turner, 2007) and is emerging as a methodological paradigm that supports the use of mixed methods, alongside and equal to the purely quantitative or qualitative methodological paradigms (Johnson and Gray, 2010).

According to Cameron (2011) along with Creswell and Plano Clark (2007) the pragmatic paradigm is closely associated with utilising a mixed methods approach. Bryman (2012) asserts that a mixed methodology exists within the pragmatic paradigm, meaning that all methodologies are available to the researcher to enable methodological choice, that is driven by the needs of the question (Brannen, 2005). Therefore, this mixed methods approach was selected for the purpose of this research thesis as it is based on the needs of the questions and the subjects being explored. Additionally, this thesis follows the centrality of the premise outlined by Creswell and Plano Clark (2007), that a combination of quantitative and qualitative methods allows for a deeper understanding of the research, rather than using a single approach and it rejects an eitheror approach to paradigmatic choice (Teddlie and Tashakkori, 2010). According to Feilzer (2010, p. 8) rejecting this either-or approach moves the research away from 'contentious issues of truth and reality'. Additionally, by selecting a pragmatic approach the research can focus on the research problem (Tashakkori and Teddlie, 2003) and not on exacting and restricting alignments of paradigm.

According to Lai's review (2020, p. 730) of the most cited educational technology research papers, only 16% of those papers utilised a mixed methods approach, placing the approach as equal to nonexperimental and analytical, with the most common being experimental at 45%. However, it is unclear as to why only 16% of these papers used a mixed methodological approach in the research, so therefore it is difficult to draw inference from this statistic. Utilising a mixed methods approach in this research supports contributions to broadening the research field approach to educational technology.

3.3 The mixed methods selected for solving the research problem

Continuing from the previous section, the methods selected needed to align with the intentions of the research questions in the study (Brannen, 2005). The methodology has been established as a mixed methods approach within the pragmatic paradigm, this section will discuss the selection of methods by which the data was collected in order to address the research questions.

The methods selected will be discussed in detail in the subsequent sections, these are: an online questionnaire, interviews and observations. The design of these instruments was supported by the deductively led construction, based on the literature review and the intention to further use inductive methods of data analysis from the same data collection methods, by the integration of a grounded theory approach, this grounded theory approach will be discussed in the subsequent section.

The methods that were selected as part of the mixed methods approach were guided by the needs and intentions of the research question (Brannen, 2005). A research design was used that was predominantly qualitative with thematic coding as the method of data analysis. The qualitative analysis of the extended and contextual online questionnaire answers, as well as the interview and the observational data, revolved around the need for the data to provide a rich and detailed look at human behaviour, that is based on the meanings that are created by the participant (Creswell and Plano Clark, 2007). However, a quantitative approach using descriptive statistical analysis was also included through the 'selection of answers' in the online questionnaire, this decision was taken as the online questionnaire allowed for a larger number of participants from differing educational establishments in the U.A.E. than the interviews and observations would have afforded based on the limited scope of this research.

The table below (Table 2) shows the links between the research questions and the method selected to address them.

Research question one RQ1: Has the pedagogy used in the U.A.E. G6-12 classrooms in government and private schools changed with the use of tablets?

Research question two RQ2: What are the influencing factors on the pedagogy of tablet use in this context?

RQ	Method	Approach
RQ1	Online	Analysis of answer selection questions through descriptive
	questionnaire	statistics looking for evidence of change.
	Sections 3.4.1-4	
RQ1	Online	Analysis of long self-reported answers through thematic analytical
	questionnaire	coding looking for extended and context answers surrounding
	Sections 3.4.1-4,	practice and change. Includes an inductive grounded theory
	3.3.1	approach.
RQ1	Interview	Analysis of long self-reported answers through thematic analytical
	Sections 3.4.5-9,	coding looking at the discussions of practice and change. Includes
	3.3.1	an inductive grounded theory approach.
RQ1	Observation	Analysis of observed tasks looking at practice.
	Sections 3.4.10-12	
RQ2	Online	Analysis of answer selection questions through descriptive
	questionnaire	statistics, looking for influence factors on tablet use.
RQ2	Online	Analysis of long self-reported answers through thematic analytical
	questionnaire	coding, looking for extended and context answers surrounding
	Sections 3.4.1-4,	influencing factors on tablet use. Includes an inductive grounded
	3.3.1	theory approach.
RQ2	Interview	Analysis of long self-reported answers through thematic analytical
	Sections 3.4.5-9,	coding, looking for extended and context answers, surrounding
	3.3.1	influencing factors on tablet use. Includes an inductive grounded
		theory approach.

Table 2: Links between the research questions and the method selected to address them

The first research question asks if pedagogy has changed in the classroom with the use of tablets, seeking to explore if a change has taken place by establishing categories or binary descriptors of change, that are underpinned by realism (Brannen, 2005) and the quantitative paradigm in the 'selection of answer' questions in the online questionnaire. It is this categorisation of change that influenced the choice of using an online questionnaire and shaped the online questionnaire questions for analysis through descriptive statistics. The qualitative analysis of the extended and contextual answers in the online questionnaire and the responses to the interview questions, were underpinned by the needs to question, uncover and describe the

human experience (Myers, 2000) of the teachers using tablets in the classroom. The lesson observations look at how the tablets are used, they do not offer insight into the change between pre and post-tablet use and were triangulatory or 'corroborative logic' (Mason, 2006) for data coming from the questionnaire and interviews, additionally forming their own source of observationally and qualitatively acquired data.

The second question about why tablets are used the way they are is driven by interpretivism (Brannen, 2005) and the qualitative research paradigm as it seeks to explore the influences, relationships and interactions within the data. In conjunction with a grounded theory approach, question two was shaped by the use of interviews and extended long answers on the online questionnaire, to look deeper into the self-reported personal experience of the teachers and attempt to establish connections or commonalities of understanding.

To draw this section together, the methodology of this research places the researcher as a passionate participant within the world being investigated and places them as an insider to the process (Weiner-Levy and Queder, 2012). An advantage of being an insider in the small educational technology community in the U.A.E. meant easier access to data sources such as teachers and program coordinators, where additional data was able to be collected through interpersonal relationships (Mercer, 2007). Positioning teachers and their experiences as a core tenet of this research, a mixed methods approach was adopted, as these experiences and the relationships between the variables cannot be explored through the purely quantitative approach (Silverman, 2006).

3.3.1 Utilising aspects of Grounded Theory

In their book, *The Discovery of Grounded Theory*, Glaser and Straus (1967) established a new process of extracting and generating theory from empirical data, which could be considered as a major contributor 'to the acceptance of the legitimacy of qualitative methods in applied social research' (Thomas and James, 2006 p. 767). Grounded Theory has subsequently been utilised in many research settings and is highly regarded as a tool for analysis of social systems especially in education (Thomas and James, 2006; Miller and Fredericks, 1999).

Grounded Theory is critiqued regarding its overall legitimacy as a research approach (Thomas and James, 2006) and according to Charmaz (2008) Grounded Theory at its initial inception was embedded in 'objectivist' and 'positivist' paradigms, however she reimagined/interpreted it in a 'constructivist' version of methodology design, which she asserts takes a middle-ground between the two paradigms (Charmaz, 2000). It is this middle-ground constructivist approach that is used to underpin the partial use of Grounded Theory in this research, as it utilises a relativist approach and acknowledges the multiple realities of those taking part in the research (Charmaz, 2000) this aligns with the middling ground of the pragmatic paradigm within which this research is situated.

In the literature review multiple ways of using tablets in the classroom were discussed (within the limited scope of this research thesis). It is the numerous uses in multiple scenarios and differing influencing factors, that underpinned the choice to include elements of a grounded theory approach, these disparate scenarios led to choosing an inductive approach to data collection to complement the deductive structured process. There are further reasons for selecting this approach, Denscombe (2010) says: it is suited to small scale research, a recognised rationale for qualitative research, adaptable, pragmatic, a systematic way of analysing the data, that data analysis can draw on computer software, is it useful for theory development, explanations are grounded in reality and it is well suited to the exploratory research. Disadvantages include: planning, context, open-mindedness, complexity, positivism, empiricism and generalisations, which are ameliorated through the interpretivist use of Grounded Theory. Further to this, Grounded Theory was selected as an approach to data collection and analysis, as it endeavours to find relationships between data and the social processes that occur in the field setting of the research (Charmaz, 2008).

The elements of Grounded Theory that are utilised in this study were: the starting point of the research from a general question, non-probability sampling (known as theoretical sampling in Grounded Theory), coding that allowed concepts to emerge from the data, constant comparative analysis and saturation reached as far as possible, within the constraints of the size of the thesis and with access to participants who met the research criteria (Birks and Mills, 2015), these are some of the core research analysis methods which must be used in order for the research to be seen as a part of the Grounded Theory paradigm (Birks and Mills, 2015). Grounded Theory requires no alignment to previous concepts and theories (Cohen, Manion and Morrison, 2011) until the data collection stage is well underway, this means that the literature review acts as a frame around the initial data collection, it informed the construction of the online questionnaire and interview questions and supported the facilitation of an inductive process at the data analysis stage, this is particularly relevant as when the literature review was complete there were few studies of a similar nature to this research project.

The use of mixed methods in this research was based on a simultaneous design (Brannen, 2005) with the interviews carried out over the same time period as the online questionnaire was available, this period of many months enabled the coding and constant comparison required by the grounded theory approach (Birks and Mills, 2015), this 'integrative logic' approach (Mason, 2009) acknowledges the link between the two research questions allowing for the interplay between the two to emerge, through the process of analysis and enabling interpretations as to the dominance of influential factors.

In summary, the choice to use elements of grounded theory and not the full process is due to the intention to explore all elements and present them in a way that they become useful data for practitioners, who wish to implement technology integrations into their institutions or classrooms. It is not to construct a full theory of technology use and influences. The subsequent sections discuss each data collection method by outlining the design through description and justification, instrument design, piloting and sampling.

3.3.2 Online questionnaire: Description and Justification

To address the first research question an internet online questionnaire was selected, as according to Denscombe (2010) there are four main advantages to utilising online questionnaire strategies: a focus on empirical data, collection of both quantitative and qualitative data, wide and inclusive coverage and savings in costs and time, these address the needs of the research questions in that there are: binary aspects to the questions, there is a need for elaboration and justification (qualitative) on some of the questions and there are many teachers across a wide range of institutions to be reached. The restraints of the research itself in cost (self-funded), size (EdD thesis) and time also suited the simplicity of the internet online questionnaire.

Considering the varied contexts and large number of people that the data could be drawn from, the internet online questionnaire was the strategy that was chosen to obtain this data, regarding time and size constraints of this research a less complex single mode online questionnaire was chosen over a mixed mode online questionnaire, before creating the online questionnaire I undertook the restore/NCRM self-study online research methods course and utilised the knowledge gained on the course to develop the content and construction of the online questionnaire. The choice of the internet as the online questionnaire tool is supported by Denscombe (2010) when he states that the data collected via the internet does not differ significantly from data collected from another source, this is significant due to the impracticalities of using other types of questionnaires as outlined below.

The option of using a postal questionnaire as the data collection strategy was not possible, as the U.A.E. does not have a postal service that is equivalent to the postal service in the U.K. this strategy was also not viable due to cost, as this is personally funded research and not sponsored or subsidised. Telephone questionnaires are not viable for similar reasons as there is a significant financial cost involved. Group administered questionnaires are less feasible as the questionnaire group is dispersed geographically and the same applies to the use of face-to-face questionnaires.

However, as Lefever, Dal and Matthiasdottir (2007) assert, the online questionnaire may not be as appealing as it once was due to saturation as a methodology, therefore the encouragement of the teachers to participate needed to be robust in its design and

implementation. For the private schools, contact was established with the educational technology leaders in the chain schools (who were also approached for interview) for permission to question the teachers within their schools. For the independent private schools, contact was made with the representatives known to be responsible for educational technology programs. The online questionnaire link was also put on social media (Twitter and Facebook), my personal website and emailed directly where previous initial contact had already been made.

The online questionnaire was created using the online questionnaire tool known as 'SurveyMonkey'. The reasons for choosing this particular tool were the functions available, including question types, analysis and display of results. The design of the online questionnaire itself is based on the epistemic community and also the fundamental considerations for online questionnaire design. However, there was a significant restraint in the design of the tools used in this research. Denscombe (2010, p. 46) states that 'The researchers literature review should identify instances where other researchers have conducted online questionnaires under comparable conditions and the sample sizes used in such online questionnaires can provide a starting point for choosing a sample size' and this would be a useful place to start if not for the issues already outlined, in that there are very few similar studies to this research. Therefore, the online questionnaire was constructed from concepts gathered during the literature review, existing projects, studies and from the researcher's personal experience.

3.3.3 Online questionnaire: Instrument Design

The design of the online questionnaire questions was based on the epistemic community, question construction methodology and factors or themes arising from the literature in order to address the research questions. The full online questionnaire can be found in Appendix A.

In consideration of alignment with the epistemic community and as stipulated previously, there were few studies that were similar in nature to this research when the research and tool design element were completed, meaning that links to other research in the epistemic community were partial in nature. The remainder of this section discusses those studies where alignments could be identified in research practice.

In Arpaci's (2015) online study of teachers and educational technology adoption, he used questionnaire items that had been successfully used in previous constructs of the same conceptual framework (UTAHT and TAM models). In the study by Proctor and Marks (2013) on computer-based games and technology for classroom instruction they built their conceptual framework from the TAM model, used a mixture of closed and open questions and a 7-point Likert scale. Whilst this research study does not rely so heavily on the TAM model for the conceptual framework, it does underpin the influencing factors question that is addressed

through some of the demographic, use of, and professional development questions asked in this research online questionnaire. As with Proctor and Marks (2013), Turel (2011) also used the TAM model in his study of student perceptions of learning with an interactive whiteboard. Turel used a 5-point Likert scale and had 39 items in the online questionnaire with a Cronbach's Alpha of .940. Additionally, in the online questionnaire by Sanchez and Aleman (2011) on teacher's opinions on the use of ICT tools (to support attendance-based teaching) they also use the 5-point Likert scale and 34 items. A comparable number of items was featured in the online questionnaire for this research. Similar studies such as Kopcha (2012) also used a 5-point Likert scale for 15 items in his study on the barriers to technology integration in situated CPD, however 15 items would not have been enough to cover the factors and question requirements for the online questionnaire in this research. In consideration of the epistemic community within which my research sits, the 5-point Likert scale appears the most viable for data appropriate to the questions being asked. The items ranged mainly between 25 and 40 in the previous research and this was factored in alongside the web online questionnaire methodology, in making the decision as to the number of items to include and the number that would be aligned to each factor on the online questionnaire.

In development of the online questionnaire and question types, online questionnaire development within the epistemic community appears to lean towards the use of a 5-point Likert scale in the construction of the items within the online questionnaire (Arpaci, 2015; Hung and Jeng, 2013; Tang and Chaw, 2013; Ng and Nicholas, 2013) although some researchers such as Teo (2013) chose to use a 7-point Likert type scale. For the purpose of this study the 5-point scale was chosen as this fitted with the community and the level of complexity in a 7-point scale did not appear necessary for the types and style of questioning. The final online questionnaire consisted of various question types including: single selection, multiple selection, 5-point Likert (Strongly agree – Strongly disagree), extended response, binary Yes / No, 3-point impact questions, with these questions addressing various aspects of the conceptual framework.

The online questionnaire was designed with items constructed to deductively align with the literature review, such as questions on pedagogy and training with space for elaboration on answers to facilitate a complementary inductive analysis process. The online questionnaire questions alongside the constructs are outlined in the table below (see table 3).

Question one: Has the pedagogy used in the U.A.E. G6-12		Literature Base and
classrooms in government and private schools changed with the use		Constructs.
of tablets?		
Concept	To what extent do you agree or disagree with the	Fullan (2011)
and	following statement? 'My pedagogy (way of teaching)	Pajak (2012)
opinion-	has changed since using tablets'.	Teacher Centrality and
based		Reform.
questions		Falloon and Khoo (2014)
		Cook (2009)
		Sharples (2010)
		Bogdanovic <i>et al.</i> (2014)
		Affordances
	In regards to learning, what do you do with your tablet	Falloon and Khoo (2014)
	devices, that you could not do before they were	Cook (2009)
	available? Please comment below.	Sharples (2010)
		Bogdanovic <i>et al.</i> (2014)
		Affordances
	What activities can be done on a tablet that cannot be	Falloon and Khoo (2014)
	done on another device or media? Please comment	Cook (2009)
	below.	Sharples (2010)
		Bogdanovic <i>et al.</i> (2014)
		Affordances
	Do you think that pedagogy is changing (as compared	Prensky (2001)
	with traditional models of teaching), with tablets and	Partnering
	the web connected devices that are now being used in	Rogers (1962)
	classrooms?	Diffusion Model
	If you think that tablet-based pedagogy is changing,	Romrell, Kidder and Wood
	how would you describe or define it?	(2014)
		SAMR
Practical	Has the tablet had an impact on the way you conduct	CCL (2015)
and	summative assessment?	Laurillard (2007)
		Assessment

logistical	Has the tablet had an impact on the way you conduct	CCL (2015)
questions	formative assessment or assessment for learning?	Laurillard (2007)
		Assessment
	Has the layout or design of your classroom changed	Teaching and Learning
	through using tablets? E.g. movable tables or open	Pedagogy
	connected spaces.	
	Which of the following social media platforms do you	Teaching and Learning
	use in your classroom for teaching and learning?	Pedagogy
	(Select all that apply).	
	A standard lesson has a starter, main activity and a	Teaching and Learning
	plenary. Do your tablet-based lessons have the same	Pedagogy
	structure?	
	Have you ever changed the timings / length of your	Teaching and Learning
	lessons due to the use of tablet devices?	Pedagogy
	In regards to tablet based lessons, has your teacher	Teaching and Learning
	talk-time increased, decreased or stayed the same?	Pedagogy
	In tablet-based lessons, when using Apps, do you	Device Ecosystem
	mostly use one App, or do you sometimes use	
	more? Please select:	
	Which do you use more: Apps or websites?	Device Ecosystem
	If you are aware of the flipped classroom model, have	CCL (2015)
	you ever applied it using tablets?	Pedagogy
		Flipped Classroom
	In your opinion, has the use of collaborative learning	CCL (2015)
	(e.g. Peer / Group work) in your classroom increased,	Pedagogy
	decreased or stayed the same with the use of tablets?	Collaborative Learning
	Has your use of homework increased, decreased or	Teaching and Learning
	stayed the same, considering the use of tablets?	Pedagogy
	Has your use of personalised learning increased,	CCL (2015)
	decreased or stayed the same when using tablets?	Pedagogy
		Personalised Learning

Table 3: The online questionnaire questions and constructs for research question one

The table below (see table 4) outlines the constructs for the online questionnaire questions that address research question 2.

Question Two: What are the influencing factors on the		Literature Base and Constructs
pedagogy of tablet use in this context?		
Management	Which tablet device do you use? Please select	Device Ecosystem
and external	from the below.	
influence	How long have your students been using a tablet	Rogers (1962)
	as a learning tool in your classroom?	Diffusion Model
		Fullan (1991, quoted in Cox,
		Preston and Cox, 1999)
		Teacher Centrality and Reform.
	Please select from the scenarios below the one	Blackwell, Lauricella and
	that best describes how the students are	Wartella (2014)
	provided with tablets in your school.	Li and Choi (2014)
		Teacher Centrality and Reform.
	Did the integration of tablet devices form part of	Rogers (1962)
	your professional development targets, for either	Diffusion Model
	the last academic year (16/17) or this next	Weiss (1995)
	academic year (17/18)?	Pajak (2012)
		Fullan (1991, quoted in Cox,
		Preston and Cox, 1999)
		Teacher Centrality and Reform.
Internal	How long have you been using a tablet as a	Venkatesh <i>et al.</i> (2003)
choice,	learning tool in your classroom?	ТАМ
influence		Rogers (1962)
		Diffusion Model
		Fullan (1991, quoted in Cox,
		Preston and Cox, 1999)
		Teacher Centrality and Reform.

	Did you personally own and use a tablet or smart	Venkatesh <i>et al.</i> (2003)
	device before you started using one in the	ТАМ
	classroom?	Rogers (1962)
		Diffusion Model
		Pajak (2012)
		Fullan (1991, quoted in Cox,
		Preston and Cox, 1999)
		Teacher Centrality and Reform.
	What impact has the tablet had on your	Blackwell, Lauricella and
	workload?	Wartella (2014)
		Li and Choi (2014)
		Teacher Centrality and Reform.
	In regard to tablet-based lessons which core	Device Ecosystem
	Applications (Apps) or websites do you use?	
	Please list below:	
Dual internal	How did you learn to use the tablets for	UNESCO (2018)
and external	designing learning sequences / activities? (Select	The Horizon Report (2017)
	all that apply).	Li and Choi (2014)
		Yurdakul and Coklar (2014)
		Fullan (1991, quoted in Cox,
		Preston and Cox, 1999)
		Archer <i>et al.</i> (2014)
		Teacher Centrality and Reform.
		Professional Development /
		Training.
	To what extent do you agree or disagree with the	Prensky (2001) Partnering
	following statement? 'The use of tablets has	
	changed my involvement in the class as a	
	teacher'.	
	Do you choose the Apps or websites you use or	Device Ecosystem
	are they assigned to you by the school?	

Table 4: The online questionnaire questions and constructs for research question two

See the table below (see table 5) for the additional online questionnaire questions.

Additional questions

To what extent do you agree or disagree, that the following have been enhanced in your classrooms, due to the use of tablets?

If you think there is an increased student engagement effect from using tablets, to what extent do you think there is a novelty factor? For example, if the students use Apps from age 10, will their interest sustain until age 18?

In your opinion which aspects of teaching and learning will tablets or technology, never be able to replace?

If there is anything else you wish to add or consider important regarding the use of tablets in your classroom, please comment here:

Table 5: Additional online questionnaire questions

3.3.4 Online questionnaire: Pilot

In order to ensure the online questionnaire was as robust as possible, it was essential to pilot or pre-test the tool design. There are multiple reasons for conducting a pre-test of the online questionnaire, which include ensuring a common understanding of terminology or references and the general consensus on the knowledge base surrounding the subject. It is also paramount to test the practical application of the online questionnaire questions, establishing any questions that create issues of flow, structure or other problems associated with completing the online questionnaire. Piloting / pre-testing the online questionnaire also gives an indication of the amount of time that it would take to complete the questions, this helps with addressing issues of non-attempt of the online questionnaire or non-completion of questions. The pre-testing of materials is important for diminished risk in questioning according to Sarantakos (2013) so is therefore essential.

The piloting of the online questionnaire must be carefully considered in regards to the selection of people, firstly to ensure they are as similar as possible to the intended participants of the final online questionnaire, and secondly that a variety of devices are used, in order to complete the online questionnaire thus checking technical design. Five pilot participants were chosen based on the spectrum of educational and technical experience within the group (see table 6). The participants were asked to conduct the online questionnaire and comment on: navigation, spelling, typographical error, appearance and readability, which includes: page design, navigation, content and links, terminology and reference and time taken to complete the online

questionnaire. The participants completed the online questionnaire on different devices, in order to establish that the interface was compatible with differing hardware and operating systems. The pilot email was sent, and a copy of the first draft of the online questionnaire was sent out to everyone via a link in the email. A link to the feedback form (for which a Google Form was used) was also included in the email.

Respondent	Designation	Device
1	Senior Teacher – EdTech MPU	Android Tablet
2	Senior Curriculum Specialist	Android Phone
3	Senior Curriculum Specialist	Online Web Browser
4	Senior Assessment Specialist	iPhone
5	E-Learning Manager	iPad

Table 6: Online questionnaire Pilot Participants

A verbal discussion followed by an official email was sent to the participants in order to gain permission for their participation in the pilot. The pilot was conducted by the participants completing the online questionnaire on their various devices and verbal feedback was given in addition to them completing the form. The online questionnaire was then adjusted where necessary and then made live.

3.3.5 Online questionnaire: Sampling

Due to the specific demographic of the teachers who the online questionnaire targeted the sample was an exploratory sample and used non-probability sampling which included purposive sampling and snowball sampling.

Non-Probability Sampling (Cohen, Manion and Morrison, 2011):

The decision to use non-probability sampling was taken due to the fact that this study would not be looking to be generalizable across the wider population, as the study focuses only upon teachers who integrate tablets at a specified age range. There are three areas of nonprobability sampling that are used, these are purposive sampling, the subsidiary of which is intensity sampling and following on from this is snowball sampling.

Purposive Sampling (Cohen, Manion and Morrison, 2011):

Purposive sampling was chosen due to the need to have participants who fall within set parameters as the focus is set specifically on participants with the correct criteria – those teachers who explicitly use tablets in their classrooms, this is an overt bias as there is no need to be fully representative within a wider population. The decision to use intensity sampling was taken for the online questionnaire and there are exit pathways if the needed parameters are not met.

Snowball Sampling (Cohen, Manion and Morrison, 2011):

There was an element of snowball sampling involved in this process as via conversations with professionals in the educational technology network, it became a natural progression to identify those people who would meet the parameters necessary to take part in the study. There was no aspect of theoretical sampling as the aspects of grounded theory to produce a resulting theory are not employed within this study.

As the targeted sample for the online questionnaire are educational technologists, the 'ill at ease' (Denscombe, 2010) that some might feel with using the technology to engage with the online questionnaire, is somewhat ameliorated regarding non-response bias, and internet access issues are also less of a concern based on the demographics of the research population. Overall, given the options between a postal questionnaire and an internet online questionnaire, the internet may be the preferable option for the participants (Denscombe, 2010). Furthermore, there are issues with what is known as online questionnaire fatigue, whereby users experience an abundance of unsolicited communications (which some consider spamming) and become reluctant to continually participate in online questionnaires. It is of course very difficult to address this aspect of online questionnaire design in this research.

The responses collected were from the following:

- Weblink 26
- Social Media 15
- Email invitation 3
- Embedded online questionnaire 0

The next section will discuss the use of interviews.

3.3.6 Interview: Description and Justification

In looking to explore both question one and question two, interviews were chosen as a tool and designed using constructs from the literature review for both research questions alongside aspects of inductive Grounded Theory. Conducting the interviews within Grounded Theory methodology, aligns with the assertion that participant interviews are the most used sources of data according to Birks and Mills (2015). Interviews also align with the constructivist paradigm, whereby knowledge is created through human interaction (Kvale, 1996) and in this case through conversation, albeit purposed conversation. Much human interaction comes in the form of language exchange and much meaning is created upon these interactions. The term 'inter-view' as marked by Kvale (1996) helps refine further the concept of a mutual exchange around a subject of joint interest. The use of an interview underpins the human aspects of qualitative research, in that the use of interviewing as a data collection tool is by definition a social act, a creator of language, experience and shared ideas. Further to this the interview was chosen as a method to collect data due to its flexibility, by using a semi-structured model it was possible to control the interview process and probe further during the interview where applicable, something you are unable to do as part of an online questionnaire.

In trying to encapsulate further the impact of tablet use on pedagogy, interviewing in two levels was chosen to add a further dynamic to the research. The two levels defined are the 'Implementers' and the 'teachers'. The choice to make the multi-level distinction is to try to capture a wider perspective, as with the study by Ng and Nicholas (2013) who conducted focus group interviews and two interviews targeted at program leads, this split was chosen as the people who implemented the tablet integration oversee/oversaw many teachers in the school, thus having a wider perspective of experience, whereas the individual teacher only focuses mainly on their own experience, however this is at a greater depth than can be externally observed by the implementer.

3.3.7 Interview: How many interviews is enough?

One of the issues in this research was to determine the number of interviews that should be conducted, which is underpinned and addressed by the notion 'it depends'. Baker and Edwards (2012) endeavoured speculatively to find an answer addressing the question of 'how many interviews is enough' and uncovered a multitude of opinions and a complex series of factors, that affect the final number of interviews conducted during a research project, hence the assertion 'it depends'. Approaching social scientists from various epistemic fields, they create a frame from which to work / refer to, in the design and application of the instrument 'the interview'.

The number of interviews conducted depends upon the issues outlined in table 7 below:
Epistemological questions	
Methodological questions (nature and purpose	In the case of this research the nature is
of the research).	Grounded Theory and therefore the number
	cannot be predetermined but occurs when
	data analysis suggests saturation point has
	been met.
Objectives and Analysis: Commonality,	
Difference, Uniqueness, Complexity,	
Comparison and Instances.	
Practical issues: Level of degree, Time,	This research thesis is for the award of an EdD
Committee requirements.	and not a PhD and therefore had to be kept as
	succinct as possible yet still allow for viable /
	analysable data collection processes.
Philosophically and pragmatically: The	The epistemic community is addressed within
judgment of the epistemic community in which	this methodology chapter.
the person conducting the research is situated.	

Table 7. Interview numbers based on Baker and Edwards (2012)

There is an overarching argument within their overview that when your data has reached saturation point and you have achieved a range of answers, that is the point when you have conducted 'enough' interviews. However, as Baker and Edwards (2012) note this makes the process more challenging in that sampling, collection and analysis occurs all together, rather than as a chronological process, as the methods used in creating the methodological framework for this research are based in Grounded Theory, then this idea of data saturation aligns to the underpinning framework and the method by which the data was collected and analysed. For the interviews with the teachers it is felt that data saturation was achieved, as by doing the comparative analysis no significant new codes were created towards the end of the analysis process. For the implementer interviews this was different, as the number of interviews was determined by the people available to interview, who fell within the very niche parameters for this classification. However, having stated this a lot of the themes were very similar, apart from two interviews which were from people who lead multiple schools and therefore had a slightly different perspective to those who worked on roll-outs in one school only.

3.3.8 Interview: Instrument Design

In creating the interview questions there were only a few key questions, then a series of prompts to be used if the interviewee had not spoken about them in their initial answers. The initial question looked at the demographics and contexts of the roll-out that the interviewee had been a part of, with the subsequent questions addressing the main aims of the research.

The question regarding changes in pedagogy was more targeted and the prompts focussed on particular areas of pedagogy as outlined in the literature review. The question on influencing factors was a lot more open, as the influencing factors (and the pedagogical change to a lesser degree) were not in the existing literature enough to form a more focused question set, hence one of the reasons why grounded theory methods were used.

Mouza and Barrett-Greenly (2015) in their study on professional development for a mobile learning initiative in school, used interviews with teachers as part of their data collection methodology. The interviews were semi-structured (as with this research) and Mouza and Greenly (2015, p. 5) state that this structure allows 'a formal questioning strategy that would yield comparable data, while at the same time maintain flexibility to probe for a deeper understanding'. Their interviews ranged from 30-60 minutes, which was mirrored with the length of the interviews for this study, with the exception of a few interviews that went over the hour. Peacock (2009) also used semi-structured interviews and the question design was based on themes emerging from the literature. Israel *et al.* (2015) utilised semi-structured interviews derived from research questions and theoretical frameworks. Questions went through a vetting process via their research team, their computing experts and the interviews had a maximum of 13 questions. Kopcha (2012) used 9 items in a semi-structured protocol, these are comparable to the amount of initial questions on the interview schedule for this research.

Sanchez and Aleman (2011) conducted an interesting study on the theme of 'does the new generation of digital learners exist' and argues against Prensky's notions of what it means to be part of this digital generation, they used semi-structured interviews lasting 45-60 minutes each and the interviews conducted on familiar grounds – the teachers own school. Each of the interviews conducted for my research took place in the workplace of the participants, in order to create a more comfortable and familial experience for them. The research questions and literature base are outlined in table 8 below.

Research Question	Prompt areas	Literature Base	
Please can you tell me about the context in which you work / teach? Can you talk me through the	Private / international/ government /vocational/ Subject taught or subject background. Position held. Why did you decide to	Context / Demographics. Venkatesh <i>et al.</i> (2003)	
process by which the tablets were introduced in the school?	What factors influenced the roll-out? What barriers or constraints were there – teachers as well as technical? How did you learn to use the tablet? Professional development for yourself and teachers. What factors were considered in the management of the change to tablet use and how were these dealt with?	TAM Rogers (1962) Diffusion Model UNESCO (2018) The Horizon Report (2017) Li and Choi (2014) Yurdakul and Coklar (2014) Fullan (1991, quoted in Cox, Preston and Cox, 1999) Archer <i>et al.</i> (2014) Weiss (1995) Pajak (2012) Blackwell, Lauricella and Wartella (2014) Li and Choi (2014) Teacher Centrality and Reform. Professional Development / Training.	
The main focus of the study is to look at whether pedagogy has changed in the classroom. Please can you tell me about what happens in the classrooms in your schools now that tablets have been introduced? Please think	Time spent using Device affordances / use / Lesson shapes TTT – teacher talk time Models of learning – flipped / collaborative /	CCL (2015) Pedagogies Laurillard (2007) Assessment Romrell, Kidder and Wood (2014)	

about the differences if any,	personalized / content	SAMR
between now and before the	creation /	Prensky (2001)
tablets were introduced.	Assessment / AFL	Partnering
	Classroom layout	Falloon and Khoo (2014)
	Classroom time – outside	Cook (2009)
	of class.	Sharples (2010)
	Homework	Bogdanovic <i>et al.</i> (2014)
	SAMR	Affordances
	Social Media	Teaching and Learning
	Most impact – Apps or	Pedagogy.
	Connectivity.	
	How does this compare	Device Ecosystems
	with your classrooms	
	before the tablets?	
Do you think the use of the tablets		
has affected attainment outcomes		
/ can you discuss why you think		
this?		
Do you think the use of the tablets		
has affected achievement		
outcome / can you discuss why		
you think this?		
Do you think the use of the tablets	If vest can you give	
has affected engagement in the	examples	
classroom / can you discuss why	Do you think there is a	
you think this is?	'novelty effect' involved	
,	here?	
Taking into consideration	New podegogy opporging	
aventhing we have speken shout	New pedagogy emerging	
what are your opinions on the	Negative aspects	
uses of tablets in the classroom?	Would you do anything	
	differently in hindsight?	

Table 8: The research questions and literature base

3.3.9 Interview: Pilot

Once the questions were put together the interview was tested on a colleague, who had carried out a roll-out of iPods and then iPads in their previous employment. During the interview I was noting time per question, areas which needed prompting or clarification and questions where there was more interest from the respondent. It is noteworthy that due to the participants interest and knowledge of the subject, that the answers flowed well and were in-depth. The order of the questions flowed with regards to a more natural discussion, however I found the concept of engagement did not really need a separate question, as it came up many times during the other questions, I noted for following interviews that I would only ask this as a separate question where relevant.

3.3.10 Interview: Sampling

In order to begin the interviews a 'Purposive Sampling' design was used to approach potential interviewees as advocated by Birks and Mills (2015).

The selection of the interview participants used two separate typologies as defined by Teddlie and Tashakkori (2009), intensity sampling and reputational case sampling. The interview participants were classified into two groups, 'teachers' and 'implementers'. The 'teachers' group were those who used the tablets in their classrooms and the 'implementers' were those who were responsible for technology integration programs in their respective schools or institutions.

For the 'teachers' being interviewed intensity sampling (Cohen, Manion and Morrison, 2011; Teddlie and Tashakkori, 2009) was used, as the teachers were selected based on their knowledge and usage of educational technology, however less reliance was placed on reputational case sampling and a selection of teachers from differing types of educational establishments in the U.A.E. were interviewed. For the 'implementers' reputational case sampling (Cohen, Manion and Morrison, 2011; Teddlie and Tashakkori, 2009) was used, this was established through personal relationship to the researcher, connections made at professional conferences and through connections on the social platforms 'LinkedIn' and 'Twitter' (which are only used in a professional capacity by the researcher) this style of sampling was used due to the focus on selecting participants based on a very specific set of highly specialised parameters, of which the researcher is aware. In the case of the implementers they had to have overseen the roll-out of tablet-based devices in their schools or institutions. The people interviewed came from single private schools, chain private schools and government institutions, in order to get as much of a breadth of coverage of different contexts of roll-outs as possible. Snowball sampling (Cohen, Manion and Morrison, 2011) was used following these initial interviews, with the purpose of conducting further interviews and identifying participants for the lesson observation phase. The

seven teachers interviewed came from different schools. Three teachers came from one federal vocational high school establishment, two from an international school (the observation school) and two from two other international schools. I did not conduct member checking of the interview transcripts.

The next section will discuss the lesson observation tool.

3.3.11 Observations: Description and Justification

The use of lesson observations as a data collection tool is an opportunity to observe live data from an in-situ scenario (Cohen, Manion and Morrison, 2011) rather than just relying on mediated personal self-reported accounts, as with the interviews and online questionnaire tools also used in this methodology framework. The need to use observations is because people may not do what they report to do, giving the observer the unique perspective of actually seeing the scenario for itself (Robson, 2002), this is particularly relevant as in the self-reported data there may be an element of reporting what they 'think' they should say they do, as opposed to reporting what they actually do. Whilst this may not occur with the online questionnaire as there is no in-person interaction, there is in the process of interviewing which is conducted in a face-to-face environment and therefore the interviewees may feel more exposed, and wish to highlight what they believe to be 'good' or 'expected' practice as dominant in their everyday teaching with tablets, when this may not be an accurate representation. The use of lesson observations is one way of addressing this potential data inaccuracy.

The observational research tool designed and used in this study focuses on 'events' specifically pedagogical methods and tasks, utilised during a tablet-based lesson as seen from the role of an observer, whilst there is always the element of the Hawthorne Effect (Bryman, 2012) to consider, the teachers being observed were adhering to lesson plans that were in place before the observations were scheduled.

The purpose of adding this instrument is to enable triangulation (Bryman, 2012) with the self-reported data in the online questionnaire and interviews, as part of the mixed methods approach to this data collection, this triangulatory aspect is important as the actualities of what scenarios occur in the classroom needs to be corroborated with the self-reported pedagogies.

3.3.12 Observations: Instrument Design

The design of the observations was centred around research question one, looking at how tablets are pedagogically used in the classroom. The purpose of the observations was to view in-

situ, what actually occurs during a lesson using tablets. The Grounded Theory aspect of this research meant the tool design needed to be based on inductive practice in data collection.

Within the epistemic community outlined in this section, it can be seen that a mix of approaches to lesson observation was taken and the tool design for this research aligns with various and inductive aspects of each. Heinrich (2012) in his study on iPad use in the classroom, utilised classroom observation following on from observed professional development sessions. The observations documented: teacher's pedagogical decisions / activities, physical setting, role of the teacher, role of the students, lesson itself and teacher / student interactions. The process involved four teachers being observed five times each over the course of a year, therefore twenty observations in total. Observations were 45-90 minutes with debriefing sessions held after the observations, this research study followed a similar observational category set as pedagogical activities and the role of students and teachers are of importance when considering the first research question. Arnab et al. (2013) in their study of game-based learning to support sex education, utilised classroom observation alongside corroborating with self-reported measures from the students to analyse the effectiveness of the games used. Whilst this research study did not include a self-reported measure from the students, it does corroborate self-reported measures from a teacher's perspective. Israel et al. (2015) used a case study methodology with individual teachers regarded as a 'case', seven teachers and two administrators. Israel et al. (2015) used time-incremented field notes to document: instructional practices, students' interactions, student computing activities and photographs of student's work were taken. A mixed methodology and triangulation of data was adopted to corroborate between interviews and observations. Whilst my study did not take pictures of student work, a similar strategy was used in that field notes were taken, although they were not time-bound they documented the flows within the lesson. Kopcha (2012) on the other hand did not use time-incremented field notes, instead he used a 15-item observation protocol, which aligned with his online questionnaire and items were addressed on a Likert scale during observations. Nine teachers (six videotaped, two or more times) were observed. Lessons were between 25-55 minutes long totalling 603 minutes, in total 10 hours, with an average of 37 minutes per lesson. The decision to not design the tool similarly to Kopcha was based in the overarching research approach to follow an inductive and therefore less restrictive model of observation practice, in an effort to capture any and all parts of the lesson.

The amount of observations conducted is not high in the studies discussed above, even Ng and Nicholas (2013) only observed seven lessons in their study, this low observation count aligns with the three days of observations conducted for this study, as the number of lessons observed was similar to the studies outlined. The instrument itself was simplistic and acted as a note taking

exercise in a field journal, looking at the pedagogical activities, workflows and teacher and student activities as previously outlined.

To summarise, in consideration of the epistemic community and the utilisation of aspects of Grounded Theory, a series of field notes was kept for each lesson as to when the tablets were used, activities, workflows teacher / student role. The observation tool did not utilise a set of observation parameters such as a tally or tick sheets, due to the inductive nature of this aspect of the research.

3.3.13 Observations: Pilot and Sampling

The observation part of this research is where the most restrictions were experienced, these were restrictions in access and permissions for observations and also difficulties in securing time off from work, as such, observations were only carried out in one institution over a period of three days, this was a major difficulty for this part of the research. The effect of these restrictions meant that the observation instrument could not be piloted before the first set of observations, so it had to be utilised in its 'designed form', however as this was the format of the inductive field notes the detriment to the study was not considered prohibitive. Another difficulty is that lesson observations could not be observed over time as with the epistemic community. Additionally, not being able to conduct lesson observations in a varied range of educational intuitions, that aligned with the online questionnaire and interviews, meant that full triangulatory alignment was not possible.

The school that the observations were conducted in is a co-educational private school located in the northern Emirates serving KG - G12 and followed an IB, GCSE and A Level provision curriculum program. The number of observations carried out was 12 with 4 observations a day carried out over 3 consecutive days, with the observations being held towards the end of the data collection process. 3 lessons observed were math, 6 were English and 3 were science. The three lessons of math that were observed were with one of the implementers that was interviewed. 6 lessons of English were observed across 2 teachers and the 3 science lessons were 1 teacher. One English teacher was interviewed and observed and another teacher interviewed but not observed.

The next section will outline the data analysis process, utilising the data collected from the tools as discussed thus far in this methods chapter.

3.4 Data Analysis

The data analysis for this thesis utilised differing analytical techniques. The online questionnaire utilised descriptive statistics and content analysis, the interviews were semi-structured to allow for deductive thematic analysis based on the literature review, yet also

allowed for the inductive grounded theory approach to explore themes that emerged from the data. The observation data was analysed through looking at events, tasks, workflows and roles, using them corroboratively with the thematic and coding data from the online questionnaire and interview. The SAMR and TPACK models were used to explore the data in relation to these frameworks, particularly where the activities discussed sat within these frameworks. The data collection and analysis were concurrent across several months for all three methods, with thematic and coding comparison taking place between data from all sources. The techniques of analysis for each of the methods will be outlined in the subsequent sections.

3.4.1 Analysing the Online questionnaire

The number of respondents to the online questionnaire was forty-five. The process of analysing the online questionnaire involved using descriptive statistics and content analysis of the open ended and contextual data. The descriptive statistics data was from the various types of online questionnaire questions already discussed in previous sections (single selection, multiple selection, 5-point Likert [Strongly agree – Strongly disagree], extended response, binary Yes / No, 3-point impact questions). The data from these questions enabled the experience of those people participating in the online questionnaire, to be expressed through percentages and other indicators through the functions available in the online questionnaire system 'SurveyMonkey', that provided graphical representation of the data (Creswell, 2014) by interpreting these simple descriptive statistics, it assisted with forming the 'picture / narrative' of the experiences of the online questionnaire respondents in relation to the questions being asked.

For the content and thematic analysis (Braun and Clarke, 2006) of the open ended and contextual questions, the comments and extended answers were printed onto paper hard copy and coded manually with highlights, and notes about the themes, codes, links and ideas were made, these codes and notes were then reviewed and compared to the codes already in the existing data analysis. The open-ended questions were ones that required the participant to provide their own ideas without prompt or example. The extended answers option to questions analysed by descriptive statistics, provided data that held explanatory power for the original statistically represented answers.

These codes and notes were used for the ongoing constant comparative analysis with the interviews (Birks and Mills, 2015) for thematic analysis and also for final corroboration and triangulation of the data towards the end stages of the analysis.

3.4.2 Analysing the Interviews

The coding for the interview transcripts was completed using the software NVivo (NVivo QSR, 2013). The transcripts of the interviews were uploaded onto the software, analysed and thematically (Braun and Clarke, 2006) coded as each interview took place. Some of the interviews were very densely coded, meaning that few new codes were introduced after these interviews had been analysed, as many of the interview responses were very similar there were only around 120 codes established. Coding the long answers, on the online questionnaire responses was completed manually on documents extracted from the online questionnaire, and the codes from the online questionnaire answers cross-checked against NVivo (NVivo QSR, 2013). There were no new codes on the long answer questions as they already existed in the bank of codes from the interview analysis process. I did not carry out any member checking of the transcripts and this is a limitation of the study in regards to validity.

As new interviews were completed they were coded and the codes were considered alongside existing codes, however few changes were made to the codes in order to get a clearer more detailed set of data to work with thematically in the subsequent stages. In order to address reliability within the process I asked a colleague who holds a PhD in linguistics and AI to code one and a half interviews, acting as a coder with no connection to the research (Luker, 2008) we then met and discussed the codes assigned, discussing definition and disagreement, helping to refine the coding work being undertaken (Miles, Huberman and Saldana, 2014).

After the coding work had been completed and other data considered, I took the decision to manually align codes by thematics for personal preference reasons. All codes were taken from NVivo and written onto individual pieces of coloured card and laid out on the floor (see figure 6).



Figure 6: Thematically Linking Codes (intermediate)

From these codes 37 clusters were made that were thematically linked (see figure 7).



Figure 7: Refinement of intermediate codes

These 37 codes were then condensed into the key overarching themes that will be discussed in the findings (see figure 8).



Figure 8: Reaching final themes

3.4.3 Analysing the observations

The analysis of the observations was based on the field notes that were taken during the course of the lesson observations. The observations were conducted as outlined previously, in order to deepen the understanding of the dataset (Cronholm and Hjalmarsson, 2011). The field notes focused on events in the classroom, pedagogical methods and tasks, workflows and the roles of the teacher and the students. As discussed in the previous observation instrument design section, the field notes were not constrained by quantitative techniques, so as to allow all observable moments to be recorded (Cohen, Manion and Morrison, 2011). The observations ran across three consecutive days so the analysis was completed after all the observations had taken place.

The analysis involved manually mapping and grouping the pedagogical methods and tasks that had been observed with descriptive notes about each. The groupings were initially based on the existing framework of questions contained within the online questionnaire and also the interview prompt questions. Incidentally there were no 'outlier' activities that were not additional to these areas, so therefore no new themes emerged inductively from the data in the observation analysis process. The workflow, teacher roles, student roles and activities were similarly grouped, and notes made, working with these groupings allowed for analysis of dominance or frequency of the activities in the groupings, which supported the comparative analysis with the rest of the data (Birks and Mills, 2015).

As will be discussed in subsequent chapters, the limitation of analysing such a small sample of lessons impacted on the value of this as a third method of data collection and analysis, despite providing data that partially contradicted the other methods. The following section discusses using a grounded theory approach in the research process.

3.5 Using Grounded Theory, overview and issues of quality in the research process.

Demonstration of rigour in the process of the research is an important aspect which must be clear in its application, as Birks and Mills assert 'quality is synonymous with rigour' (2015, p. 33). Despite not following an existing methodological framework for this study, the methods used to construct this particular framework of study, are synthesised from existing and established methods and practice. Issues of quality are addressed in three areas according to Birks and Mills (2015) these are: researcher expertise, methodological congruence and procedural precision.

Researcher expertise

As a doctoral degree can be viewed as a 'research apprenticeship' (Birks and Mills, 2015) limited experience in using the method is not necessarily a limiting factor, as they assert generic skills in academia are applicable to working in a new area for a thesis submission and will enable a deep and consistent knowledge of grounded theory to develop during the research process itself.

Methodological Congruence

- Your personal philosophical position;
- The stated aims of your research;
- The methodological approach you employ to achieve these aims.

These have been outlined in the previous sections.

Procedural Precision

The research took elements of grounded theory as part of the research and coding process, the theory generation part of the process was not utilised. Additionally, the access to relevant participants in the research was highly limited, one of the areas of grounded theory that could not be fully achieved with confidence was saturation, however purposive sampling, coding and comparative analysis took place. Handwritten notes were kept along the process and alongside ideas and connections, potential models and influences were mapped along the way. Once the interviews had been transcribed they were stored on NVivo (NVivo QSR, 2013) for analysis. Long answers from the online questionnaire questions were printed and coded, no new codes existed in the long answer questionnaire questions and mirrored the interviews. The data from the online questionnaire and the observation was considered alongside these codes and overall, all aspects of the data corroborated themselves. There were less than ten final concepts which aligns with the assertion of Lichtman (2006) that this is the outcome of most qualitative research.

3.6 Ethics

Ethical considerations are a fundamental element of any research, and this thesis underwent an approval process through the University of Southampton's Ethical review board (ERGO) before any data collection commenced. Considering that the concept of 'do no harm' may be more widely associated with medical research, it also applies to the most basic parts of any interactions conducted during the research process. In any social research paradigm a fundamental underpinning is the cost/benefits ratio, Cohen, Manion and Morrison (2011) state that this ratio outlines the personal cost to the participants, against the benefit that the research can bring and be subsequently utilised and applied, stating that there are no absolutes and researchers must make subjective decisions as to how this ratio is balanced within their research projects. All the participants in this research took part with informed consent. The participants gave their permission to be included in this study after being given information relevant to their participation. There was no element of this study that would necessitate any one to have not been informed in full before taking part in this research. All participants were provided with an information sheet regarding the interview process, what will happen with the data and their right to withdraw from the study, they were also provided with a form to read and sign, therefore giving their informed consent for the study. Anonymity in the data was discussed with each interview participant and it was explained to them that their interview would be identified numerically and all references to schools or institutions removed. The observations were subject to the same process of information and consent. Examples of the forms can be found in Appendix

C. The online questionnaire contained similar information for participants appertaining to the online data collection which can be found in Appendix A.

The risk of harm to the subjects was minimal, as there were no obvious areas of the interview process that were designed to elicit anything which could cause distress to the participants. Any benefits for the subjects could be considered in collective terms, as it is hoped that the outcomes of the research may be able to support those looking to develop and implement technology in their schools or institutions.

ERGO Ethics

In order to conduct this research, the ethics committee at the University of Southampton reviewed the ethics application and granted the approval to conduct the research. The submission approval is detailed in Appendix D.

Chapter 4: Findings

Building through the proceeding chapters, the focus of this research has been on placing teachers as central to the process of change when integrating tablets into the classroom. In the literature review we have seen the potential difficulties with adapting a teacher's deep pedagogical grammar towards the use of technology, providing a frame for investigating how and why a teacher adopts and uses the tablets, through various influencing factors.

The previous methodology chapter outlined the approach to data collection and the analytic process that took place, with data gathered from both teachers and implementers across three data collection tools, online questionnaire, interviews and observations, this chapter will outline the findings from the data with the discussion of these findings placed in the subsequent chapter.

The following sections begin with a description of the participants in the online questionnaire and interviews, followed by each research question in turn, summarising the findings from each of the methods used to gather the data, as pertains to that question. Following the findings from each research question, the emergence of key themes from the data will be outlined, these key themes were training and assessment. The importance of training was discussed during the literature review and it was embedded in the data collection methodology. Whilst assessment featured in the framework, it was the grounded theory approach and the inductive process through which assessment emerged as a key theme.

4.1 The participants: Online questionnaire and Interview

The first eight questions in the online questionnaire (which can be found in Appendix A) relate to the demographics of the person completing the online questionnaire. The majority of participants (32%) were in the 39-45 age range, with 83% aged between 32 and 52, of the participants 61% were female, with 2% opting not to say. 77% indicated that they have 9+ years of experience working in education and there was an array of ages of the students taught, as can be seen in figure 9 below.



Figure 9: Participants responses to: What are the ages of the students you teach? (Select all that apply)

45% of participants indicated that they had not worked in industry before becoming an educational practitioner, this may align with the 47% of participants who identified as English as a second language teachers, with the remainder a mix of differing subjects between 2-10%. The majority of participants taught in a vocational public school (42%) as can be seen in figure 10 below.



Figure 10: Participants responses to: Please indicate the type of institution you work in

The demographics of the interview participants are as below (see table 9) available in Appendix G. The implementer interviews are identified as II1-7 (implementer interview 1-7) and these participants are those who are responsible for tablet programs in their respective institutions. The teacher interviews are identified as TI1-7 (teacher interview 1-7) and these interviews are with teachers who actively use tablets in the classroom.

Identifier	Role	Context Org	Age Bracket	Gender
1	Senior Manager	Multiple	32-38	Male
	Education Technology	Institutions		
112	Director of Digital	One Institution	39-45	Male
	Learning			
113	Technology	One Institution	25-31	Female
	Integration Specialist			
114	Department Manager	One Institution	25-31	Male
115	Head of Digital	Multiple	39-45	Male
	Education Strategy	Institutions		
116	Senior Leadership	One Institution	32-38	Female
	Team (Academic)			
117	Head of Digital	One Institution	32-38	Male
	Learning and			
	Innovation			
TI1	Teacher	EFL	25-31	Female
TI2	Teacher	EFL	32-38	Female
TI3	Teacher	EFL	32-38	Female
TI4	Teacher	Middle School	32-38	Female
TI5	Teacher	EFL	39-45	Female
TI6	Teacher	Middle School	25-31	Female
TI7	Teacher	Middle School	18-24	Female

Table 9: Demographics of interview participants

4.2 Research Question One: Has the pedagogy used in the U.A.E. G6 12 classrooms in government and private schools changed with the use of tablets

Research question one looked at whether the pedagogy used in classrooms had changed in anyway or remained the same. In the next sections the findings from each method of data collection will be outlined, starting with the online questionnaire, then interviews and observations.

4.2.1 Online questionnaire responses

Within the online questionnaire, the questions appertaining to research question one focused on two areas of pedagogical use, these were the 'opinions and concepts' teachers held towards using the technology and secondly, the more 'logistical or practical aspects' of the pedagogical practice. The first part of this section will summarise the findings from the opinion and concept questions and the second part summarises the logistical and practical questions.



Opinions and Concepts



73% of the participants suggested that their pedagogy had changed since using tablets (See figure 11). There were 27 comments left on this question and most of which indicated that any change to pedagogy was moderate or very specifically focused in a certain area. Some of these responses were around student-centred activities, including research and inquiry-based learning, collaborative and creation activities, assessment activities such as self-marking quizzes with live feedback and annotations. These activities appear to be situated in Augmentation and Modification on the SAMR model. A few additional comments in this section were:

- I do not think the pedagogy has changed; the way we use tablets needs to change.
- If you can't teach anyway, using a tablet won't help you (or your students) much.
- The school doesn't have an effective policy of punishment ... so the boys ... can do what they want.

This quote would sum up the responses 'I would not say it changed significantly, however I became keener on doing collaborative tasks as the technology I was able to exploit enabled me to plan and carry out tasks I would not have been able to before'.



Figure 12: Participants responses to: Do you feel pedagogy is changing (compared to traditional teaching)

78% of the participants also said they feel that pedagogy is changing as compared to traditional models of teaching (See figure 12) they were also asked (see question 39 of the questionnaire in Appendix A) if they thought it was changing could they describe or define it. One of the more general comments that encapsulated the mood of the responses was 'education for the real world, accessible anytime and anywhere. Millennials are changing society ... and the classroom'. A second important comment along the same theme was 'We are more adept or forced by default toward the connectivism pedagogy as twenty-first century teaching and learning skills break away from the right style, or, transition model of teaching'. The more specific comments seemed to focus around a more applied version of education, however in the same vein as the previous ideas. In looking at that move to connectivism from transition is the idea that we are moving to being content creators, through collaboration and student-led, controlled, defined and paced learning through pedagogy, such as project-based learning. Students are proving and doing through application of knowledge and not just memorising. The idea of the visual nature of the use of tablets was also mentioned here as well as in the interviews, and this ties in with wider discussion of the multimodality afforded by the devices, these types of answers appeared to be moving more into the Redefinition aspect of the SAMR model.

Two questions revolved around making comparisons between and before and after devices were available. The online questionnaire asked (Q17): 'In regards to learning, what do you do with your tablet devices, that you could not do before they were available?' The responses to this question revolved around workflow of the lesson and feedback opportunities rather than any particular attributes of the technology. Teachers said the provision of content and use of digital objects was easier as was the workflow and transitions within lessons. Access to information was quicker as was the generation of levelled activities. Teachers also commented on better formative assessment opportunities through written, audio and video affordances.

Whilst a couple of responses stated that there was nothing new, there were a wide range of responses to this question. One theme revolved around access with comments such as 'ease of access to other types of teaching tools', 'speed I am able to access information', 'easy access to resources stored separately and in other countries' this area of access links to the TAM (Technology Acceptance Model) where perceived ease of use is a foundational concept, alongside perceived usefulness which both tie into the responses given to this question.

Portability is one of the more common affordances referenced when it comes to tablet use, however 'taking learning outdoors' is the only comment made in regards to portability, this could be due to several factors including the weather in the U.A.E. being prohibitively hot to be outside for most of the year, also there is a reluctance in some institutions to even allow students out of their seats, so this may impact on how prevalent the portability aspect is and why it was perhaps only mentioned once across the responses.

Interactivity in content such as games and interactive sites was mentioned alongside modelling and displaying information better for the students.

Feedback and collaboration were mentioned in the context of giving feedback in 'real time' and 'audio and video feedback' and in regards to changing 'simple writing tasks to online collaborations, when I can leave feedback in real time', this particular activity was mentioned by three participants and was a well-known digital strategy in the region.

Visuals and multimodal access were mentioned regarding 'immediacy' and 'access' which ties in to the first point. Types of transposition activities were also mentioned, for example 'changing story writing into a movie / video'. It is in this question that I thought aspects of Redefinition on the SAMR model would be prevalent, however as with other answers it remains in the S, A and M on the model.

The online questionnaire also asked (Q18): 'What activities can be done on a tablet that cannot be done on another device or media?' Interestingly, in contrast to the previous question the answers given for what cannot be done on another device, focussed more so on the functionality of the tablets. Interestingly portability was mentioned frequently throughout the answers to this question unlike the previous one. Apps, App based software and App Smashing

were mentioned frequently in the responses to this question, as well as the comment that 'one can download a range of Apps, multi-skill tasks may be performed using just one device'.

Portability of the device was also mentioned frequently in regards to its 'lightness' as compared to a laptop, 'communication' and 'students can walk around for activities'. Content creation was mentioned in regards to a wider audience, the 'main one is multimedia curation and creation' and 'creating a 4D book (using book creator) integrating text, images, sounds, pictures and video clips and then sharing with a wider audience not just within the class, but with parents as well'. 'Educational games' and quizzes where students can compete against each other in real time were mentioned here also. Feedback and formative assessment were mentioned as was interactivity and adaption to learning styles. In response to the question asking what can an iPad do that another device cannot, 5 out of the 31 answered that they did not know. One comment stated that the same things could be done on a PC or MacBook, whilst it is not possible to run through all available scenarios, it may be the case that you can do everything else on another device, but would it be as accessible, fast and a smooth process? Both questions elicited responses that focused around everything you would need being there on one device.

The final question, looking at concepts and opinions for research question one, asked what people felt tablets and technology would never be able to replace. The majority of answers were about the human elements of teaching, such as relationships, social interactions, Socratic pedagogy and soft skills.

Logistical and practical

For this aspect of the online questionnaire for research question one, the questions are divided into four main areas, around which the questions were focused as outlined in the methodology in the previous chapter and are detailed in Appendix A. The four areas are the teacher role (questions 23 and 27), pedagogy (questions 24, 25, 31, 32, 33, 34, 35 and 37), assessment (questions 19 and 20) and lesson logistics (questions 22, 26 and 36).

The teacher role



Figure 13: Participants responses to: To what extent do you agree or disagree with the following statement? 'The use of tablets has changed my involvement in the class as a teacher'

74% of participants suggested using the tablets had changed their involvement or role in the class (See figure 13). There were 28 comments made in further explanation of why the answer was selected, which can be summarised as comments: being more involved in the learning with easier access to student work and student-led activities meaning less direct teaching. The main comments revolved around the teachers feeling like they were becoming more facilitators of learning and used the phrase 'guide on the side', which is a common phrase for this particular phenomenon.



Figure 14: Participants responses to: In regards to tablet based lessons, has your teacher talk-time increased, decreased or stayed the same?

57% of the participants indicated that their teacher talk-time has decreased, with 36% indicating that it had stayed the same (See figure 14). The comments made here are similar in nature focusing on student-centred experiences, that students are more engaged with Apps and videos and that teachers spent time answering questions about content instead of delivering it. The teacher talk changed from instruction to discussion or interaction only as needed, after

instruction was given to the class, with some comments saying there was less interaction with more able students and more interactions with less able students.

There were a couple of negative comments placed on this question:

- Tablets don't change teaching, they just let you do some 'cool' stuff and save people having to carry around heavy bags of books.
- TT time is mostly wasted. It's hard to get their attention in the first place and they don't listen when you do. You're going to be asked the same questions you've just comprehensively answered anyway, so there's little point.



Pedagogy

Figure 15: Participants responses to: A standard lesson has a starter, main activity and a plenary. Do your tablet-based lessons have the same structure?

62% of the participants indicated that their lessons continued to have a standard lesson structure, whereas 26% indicated 'sometimes', the remainder said that their lessons did not (See figure 15). There were only 13 comments for this question which can be summarised as the tablet being used for one part of the structure of the lesson, that creation was rolled into subsequent lessons and the entire structure sometimes changed to project-based learning. Other comments included that they had never taught using standard lesson structures.





41% of the participants suggested that they had used tablets for the flipped classroom strategy (See figure 16). The follow up question asked those that had used it, how they felt about it as a teaching strategy, whilst the majority of people thought it was a good strategy, with one comment naming it an 'excellent pedagogy', other participants indicated that it was often the case that the students failed to complete the initial flipped content element and therefore the structure of the learning sequence failed.

An element of planning was involved for using the flipped classroom, it was stated that checks with other teachers need to be made, in order to ensure everyone was not using the strategy at the same time, therefore putting too much 'out of school' responsibility upon the student. Students and teachers alike need to be trained on the process also. One comment was very pro this particular model, however overall it did not appear to be a widely used pedagogy:

I could not imagine a classroom using 21st century pedagogies with technology not using a flipped classroom model. Students are the ones now that need to be proactive and take charge I need how and what they are learning. I have had a few classes where I greeted students and they were the ones that controlled the learning and activities being conducted.



Figure 17: Participants responses to: In your opinion, has the use of collaborative learning (e.g. Peer / Group work) in your classroom increased, decreased or stayed the same with the use of tablets?

48% of the participants felt the use of collaborative learning increased (See figure 17). 24 of those participants commented on this question saying that teachers had always taught this way anyway, however the possibilities for use are greater, they said students seemed more interested in the production stage of learning and sharing digital experiences with each other and that tablets were good for individual and pair work.





Out of the three definitive pedagogies in the online questionnaire (flipped classroom, collaborative learning and personalised learning) this is the pedagogy that had increased the most amongst the users, with 73% choosing that personalised learning had increased in their classrooms (See figure 18). Looking to the comments in the previous question (Figure 17) that tablet use tends to be based around individual tasks, it is maybe not surprising that 73% of participants indicated that personalised learning with the tablets had increased. The most common comment (made by four people) was that personalised learning was about self-pacing. The teachers felt they were more able to send students specific resources, websites, extension

activities and differentiated tasks, this is Substitution and Augmentation on the SAMR model. However, there were comments saying that they rarely get time to research and learn new Apps, and it also takes time, adding there was not enough training and what there was rarely helped.





68% of the participants indicated that they use more than one App during a lesson (See figure 19). The comments for this question were mixed regarding the single or multiple use of Apps in a lesson flow, this question focused on the idea of workflow between Apps in the classroom, this depended on the type of activity and workflow as the use of multiple Apps can be as separate stages of a lesson, such as using a video on YouTube for some content learning and then using perhaps Edmodo to upload work to the teacher, utilising one App at a time. There is also something called 'App Smashing' which is where the work from one or more Apps is utilised in another and it is more about content creation than consumption with a single App. The responses in the comments section on this question were about App Smashing, differentiation and learning styles. App Smashing comments were, 'I sometimes App smash and integrate a number of Apps to create a finished piece'. A specific reference to Apps was made with the comment 'Book creator with iMovie and pictures from the camera'. Another comment discussed encouraging students to 'present information differently', whilst another spoke about Apps to 'create'.

In question 32 participants were asked whether they considered if using Apps or having the ability to connect to the internet was most important, 58% of respondents indicated that the internet connection was the most important, however when asked which was used more often Apps or websites in question 33, the answer given by 66% of participants was Apps.



Figure 20: Participants responses to: Which of the following social media platforms do you use in your classroom for teaching and learning? (Select all that apply)

For the question on social media, YouTube had the most significant usage (See figure 20), this was followed by Edmodo, Google+ and Hangouts and Schoology, with these platforms being used for document exchange and control, amongst other things in a digitised environment, others mentioned were: ClassDojo, Showbie, Picollage, Kahoot, Classkick, Seesaw, although not strictly social media.

Assessment





57% of the participants indicated that the tablets had impacted the use of summative assessment in the class (See figure 21). There were 27 comments for this question, which included that summative assessments were still carried out with pen and paper. The teachers said that there was a tendency to opt for objectively graded questions, which was not necessarily the best for the needs of the assessment especially in language learning. The positive comments were that the tablets made practical assessments easier, teachers were able to backup evidence easily and accessibly on the tablet. The assessments became less time consuming through auto grading and facilitated immediate actionable feedback and enabled misconception checking, making it possible for formative use of correctly deployed summative assessment. It was easier for students to use a camera to build evidence for a holistic or portfolio-based assessment, students were able to vary interactive presentations, have student choice in final pieces and there were comments that students had more choice for ways of presenting their assessments.





79% of the participants indicated that the tablet had an impact on conducting formative assessment (See figure 22). There were 27 comments for this question including a few negative comments, which were that the benefits of Apps are known but barely used in the class and some formative assessment was still paper based. The more positive comments were that the formative assessment helps with student's engagement and information is easily accessed in real-time, they gain accurate views of students, students explain answers through photographing work and Apps and using software such as Kahoot, Plickers, Quizlet, digital polls and quizzes, these give instant formative feedback on any piece of work, cutting class time, and allowing the targeting of students for intervention where necessary. The software can enable you to trade, grade and comment and students can re-do tasks / formative assessments from the privacy of their own tablet. The tablets also allow for more creativity in the formative assessment and for selfdiscovery, inquiry, 360 views, VR, as well as tablet enabled game-i-fication where review questions can become games. The variations of activities range from Substitution to Augmentation and Modification on the SAMR model.

The positive impact on formative assessment is greater than on the summative assessment, with the integration of Assessment for Learning principals appearing more prevalent.



Logistics

Figure 23: Participants responses to: Has the layout or design of your classroom changed through using the tablets? E.g. movable tables or open connected spaces

62% of the participants indicated that the layout of the classroom had not changed (See figure 23). There were 17 comments for this question which were similar in nature. The teachers said that it was difficult to do group work with an iPad, which are better suited for individual and pair work, as the tablets created an insular class (at times) it also engaged some students, however it also inhibited the shy students this is interesting, as the interview data indicates that the tablet is seen as supporting shy students. Regarding physical layout, the comments were that U and L class table shapes were preferred, however the comments also said that table layout does not matter as much as the proximity to the plug sockets. Comments were made that small classrooms limit space, that groups sit on the floor to work together occasionally, tables are grouped so all visual equipment can be seen and tables are placed in islands. There were also comments that the tablets enabled remote learning in other parts of the school, fields and home.



Figure 24: Participants responses to: Have you ever changed the timings / length of your lessons due to the use of tablet devices?

48% of participants feel that the lesson lengths had not changed (See figure 24). There were 21 comments for this question, which revolved around the ideas that learning and exploring new Apps takes time and connection and download issues affect lesson length. Teachers said they usually teach or request double periods, whereas some said there was no flexibility with set timings and a set timetable, also saying that they need to finish within a teaching period or continue with a break into the next lesson. Comments were made that students working at their own pace affects structure and sometimes students do not want to stop learning, which is also complemented by comments that the tablets enable the learning to continue outside the lesson. Comments also stated that the starter and plenary have become shorter as automation is easier.





73% of participants said this stayed the same (See figure 25). There were 11 comments for this question, some teachers saying that homework was set by school and some teachers saying students were not given homework as per school policy. Additional comments stated, that students were happy to do homework on the tablet as it does not feel like work and that homework was automatically student self-paced. Teachers said the type of homework changed to discussion in an online forum, recording interviews, self-marking quizzes and that there was more time to research and create in class (so potentially less homework to do) and others received more work from students doing activities at home, which was not technically homework.

4.2.2 Statistical analysis of the online questionnaire data

In order to work with the data in more detail the survey results were exported and analysed within SPSS. A bivariate analysis (Muijs, 2011) was conducted, comparing majority demographic variables with the experience and opinion variables. The demographic variables were: age, gender, years in education, years in industry, type of institution, subject taught, time teacher spent using tablets, time students spent using tablets, device scenario, whether a device was personally owned before and if professional development targets were in place. Using each of these variables, the experience and opinion questions were explored to investigate the relationships via the p-value and the phi value within the Chi Square test, where the phi value is the effect size measure for the Chi Square test. It is important to look at both, as the phi value effect size will indicate the strength of the relationship between the variables being analysed, whereas your p-value indicates a level of significance within the data. The complete set of tables are in the repository, detailed in the thesis information at the start of the document due to the size of the data produced in the crosstabulations.

Age

Whilst the p-value was 0.18 for the questions regarding teacher talk-time and age, the Phi value at .753 alongside this low p-value prompted a closer look at the data, which showed that the older the teachers were the more likely their talk-time had decreased or stayed the same, this may indicate a move away from more traditional approaches to teaching using tablets by older teachers. There were no other data results that displayed statistical significance.

Gender

Regarding gender there were no data results that displayed statistical significance with the exception of the question 'Have you ever changed the timings / length of your lessons due to the use of tablet devices?' A significant difference was found in the responses with the p-value as .005, and the Phi count at .499 indicating a moderate relationship between the variables. Viewing the data, we can see that more females than expected had changed the timings and lengths of their lessons, in addition less males than expected had done so, both by an approximate range of 5, this may indicate that females are more likely than men to adjust the lengths of their lessons when using tablet devices.

Years in education

There were no data results that displayed statistical significance.

Years in industry

There were no data results that displayed statistical significance.

Type of institution

There were no data results that displayed statistical significance.

Subject taught

There were no data that displayed statistical significance with the exception of the questions 'To what extent do you agree or disagree with the following statement?' and 'The use of tablets has changed my involvement in the class as a teacher?' A significant difference was found with the p-value at .005, and the Phi count at 1.308 indicating a very strong relationship between the variables, when viewing the data, we can see that computer science teachers, felt that their use of tablets had changed their involvement more than any other subject.

Time teacher spent using tablets

Whilst the p-value was 0.50 for the questions regarding lesson structure and time the students had been using tablets, the Phi value at .791 alongside this low p-value prompted a

closer look at the data, which showed the longer the teachers had been using the tablets the less likely a formal lesson structure would occur.

Whilst the p-value was 0.44 for the questions regarding personalised learning and time the teachers had been using tablets, the Phi value at .808 alongside this low p-value prompted a closer look at the data, which showed the longer the teachers had been using the tablets the more likely that personalised learning increased or stayed the same. There were no other data results that displayed statistical significance.

Time students spent using tablets

Whilst the p-value was 0.22 for the questions regarding lesson structure and time the students had been using tablets, the Phi value at .825 alongside this low p-value prompted a closer look at the data, which showed the longer the students had been using the tablets the less likely a formal lesson structure would occur. There were no other data results that displayed statistical significance.

Device scenario

There were no data results that displayed statistical significance.

Whether a device was personally owned before

There were no data results that displayed statistical significance.

If professional development targets were in place

There were no data results that displayed statistical significance with the exception of the question 'Has your use of personalised learning increased, decreased or stayed the same when using tablets?'. A significant difference was found in the responses with the p-value as .005, and the Phi count at .725 indicating a strong relationship between the variables, when viewing the data, we can see that personalised learning increased significantly where professional development targets were set across the two years of the study timeframe, this may indicate that the narrative of personalised learning coming from the EdTech field may have influenced the types of professional development taking place.

The variables and the pedagogical questions 'To what extent do you agree or disagree with the following statement?' and 'My pedagogy (way of teaching) has changed since using tablets',

were run as a separate SPSS file as it was a key question within the research. The findings for this crosstabulation are as follows. For age, the p-value was .040 with a Phi of .912 indicating a strong relationship in the data, we can see that the teachers in the 32+ age brackets felt strongly that their pedagogy was changing as a result of using the tablets. For gender, the p-value was .023 with a Phi of .620 indicating a moderate relationship, in the data we can see that the male teachers were more likely to strongly disagree, whilst the female teachers were more likely to agree. There were no other data results that displayed statistical significance.

4.2.3 Interview responses question one

As outlined during the methodology chapter, the interviews were conducted in alignment to the research questions and literature review, but with use of a grounded theory approach so as not to limit the potential scope of data collection during the interview process. The following section for question one on pedagogy is grouped in into the main ideas that arose from the interview data, which were **pedagogical approaches**, lesson design and interactions, curriculum, assessment, lifelong / transversal and digital skills.

Pedagogical approaches

In this theme we find teacher-centred approaches, learner-centred approaches with collaboration and personalised learning as well as learning environment-centred practice. There were not a lot of references to teacher-centred pedagogy, this may be to do with the shift to a constructivist education paradigm or the association of technology use with constructivist principles, which was outside the scope of this research. However, one respondent did allude to behaviourist methods 'having their place', which is something I personally agree with and it is interesting to note that this came from an implementer, as teachers might be to swept up in this shift to say anything that may appear to challenge the school culture:

II1 mathematics is a procedural subject which can be taught with drill and kill. Therefore, an automation is a very logical thing to do in maths.

In contrast to teacher-centred pedagogical practice, learner-centred and personalised learning were spoken about ubiquitously throughout the data. In the interviews with **II1** and **II3** they both discuss wanting to encourage creativity and ingenuity from the students, through utilising the various options that are available through the affordances of the tablet.

Personalised learning was spoken about mainly from two perspectives, the first by **TI2** and **TI3** was that students choose their own tasks, structure and added personal touches to the work. Whereas **II4** discussed personalising learning from a feedback standpoint, where they felt more personalisation occurred as the same content was going out and being created, therefore we have personalised learning in creation of work and feedback loops, which fits with non-technological expectations of learning, but which also appears to be enhanced as to the personalisation options made available by the tablet. The interview with **II5** took a more holistic / overarching viewpoint, where personalisation is down to the very specific needs of each child 'they've already implemented the notion of high level, challenging, problem-based learning – personalised learning pathways, proper personalised learning', this could be placed in the concepts of Substitution, Augmentation and Modification on the SAMR model, as the processes are available without technology and the tablets provide an additional tool with which to conduct these activities.

Collaboration in different guises was mentioned across the data, most people commented that collaboration and opportunities for it had improved, as a tablet can be a very insular device this was surprising. It is unknown whether to attribute this discussion to the constructivist paradigm shift or whether collaboration to this extent was genuinely taking place, as it was not observed to a great extent during the lesson observations. **TI1** and **TI3** discuss collaboration using live documents, such as google docs to work with other students and make changes and also experience the collaborative process live, which is Augmentation on the SAMR model, whereas **II4** asserted that collaboration was an incidental by-product of the activity being conducted in class. In the interview with **II5** we see collaboration discussed with 'student agency', 'ownership' and 'continuous learning'. Learning-centred pedagogy is about the environment in which you study and how you interact with that space. The main comments appeared to revolve around the portability of the device, with comments regarding teaching in other spaces around the school, outside the classroom and a workflow that involved other types of technology, usually described as an ecosystem, which fits in with the idea about a suite of devices replicating the world of work.

Lesson Design and Interaction Patterns

The flipped classroom model was looked at quite negatively across the board, with only a few participants who felt it was a successful model of practice. **TI2** indicated that as 'Kids generally don't do homework, we're not really told to give them homework' this may be the reason for the response of **TI3**:

TI3 We all believed it would work, however, we were kind of not backed. We were told not to do it. All of our students had to be present in classes and it basically had to follow a certain model, delivery had to be there and then.

Across the board no-one appeared to change lesson timings, apart from with the younger students where a primary curriculum is by nature more flexible, the school structure in secondary, tertiary and traditional curriculum acted against changing this aspect of the learning. Lesson structures were deemed to be changing, regardless of the presence of technology as seen in the interviews with **II3**, **II6** and **TI2**. Approaches to homework remained standard in most cases apart from a few responses such as the one from **II4** below, which was also mirrored in the interview with **TI5**.

II4 I wouldn't say whole school, but certain teachers, so one of the teachers, the homework would be, I'll be online from this time to this time, that's when we'll do the homework together.

Reduced teacher talk-time and facilitation of learning appeared to be the key elements of interaction between teachers and students in the responses, however the question here is why did this occur? Is it because the teachers were expected to follow this type of pedagogical change or did this occur as part of another process, unfortunately this was outside the scope of the research.

Curriculum

Curriculum content aligned with technology was the most discussed area in curriculum design with varying opinions as to the approach or success. It was felt that technology needed to be embedded into the curriculum, as well as the pedagogy and that the curriculum needed to be flexible enough to make room for the technology use.

TI2 It's like, when you put people on training courses, tech needs to be embedded in it. It needs to be embedded in the curriculum so- so they can actually see it being used. ...The curriculum is too rigid, it doesn't really allow for these, for teachers to be creative with these things 'cause they've got to fit this much content in the lesson, they can't have it run over to another lesson 'cause there's this much content.

This is also reflected in a comment by TI3:
TI3 ...and there's no time within the curriculum as it is to then build-build on it.

Juxtaposed against this comment is a statement from **II7**, who has a very different experience of curriculum adaptation:

II7 So they will all do things like collapse for a STEM day, or collapse for, like I said, Mobile Tech Week. We collapse the entire curriculum for a whole week.

Similarly, **TI4** ensure space within their curriculum:

TI4 So as they progress – we're an IB school – so as they progress through KG 1 through, up the grades and the PYP through to NYP, we're expecting them to use apps to- according to the model, the SAMR model, and to pass on their knowledge and their skills.

II4 felt in hindsight that they should have focused on the curriculum more; however they were very early adopters of technology at each iteration and were pioneers of the technology as it was released, going from iPod touches to the full iPad roll-out as soon as they were released:

II4 I would probably look to focus the curriculum more, to change the curriculum, to support the use of technology – not the technology, but change, update it to be more 21st century.

TI5 felt that by not addressing space in the curriculum for the implementation, it had a directly negative impact:

TI5 I think one of the negative impacts of, um, implementing new technologies or new curriculum or new pedagogies, things like that, is that with the implementation of the iPads at **** the learning outcomes, the pacing of the learning outcomes in the curriculum did not change, which I think it should have within that first year.

One of the most positive attitudes toward curriculum change came from II3:

II3 I believe that curriculums are changing to suit technology. Hundred percent.Coding 10, 15 years ago was non-existent in the Math classroom and if you look at

Math curriculums now, it revolves around coding, there's always- there's sections now that are- that focus just on coding, and that is because of technology...So the adapters of curriculums are trying to- they're taking the curriculum further now to meet the needs of technology; fast as technology having to meet the needs of the curriculum.

One of the most interesting points was made by **II2** in so far as they felt it was an evolution not a revolution that they wanted:

II2 So what we don't want to do is, we don't want to- we don't want a revolution in our curriculum, we don't need a revolution in our curriculum, what we want is more of an evolution and more of a- adding to the curriculum and giving our teachers and our pupils additional tools for their- for their teaching and for the pupils' learning.

Assessment

One of the key aspects about assessment in technological transformation is asserted clearly by **II5**:

II5 I think assessment has to change, has to be transformed, because we're changing and transforming what we're assessing.

One of the major parts of assessment from a top-level viewpoint is attainment and achievement. There was a lot of positivity in the data regarding the progress and achievement of the students, there were also comments on classroom-based assessment, looking at authenticity in assessment and portfolio-based work, whilst some of the data discussed using Apps such as Seesaw and Schoology/Edmodo for online portfolios of work, **II5** discussed the move towards a sea-change in the paradigm of assessment:

II5 So, I think that's what it needs to look like, and it increasingly will, with students producing portfolios of what- what their capabilities are, more holistic portfolios, rather than just saying, I studied for 10 exams, this is what I got, and my score.

Focussing more closely on class-based assessments were the comments about tablet use for assessment for learning, instant feedback, comparison and misconception checking in various interviews, which we saw similarly in the online questionnaire extended responses. Depending on the type and style of activity these would be Substitution and Augmentation on the SAMR model.

Lifelong learning, transversal and digital skills

These attributes and skills were either directly or indirectly addressed in the data and were seen as one of the many benefits for using technology. There were references to a 24/7 mindset of learning in the interviews with **II1**, **II3** and **II5** for instance, as well as references to students returning to see their old teachers and saying that they now appreciate the value in working with the technology, as they gained a set of skills that they have been able to apply in H.E. and work. Although digital skills could be considered an extension of lifelong learning and transversal skills, I felt they should be addressed separately as they are a unique set of contemporary fluencies. In the interview with **II1** they discussed the idea of Digital Citizenship and the teaching of it, as being incredibly important. **TI2** highlights that personal digital literacy skills are not as high in the region as compared to other geographical areas, giving the example 'I can use a computer' means Google search. The interview with **II7** discussed the suite of devices that students were exposed to which enhanced their digital skills, they highlight that tablets are being used by younger students and laptops and BYOD are more prominent in the older age groups.

4.2.4 Observation

The observation data collection took place over 12 lessons with four teachers, three of which were double periods resulting in nine real-time observations. The identifiers are as below.

	Teacher	Subject	Gender
Lesson 1	OBI1 (Observed Implementer 1)	Math	Female
Lesson 2	OBI1	Math	Female
(Double)			
Lesson 3	OBT2 (Observed Teacher 2)	English	Female
Lesson 4	OBT2	English	Female
Lesson 5	OBT3 (Observed Teacher 3)	English	Male
Lesson 6	OBT3	English	Male
Lesson 7	OBT3	English	Male
(Double)			

Lesson 8	OBT4 (Observed Teacher 4)	Science	Male
Lesson 9	OBT4	Science	Male
(Double)			

Table 10: Lesson observation identifiers

Key observations from each lesson:

	Teacher	Subject	Pedagogical	Workflows	Roles of the	Roles of the
			methods		teacher.	students.
			and tasks.			
Lesson	OBI1	Math	Using math	Teacher	Introduces	Students
1		Angles	App to	introduces	lesson.	complete tasks
			identify	lesson.	Supports	in the App
			angles and		students	independently,
			answer	Students	through the	asking teacher
			questions.	apply and	activities	for support
				reinforce	throughout	where relevant.
				knowledge	the lesson.	
				learnt		
				previously.		
Lesson	OBI1	Math	Using math		Introduces	Students
2		Angles	App to		lesson.	complete a
Double		Perimeter	identify		Supports	starter activity,
			angles and		students	reinforcing
			answer		through the	previous
			questions.		activities	learning.
					throughout	
			Using math		the lesson.	Students given
			App as a			task to explore
			reference			complex
			for process			perimeter
			for working			calculations,
						paper

			out			worksheet to
			perimeter.			be stuck in
						book, refer to
						App for support
						/ cues.
Lesson	OBT2	English	iMovie		Facilitation	Students take
3		Superhero	Presentation		of sharing of	turns
		lesson.	Each group		videos	presenting their
			(2-3		through	videos, and
			students)		Apple TV.	watch those of
			designed a			their peers. A
			superhero			vote on whose
			and made			was the best
			an iMovie			took place at
			using a			the end of the
			collection of			lesson.
			images and			
			video.			
Lesson	OBT2	English	Nearpod	Using the	Conducting	Students
4		Poetry		Nearpod App	the lesson	complete the
			Lesson	to conduct	and moving	activities. Some
			covered	the lesson,	through the	pair work,
			literary	with various	activities on	some individual
			techniques	activities	Nearpod.	tasks.
			with	based on the		
			activities	affordances	Providing	
			such as,	of the App.	support and	
			identify,		limited	
			create own		feedback.	
			examples			
			and also			
			identify			
	1					
			within a			

			final stage of			
			the lesson			
			with whole			
			class going			
			through the			
			poem			
			together at			
			the end on			
			the board.			
Lesson	OBT3	English	iMovie		Teacher	Students
5		Poetry			facilitating	working in
			Students		activity and	groups.
			working on a		supporting	
			project to		where	Ongoing project
			create a		relevant.	to discern and
			series of			represent
			tableaus to			through
			represent			tableau and
			key images,			props the key
			themes			images from
			ideas from			the poem and
			poems.			produce an
						iMovie as the
						final product.
Lesson	OBT3	English	Internet	Researching	Teacher	Students asked
6		Newspaper		examples of	conducted	to find
				tabloid and	this lesson.	examples of
				broadsheet		each on the
				front pages.	Introduces	internet with
					the concept	the iPad.
				Brief activity	of different	
				ten minutes	types of	Annotation of
				with tablet	newspapers.	worksheet
				during initial		given out
1	1	1	1	1	1	1

				stages of the	Teacher goes	comparing the
				lesson.	over	features of
					features,	both styles.
					similarities	
					and	
					differences.	
					Discusses	
					sensational	
					language.	
Lesson	OBT3	English	Nearpod	Using the	Teacher	Collaborate
7		Romeo and		Nearpod App	supporting	board: Key
Double		Juliet	Recap lesson	to conduct	around the	characters.
			for work	the lesson,	room during	Followed by
			done in	with various	the	discussion.
			previous	activities	activities.	Collaborate
			academic	based on the		board: Key
			year.	affordances		events.
				of the App.		Followed by
						Draw it timeline
						of the events in
						the story.
Lesson	OBT4	Science	Teacher		Teacher	Each group
8		Cells	input.		facilitates	researches an
					the technical	aspect of cells,
			Jigsaw		aspect of the	different types,
			activity		jigsaw lesson	parts,
			Research on		including	functions,
			questions.		assigning	organisms,
			10-15		groups.	respiration,
			minutes			photosynthesis.
			spent on this			Groups then
			aspect of			split up and one
			the lesson.			'expert' in from
						each question
						forms new

					group. Students
					create
					(manually) a
					poster display
					information
					about cells.
Lesson	OBT4	Science	Internet	Teacher goes	Student-led
9		Revision	BBC bitesize	through	activity.
Double		Earth		resources on	
		Science.		BBC bitesize	Students given
				with whole	topics to
				class.	prepare an
					iMovie to be
					used for
					revision
					purposes. The
					underlying idea
					to 'teach'
					someone who
					doesn't know
					anything.
					iMovie to be
					finished for
					homework and
					added to a
					library of class
					resources.



During the lesson observation phase I was able to do less observations than I would have liked, this was due to access issues, however I viewed the same types of lessons in each of the observations. The resources utilised on the iPad were mostly: iMovie, Nearpod, the internet and a math specific App which was seen during the math lesson observations.

As seen in the table above the math lessons utilised a specific math application for the majority of both of the lessons. It was incorporated as a tool to question the students based on

their current knowledge and also as a resource to explore ways of working with more complex perimeter questions, so the students had formulas and solutions to hand; during the lesson the teacher explained to me that she was beginning to remove the scaffolding for these types of questions. However, these activities were very much at the level of Substitution on the SAMR model and the questions and resources could have been given on paper, providing the same learning experience.

The English lessons provided a mix of activities with the iPad, with two lessons utilising iMovie, two using Nearpod and one using the internet for research for a short amount of time in the lesson. The first lesson I observed with **OBT2**, was students presenting iMovies they had made based on a superhero character they had created. The videos were the culmination of a unit about genre and they had been looking at narrative and characterisation, including tropes and stereotypes and had briefly touched upon colour psychology and 'mise en scene'. The video had to include an overview of their character, their superpower and backstory and talk about how their character was developed using what they had learnt in the unit, some of the students chose to create villains and sidekicks so this added a wider focus to the presentations. At the end students voted for the best video, I saw this as a missed opportunity for some good rubric work with peer and self-review. Although the videos were good to watch, it is difficult to place the activity highly on the SAMR model as much the same could have been achieved with presentations, posters and props, however the digital skills (which were not part of the scope of this research) were being improved. The second English lesson I observed, again with OBT2, utilised Nearpod throughout the lesson with a whole class activity at the end. The activities could have been done with pen and paper, so they were mainly situated at the Augmentation stage of the SAMR model, however there were more opportunities for whole class feedback and sharing, than would have been available without the use of the tablet coming from the 'identify' and 'create' tasks within the lesson. The gain in the use of formative assessment is what we see replicated in the other data. The third English lesson I observed was with OBT3, again this was a lesson about poetry and the students were working on an iMovie project, to re-create key or significant imagery within the poem and to see if they could also identifiably re-create the story or narrative of the poem. Using iMovie on the tablet certainly simplified the task with regards to time and aspects of creative affordances, again increasing students' digital skills, however the learning objective could have been achieved with camera and PowerPoint, so the enhancements were there but minor and mainly linked to the use of sound in the videos. I did observe a change to the typical lesson, where this lesson was a continuation / extension of the learning activity to incorporate the use of the tablet. The fourth English lesson with **OBT3**, utilised the tablets for a very short part of the lesson. The students used the tablets to search for examples of tabloid and broadsheet front pages for around ten minutes. I felt this part of the lesson could have been done

better with students bringing in and comparing examples found before the lesson, the use of the tablet did not enhance the lesson. The last English lesson observed was a double lesson, again with OBT3, this was an interesting lesson as it was the beginning of the GCSE work on Romeo and Juliet and required students to recall what they had learnt the previous academic year, when they had first been introduced to the play. The lesson featured generative learning tasks as well as pair, group and whole class learning facilitated by the use of Nearpod. In the first activity students were asked to contribute individually (with discussion allowed) to a collaborate board where they named key characters, they were asked if possible to share 1-2 pieces of information about that character. Once this activity was complete the teacher shared the collaborate board and the class discussed what was written, checking the accuracy of the content and from this they made character profiles in their books. An identical activity in flow was then carried out but this time key events from the story. Once the board had been shared and discussed a whole class activity was then conducted, where a timeline was constructed on the board by students taking turns and this was then recorded in the student's books. Using Nearpod the whole class teaching element was enhanced through the sharing and viewing of all contributions and the teacher was able to misconception check on behalf of the whole class where necessary.

The final two lessons are the science lessons with **OBT4**. The first lesson that was conducted was on cells, in this lesson the teacher utilised a 'jigsaw' structure for the learning and the iPads were used for 10-15 minutes of internet research, this enhanced the lesson regarding ease of access to information more than that contained in class text books, and students were able to sift through the information themselves, again adding to their digital skills. The idea of ease of access to information links to the data from the interviews and surveys. The second science lesson (double) utilised iMovie, the teacher introduced sections of BBC bitesize (Earth Science) displaying it to the class as both source and example, then the students had to begin planning for creating an iMovie that would be used by the class for revision purposes, as this was a double lesson and when the teacher was happy with the plan, the students could begin to create the movie asking the teacher and each other for assistance, the actual creation of the iMovie was tasked as homework and the teacher worked with students to ensure the prep work completed during the lesson was accurate.

4.2.5 Summary of findings from question one

Across the three data collection tool findings we see that fundamental pedagogical practice has not changed in a sense of completely shifting paradigms, what we do see are core areas, ideas and themes about pedagogical practice with tablets emerging from the data. The core areas or themes which are replicated throughout the findings are about pedagogy becoming more **student**

led, inquiry-based and personalised and the activities becoming more about *content creation over consumption,* from the data we see that teachers were beginning to view themselves as facilitators of learning and 'guides on the side'.

Further to this, we see wide-ranging discussion of the *formative* assessment aspects of instant or live feedback for action in real-time, that is supported by the devices as well as the functionality of the devices themselves impacting on pedagogical choice and usability.

In reference to the SAMR model, the data showed that most of the pedagogical changes discussed fell into the categories of Augmentation and Modification, with augmentation taking place in formative assessment and modification in the production or creation aspects of the teaching and learning. In this instance it is important to note that augmentation of the formative assessment may have more impact on the learning experience than the production or creation aspects, this was outside the scope of this research to explore. The next section outlines the findings from research question two.

4.3 Research Question Two: What are the influencing factors on the pedagogy of tablet use in this context

Research question one strove to look at whether pedagogy had changed. Research question two explored the why and the how of the data from question one. The findings from each method are presented, followed by the key findings which emerged from both research questions and are then summarised.

4.3.1 Online questionnaire responses

Question one was presented in two sections 'concept and opinion' and 'practical and logistical', similarly the online questionnaire questions - how, why and influence, are divided below into two areas 'external or management factors' and 'internal (teacher) factors', in some cases there are overlaps between the two.

External or management factors



Figure 26: Participants responses to: Which tablet device do you use? Please select from the below.

84% of participants indicated that they use an Apple iPad as their device (See figure 26). Teachers were asked how long students had been using the device as a learning tool, there was an array of answers as can be seen in figure 27 below.





Asking how students were provided with the tablet by the school, we see an array of answers for these scenarios, as can be seen from figure 28 below. The full question options can be found in Appendix A question 12.



Figure 28: Participants responses to: Please select from the scenarios below the one that best describes how the students are provided with tablets in your school



Figure 29: Participants responses to: Did the integration of tablet devices form part of your professional development targets, for either the last academic year (16/17) or this academic year (17/18)?

50% of the participants had the use of the tablets integrated into their professional development goals (See figure 29). The next significant selection was 'neither' with 27% of participants selecting this option.

Internal teacher factors



Figure 30: Participants responses to: Did you personally own and use a tablet or smart device before you started using one in the classroom?

73% of participants indicated that they personally owned a tablet or smart device before using one in the classroom (See figure 30).



Figure 31: Participants responses to: How long have you been using a tablet as a learning tool in your classroom?

46% of participants indicated they had been using a tablet in the classroom for four or more years (See figure 31).



Figure 32: Participants responses to: What impact has the tablet had on your workload?

Figure 32 shows a mixed response to this question. 38% indicated it had increased, 26% decreased and 36% stayed the same. Comments on this question included: learning how to use the device and Apps takes time with workload increasing when things go wrong, that BYOD takes time to learn, that professional development and adapting lessons takes time, that the beginning of a project has the most impact on workload and in general finding ways to integrate the tablet takes time, needing research and much preparation. Positive comments were that paperwork was reduced, there was better organisation of lessons and resources (which enabled a focus on teaching and learning) and there was a decrease in workload (when Apps were given by the school which was not often the case).

Overlap external and internal



Figure 33: Participants responses to: How did you learn to use the tablets for designing learning sequences / activities? (Select all that apply)

77% of participants indicated that they curated their own professional development through being self-taught, with a spread of other professional development options (See figure 33). 57% of participants experienced professional development organised at a school or institution level, meaning that 43% of the participants had no school mandated professional development in this process.



Figure 34: Participants responses to: Do you choose the Apps or websites you use or are they assigned to you by the school?

61% of participants indicated that the school assigned Apps and websites and that they were also able to personally choose the Apps and websites used in the classroom (See figure 34). When questioned on which core applications and websites they used, the participants responses were made into the word cloud in figure 35 below, with the size of the word indicative of prevalence.

Socrative Nearpod google Book Creator Kahoot iBooks Edmodo Pic Collage Explain Everything iMovie YouTube Keynote Pages Quizlet

Figure 35: Participants responses to: In regards to tablet based lessons which core Applications (Apps) and websites do you use? Please list below

There were three additional questions that were asked as part of the online questionnaire, which are shown below that relate to attainment, achievement, engagement and the novelty factor.



Figure 36: Participants responses to: To what extent do you agree or disagree, that the following have been enhanced in your classrooms, due to the use of tablets?

There was an overall lean towards 'agree' regarding the enhancement of attainment, achievement and engagements (See figure 36). In the question regarding novelty factor 65% of respondents who answered this question (38) feel that there is a novelty factor involved in the use of tablets (See figure 37).





The final question asked 'If there is anything else you wish to add or consider important regarding the use of tablets in your classroom, please comment here'. The full responses to this question are below:

- We need better investment by schools for Apps and software to be effective.
- Finding a balance i.e. preserve the book and not lose the library method of exploring new information for academic purposes.

- I feel it has to be policed, I have noticed a small percentage of students will try to use the tablet for Netflix e.g. when they think I am not looking.
- Students often get distracted by using social media, during class time.
- Sometimes can be a hindrance with devices not being charged, internet problems, students playing games.
- For me the use of technology is only complementary learning.
- That devices in classroom present new challenges to teachers but they can be overcome with effective training. Training is a serious issue as it is still mostly technical and not pedagogical. Teachers also need time to buy-in and digest what is being asked of them.
- I found one of the issues with using this technology I never the classroom is that you need the support, security, and monitoring tools in place to appropriately use this.
- If the teachers are not 'on board' with the introduction of the technology, then it will probably fail. As mentioned above if there is no free time for the teachers to get to know how to use the technology then it will also fail. You cannot just throw a tablet or laptop at someone and expect vastly different outcomes, it is a tool just like a book is, it doesn't replace a teacher or good pedagogy.
- Better to be paper free.
- The book as I am a fan of blended learning.
- tablets are only tools and they are not accessible to all.

4.3.2 Interview responses question two

The data collected for question two during the interview was more copious than it was for question one, but not by design this may be indicative of the lack of change in pedagogical practice and more about the importance of 'why' tablets are being used the way they are and 'influencing factors'. The interview responses for question two are presented under the following themes, which arose from the data during the refinement and intermediate coding process (as outlined in the data analysis in the previous chapter and further detailed in Appendix H) *change, leadership, devices, operating systems and models.*

Change

Over the course of the interviews a perspective emerged that change was being driven at a teacher level by individuals or small groups of people, but from other perspectives it was being driven by leadership. In none of the interviews conducted did there appear to be an equilibrium or 'perfect storm' of leadership, teacher, student and parent 'buy-in'. It appears to be either the

teacher or the management pushing the agenda and both have their problems and issues. Change does have a cross-over with leadership, however it also spans across teachers and students. Aspects that cut across most of the interviews, either explicitly or implicitly, were the concepts of 'buy-in', 'value' and the 'why' of technological integration.

II1 It's where we have people that have come from a very different context of education, they've probably been trained 30, maybe 35 years ago; consequently, that does impact upon their willingness to engage with technology. Some of them. Don't get me wrong, some of them are absolutely amazing and they see the value and they want to go straight for it. Others are, "I don't get this, I don't want this in my school"....Usually the easiest way to win them over is show a success story in a similar type of school.

This is problematised in the interview with **TI3** where it is said - there are not enough largescale change stories from schools or whole systems to help with the buy-in process. On the other hand in the interview with **II6** we can see change management strategies delivered effectively:

> **II6** ... and then through the technology department, who then, we started to buy, sort of, banks of iPads – banks of iPads for particular departments. And again, it was- we asked for departments who would like to trial that, "Ok, so we're going to buy you 30 mini iPads, ok, but obviously with that you've got to take it forward and actually use them with the students and then feedback". So, the History department, and also the Science department, said "We'll do it and we'll take it on board", and so – also we have ICT reps, or technology innovators, who – not paid roles but it was their responsibility within their department to drive forward technology development.

A quote from **TI3** below, shows what happens when the opposite of the above occurs and the negative impact that this can have on the front-line staff delivering lessons using the technology:

TI3 the thing about in institutions where iPads are enforced, ok, or kind of, pushed upon people. People can feel rather negatively about them, ok. It's sometimes very hard to convince people of some- some positive aspects of the iPad, sometimes people make their minds up, they go, "Oh yeah, it's for playing games", "Oh, I'm, you know, it's too fiddly to use", or "I need a keyboard", or they find every excuse under the sun. This point is elaborated on in the interview with TI5:

TIS Uh, there was very little buy-in from the staff, it was, like, maybe a week prep time, being told "This is what's going to happen", and then who are you- um, need you to identify some people, you know, who will buy in to this quickly, and they will become the change agents for your campuses, and then you will roll it out and get the buy-in- the buy-in from the teachers after it's already been rolled out and implemented into the school...So while the pedagogical terms were put into place, the actual pedagogy I don't think- it took a little longer to actually implement. So the terms were being used but they weren't necessarily being implemented...There needs to be some type of buy-in, um, even if it's fake buy-in but there needs to be- or false buy-in, there needs to be some type of buy-in and not just, "You're going to go do", and a lot of teachers, they were shocked that it was only there for 6 months, and some of them didn't really didn't buy into it until 4 months in, so it was- their students didn't get the same exposure as some other students did.

In the following quote from **II4** you can see the technology was specifically used to target teacher talk time, after having tried to move the furniture around to support a more collaborative working environment:

II4 Yep, so we wanted to, we wanted to – when we were walking around the classes, we noticed that it was very traditional teaching style, as in high teacher talk time, teachers were lecturing to the students, students were just following but didn't really seem to be engaged in the classes. We tried to move the tables around to start with. So, we tried shifting the furniture in the school but then we found that even though the kids were sat in a different position, they still just had their necks turned, looking towards the board. So, the head teacher at the time wanted to find a way to change that, and we felt that technology would be the driver for change for that.

II4 also mentioned acceptance of change being more age-related, echoing the sentiments of **II1** who said that teachers who had trained '30, maybe 35 years ago; consequently, that does impact upon their willingness to engage with technology'.

II4 They were the ones where, if we planned a lesson and it went completely wrong, they weren't fazed by it, it was one of those things where it's "Ok, it's gone wrong, no

problem, we'll try again next- next lesson". Yeah, I don't know what made them – young?

A different perspective on the reticence to use new technology is the concept of fear of failure, this was outside the scope of this research, but it would be interesting to pursue this idea from both a personal and an organisational expectation perspective:

II2 to a certain degree. And then we have the other staff who are- who haven't had the experience of using it before, and then you get the splits of those staff between the ones that are very keen to get started and use it cause they see the benefits, and obviously you always get some staff who are reticent in terms of whether they're afraid of, you know, I suppose the- the main- those kind of staff you mainly get the staff who are afraid of fear- of- afraid of failing.

II2 mentions the 'why' of implementation:

II2 No, no that's an interesting one, and the question is- I mean, if we take teaching and learning rather than pedagogy to start off with, so we're a-like I said, a very high performing school, and one question would be, "Well, why do you want to change anything?" Cause there's a risk involved in any kind of change, you know, if we- if weif what we're doing now works and our exam results are, you know, the best in the Emirate, etc. etc. etc. why would we want to change it? And why would we want to put in a disruptive element which has the potential to do the opposite? And actually, you know, be- and- and- so- so the question is well, what- always comes back to the why. Why do we want to have this technology? What- what is- what do we want to achieve with this technology? So, we have- we have a vision for teaching and learning, which runs through.

Leadership

Interestingly although not surprisingly, most comments surrounding leadership came from the implementers. The majority of comments that came from the teachers were discussing leadership in a much more fluid way and often in a negative light. From a management perspective there was a general feeling across the interviews, that leadership was an imperative part of the implementation of the tablets or accompanying digital transformation and from the perspective of a senior organisation implementer it can be the biggest barrier:

II1 the one thing we find that's the most critical element of digital change in any school, is the leadership. If the leadership does not want to buy into it, you are not going to win. That's the number one piece of the jigsaw.

Part of the implementation from a management perspective is proper change process management, using exemplar success stories was seen to be an effective change management tool when addressing the stakeholders, such as teachers and parents. The leadership can also have a significant impact on the systems that are used as a preferential choice. In the interview with **II7** we see a comment about one principal being a 'big Microsoft guy', in this interview there was no indication of any rationale for the dropping of Google and moving over to Office 365. The idea of leadership having an effect is discussed in a negative light, in the interview with **II6** it was stipulated that the leadership of the school lacked expertise and this affected the implementation, they indicated that someone who is 'tech savvy' needs to be 'at the top'. Looking at pedagogical change we can see where management actively blocks the use of new pedagogy, in the interview with **T13** it was said that management made it very clear that the flipped classroom model was not to be used, despite the desire of the teachers to try it.

Across the data, the vision from leadership appears to be disjointed in places and detrimental in some areas:

TI2 So it's that argument, tech will only change in the classroom if the Administration or the hierarchy, actually understand what is going on and support it more than, "Oh, here's a device", or, "Here's an app we want you to use", and actually understand what- what is happening, because they don't.

II7 the lack of long-term vision back then is one of the things that's hurting us the most now. And the fact that we were early adopters, 'cause we've now got a load of – in both the Primary schools, all the teachers have got iPad 2's. Which won't run a lot of the newer stuff. So, the iPad 2, so they've just updated Classroom, we can't run that, you know. Clips has just come out; we can't run that.

If you compare the approach of the institutions in which **TI7** worked, in contrast to the Digital Ecosystem that **II5** and **II1** speak about, you can see a stark contrast between the two:

TI5 *Um, but, the use of social media, there were some schools who were happy with teachers using, um, Edmodo, and YouTube, videoing their students, having the*

students use QR codes and things of that nature, even some students would allowsome schools would allow the school- the students to use Twitter, and online WhatsApp and those types of things. And then there were other schools that were not. So, there was, um, even though it was delivered from above that we could do all those things, it actually came down to a campus by campus requirement, sort of things that the students were not allowed to do.... And it went from being a roll-out for all campuses, to actually being tailored, campus by campus.

II5 the main, sort of, function and purpose of my role right now is to implement a digital strategy across those schools in five key areas, which are: the digital ecosystem, which we're not responsible for in terms of the technical build but we're advising on – so that is the technological basis that will support the transformation, so that is the first element; then there's also the- the- the drive towards improving the digital leadership and change management capacity at our schools, to make everything happen at a local level and be sustainable; there's the empowerment and support in terms of professional learning, point of need support, monitoring, you know, involvement of key partners and so on to make sure that happens; and then the real, sort of, the real practical driver behind all of that is- is something we call the School Digital Transformation Action Plan... we produced the- a very detailed, 100+ point digital transformation action plan for schools, which covers everything, from curriculum policy, the digital ecosystem and recommended tools, which are not exclusive but it's the core, you know, everything from curriculum design to parent engagement, use of social media, professional learning, policies around, you know, the- the legal requirements of using tools and systems, pedagogical best practice – it's pretty much everything, it's the A to Z of digital transformation. And that's based on global research from Australia, you know, the U.K. Italy and the States.

In the interview with **II1** which looks at accountability and responsibility, we can see implementation integrated with performance management, they further stipulate that unless the staff involved (at all levels) become skilled digital practitioners, there will be a 'forced attrition'. Similarly, with the interview with **II1** we see the same idea of 'forced attrition' in the interview with **II4**:

II4 because the school was moving forward so fast that, if this wasn't for you, people tended to leave and go somewhere else. There was quite a high turnover, yeah. But then you could argue that what do you do in the future when all the schools, if they

go this way, there will be nowhere to go, so then what happens then? People are going to have to learn or find a new career.

In the interview with **II4** we see a more laissez faire attitude towards monitoring and accountability:

II4 So we used to do learning walks where members of the SLT and also the technical team as well, would just walk around the classrooms and come back and do, like, a, it was an informal report of how many- when were the iPads used, what did they see, what did they see happening. In terms of monitoring, we probably didn't do enough to monitor the use of the iPads, it was just through wandering through the corridors and seeing that they were out.

Further to this is a comment that could be construed as the Hawthorne Effect, which is a description of the participants in a study who may alter their behaviour based on being observed:

II4 I think, again, because there was a focus on technology, more people were visiting lessons, that probably- as a teacher, I know that, even if the technician's going to be stood in my lesson looking at technical issues, I'm probably going to make sure that my lesson is good or outstanding. Yeah, so whereas the unions might say you can only observe three times in a year, but doesn't stipulate about the technician being stood in the room, or a visitor from outside, coming to look at iPads, so probably, the teachers had to up their game because of that.

In the interview with **TI5** we see the concept of monitoring reflected in the change of the students, as they thought they were being watched more closely due to the use of the tablets, even though this was not actually the case:

TI5 ...they saw the iPad more of what we would view as Big Brother, but they saw it as we were tracking what they were doing at all times. So, we got a lot more homework back, we got a lot more activities and projects and things completed because they thought that they were being monitored. We weren't monitoring them at all times, but they thought they were being monitored at all times.

II5 talks about strategy from a top-down approach (albeit this is across multiple organisations) however it is worth considering that without the upward flow, the impact of the

early adopters could potentially be lost. In addition the sharing of best practice appears to be a missing element in all the interviews I conducted (with both implementers and teachers):

II5 Because it really is top-down, we're not concerned if it looks too top-down because schools have asked for this plan.

Cost is an important consideration in any part of school organisation. The private schools in the U.A.E. run using a business model with profit considerations, with the government investing in government schools and projects, such as investment into the education reform. Financial considerations are an important part of the process and can affect the scenario in which the rollouts operate, for example **II1** states that parental income affects device choice in a BYOD scenario and as they operate schools that range from 1,500 to 40,000 USD a year, the amount parents can afford for a device can fluctuate. **TI2** states that organisations are not willing to make a 'massive investment' in something unknown, we have seen that working without piloting or proof of concept that this can act as a barrier to success. Situations like the one outlined by **TI2** appear to be common and this can have a negative impact on teacher (and student) perception; if we refer back to the TAM model, perceptions and ease of use are highly influential factors in the success of any technology implementation project:

TI2 They'd never done this and then they threw kids in the room and said, "Ok, now you're going to do a test online", half of them didn't he know how to download an App, never mind the forget that they'd forget their Apple ID passwords or passwords to stuff all the time...So that became part of the issue. And that was a failure, and I think about after 30 minutes of them realising it wasn't working, they shut it down and never did it again, um, for the rest of the academic year.

II7 talks about a different kind of pilot:

II7 So, it was in March, the following March, we held this Mobile Tech Week... So, we allowed students to bring their own iPads from home for part of that week, and basically for this one week, we delivered the entire curriculum through the iPad.

II7 talks about a way of scaling and sustaining the technology:

II7 ...and we didn't just go and buy loads of devices, simply because we couldn't go buy- go buy loads of devices. And we built it up slowly.

The approach to this implementation focused on starting small and looking at direct classroom use, as with **II6**:

II6 So we did quite a bit of training with staff first and piloted that, we felt it was something you start small with, get your early adopters on board, and then see what we can drive- drive through.

II4 discussed the effectual difference between two types of roll-outs that they carried out in school:

II4 I think the approach of- I mean, in that school we did, teachers get the iPads, then the class sets tests, then, test sample students, and then a full roll-out, that worked well. Previously we didn't do that. Previously in my school before, we gave the teachers and the kids devices at the same time, which didn't work as well, because the teachers weren't confident to- to deliver with it.

Looking at sustainability we have a couple of different models that appear through the interviews. In the multiple devices approach, we have progression from tablet to laptop based on the age of the students, in another interview one organisation considered a complete switch to laptops despite teachers having made an adaption to using tablets.

TI5 ... it doesn't seem to be the flavour of the month anymore, using tablets in education, anyway. Even my organisation is kind of considering using laptops now, as opposed to tablets, so switching. I'm not entirely sure where the change, you know, originated, or who determined the change in policy and why. Since- we- we actually as teachers, as practitioners, we felt it was working, we were starting to get a lot out of using tablets, and now, it may, even come to an end.

The interview with **II1** highlighted the main barriers with infrastructure which are replicated across the data, if the infrastructure is not implemented properly then the roll-out cannot be successful as it impacts on too many other areas, such as teacher use and parental support.

II1 I should throw in: Wi-Fi...[also] MDM was not an option until very, very recently in the U.A.E. So- sorry, VPP – my apologies, not MDM, VPP; so, prior to that, that's a-that's a challenge.

Devices

The device choice and its affordances were discussed throughout the data, it showed a significant lean towards the use of Apple iPads and in a small number of cases the Windows Surface device. An idea emerged that tablets should be used for the younger aged students and then as they progress towards higher grades (in high school), they should move to a more traditional laptop device. In the interview with **II7** they discuss moving from a laptop to a Windows Surface device as it offered better functionality:

II7 I mean the tagline for the Surface is, "The tablet that can replace your laptop". So, I've got full Windows functionality but then I can also take it off and be mobile with it, and I've got a- I've got the camera and- and the video recording tools that you get from an iPad. ... so, after trying various things, and- and particularly because of the tight integration with Office 365 and OneNote class notebooks, the decision was made at the highest level that- that this was the way that we were going to go, which was kind of unheard of, anywhere. We've had many people tell us, yeah, that's blatantly not going to work, this is not going to work, you can't be Apple in the Primaries and then switch to Microsoft in Secondary. And we went, "Well" Why not?

II7 highlights the original choice to move away from traditional laptops in the classroom due to the unreliability of a device:

II7 all these Chro- Netbooks, were sitting down the side, and he turned around to me and he said, "Can I ask why nobody's using those?" and I said to him, "Because they're unreliable, because the kids have had their fingers burnt, metaphorically, too many times, so they don't, they don't want to use them". I said, "What they like about the iPad is they open it up and it's on. They open it up and it works." You know, it works straight away, there's no- there's no wait, there's no delay.

Laptops are also discussed in the section on age related aspects of device use.

In the interviews we see a range of comments replicating those that were discussed in the literature review, regarding the functionality of the tablets as well as referring to others not mentioned previously:

II1 the interface is very simple because you don't you don't have a keyboard or a mor a pointer... it is not necessarily things you can and cannot do, you can pretty much do most things on other machines, it's just that the flow is more simplified and stripped back on a tablet.

II2 ...tablets have sort of going along the ability to have a multi-function device... you can do everything on one device.

Portability and mobility were the most discussed affordances of the tablets and these were considered a major factor in the selection and use of the device:

II1 ... its portability, is a big one, you've got younger users, you can't expect them to lug around a 3-kilo computer with huge battery.

II2 ...it's mobile and you're not restricted to a particular classroom.... portability is a major factor, so you can start to actually extend students outside of the classroom.

Accessibility was addressed in a few ways within the responses, as in the interview with II1:

II1 ... the accessibility to sound recording and video recording, in a very simple, compact form is great.

Increased accessibility for achieving curriculum outcomes was also discussed, as with the interview with **II3**:

II3 *I* think it's the most important thing, that you have a class of 25 students and there's three different methods being used around multiplication or long division.

The use of tablets with students who had SEND was not discussed as much as I had expected, this is perhaps due to the issue that SEND is not as ubiquitously addressed in the U.A.E. as it is in the U.K. this is for cultural reasons. However, during the interview with **II7** they discussed how they were imminently about to host an assisted technology event, to address the needs of all learners including those with SEND. The tactile / kinaesthetic aspects were mentioned mainly in the interviews with teachers, reflecting perhaps their closeness to working with the device. The tactile nature of the device was always spoken about positively, the idea of

intuitiveness and the simplicity of using the device was mentioned across the data, which can probably be summed up in the statement by **II7** regarding the intention of the inventor:

II7 Steve Jobs designed it, and openly said he designed it, because he wanted a oneyear-old to be able to use it.

The idea that the tablet should be like any other tool at the teacher's disposal was shared across the data. **II7** indicated it should be like a 'pair of scissors in a digital pencil case'. **II6** and **II2** indicated the same in that it should be an 'invisible tool'. There was a mix of responses regarding novelty, some see the novelty factor as being prohibitive (**II2**) and other participants felt that with the constant change in Apps and software, there was always something new to explore or work with on the tablets therefore it negated the novelty factor (**II6**).

Operating systems and Platforms

The ability to be able to utilise an 'ecosystem of connectivity' appears to be an important consideration when selecting a device and operating system, as ease of use is a contributing factor to a school's decision for implementation, this is a good example of the TAM in action. One of the things that was notable from the data was the fact that Apple offered in-person training with the purchase of a collection of devices, whereas it was never mentioned in any of the interviews if Microsoft offered the same. The participants discussed the status and training recognition that could be awarded, for example ADE (Apple Distinguished Educator), the ATP (Apple Teacher Program), MIE/E (Microsoft Innovative Educator / Expert), MCE (Microsoft Certified Educator), however Google Certified Educator training, or similar was not mentioned in any of the data. The uptake of these particular accreditations would be a further interesting study. There was a fair amount of strong sentiment in the Apps v Connectivity (Internet) area, each of which can be summed up by the interviews with **II1** who felt that connectivity was the most important and **TI2** who in contrast felt the Apps were more important:

II1 One of my concerns is software companies get acquired, they get bought out, they get – they suddenly discontinue things. Google is notorious for suddenly overnight [clicks finger], 'I don't want to do this anymore, I'm cutting the product without telling you'...Consequently, if you are married to that App, and that's one of the ones that's cut, your whole pedagogical system collapses.

TI2 The Apps are definitely key. From working at a school that has quite questionable reliability of internet, and having worked in places where the internet isn't always stable or consistent or- or existent, uh, it's er- a lot of Apps you can use offline without it, so then they can download them at home and they can- you know, you can still use them in class.

In the interview with **II1** we can see where the preference for tablets for younger users is justified through accessibility 'So, the reason we might bring a tablet in is, a tablet is brought in for our younger users, to reduce accessibility problems' further reinforced by **II5** who stipulates 'We are very sceptical about iPads and tablets beyond the age of about 8', this fits with the pattern identified by **II7** who discusses using a suite of devices, beginning with the tablet and then integrating laptops, as the students move through school and need to perform more complex activities. There is a distinct theme that tablets are more suited to younger students in this research, this fits in with the lack of research at the middle / secondary age group generally.

Models

When considering the theories and models that go along with the use of technology, neither the implementers nor the teachers appeared to work too closely with them, this could be for a few reasons. SAMR is very closely linked to Apple and if you are not an Apple school, then your potential exposure to this model and its uses may be lessened. TPACK was even less known than SAMR as an educational model. The concept of digital natives is more ubiquitously known amongst those who use technology, even though this, like SAMR, is moving out of fashion and making way for other models such as resident / visitor.

SAMR

The SAMR model was discussed by most of the interviewees as the model used in school for the implementation, this would go hand-in-hand with the fact that most schools used the Apple iPad and Apple used the SAMR model as part of the push for iPads in education. However, there was a very mixed view of the use of SAMR and its usefulness or relevance. In the interview with **TI2** they discuss the inability to be able to use the model to look at impact or quality of the implementation. Conversely the interview with **II4** showed the more positive aspects of it. Interestingly both **TI2** and **II4** are ADEs (Apple Distinguished Educators). **TI5** talks about what happens when SAMR is introduced, but perhaps not in the correct way causing concern or an aspect of fear:

TIS I think the big thing that stands out here is the flipped classroom and a lot of the terminologies and the things that are here, the SAMR and things of that nature, they are, um, words that are used from the teachers' standpoint or someone coming in and imposing on the teacher that 'We're going to start doing flipped classrooms now, and you need to do- make sure you have SAMR into your lesson plans.

As mentioned the use of the SAMR model is waning, as the use of educational technology has become more complex. **II5** states that 'You know, even SAMR is a bit of cliché these days, the transformation piece, you know, the redefinition, wouldn't have been possible without technology'. Despite the negative opinions of SAMR in the data, **II7** had a very positive view of it and incidentally came from a 1:1 device school, using iPad in lower years and Windows Surface in the upper years of schooling for more complex work, including word processing and computing skills and coding. **II7** goes on to talk about SAMR not being a ladder, in much the same way as Bloom never intended his taxonomy to be viewed as a ladder, the same misinterpretation of purpose has perhaps occurred with the SAMR model. Leading up to my meeting with **II7**, I was also under the impression that SAMR was a ladder and 'redefinition' was the ultimate goal, hence the reason it formed part of the questions. However, the people who have been working with SAMR (particularly in the ADE community) have done so not as a ladder, but as a marker of a particular classification or taxonomy of pedagogy (none better or worse than the other). In the interview with **II6** we see the use of the SAMR model as part of the training.

II6 ...and we did, we did quite a lot of work at that, actually, at my last school. Rolled out the SAMR model, it was introduced at the start of the – we have a professional development launch at that school within the first few weeks, and that was launched. And also, we had, or we devised a toolkit for the different, for the S and the A, M and the R, and sort of strategies that we could use. And lots of modelling. I think we – I'm in contact with Apple at the moment about our one-to-one project here – and the training I want them to do is, I don't want them to come in and show us 20 Apps and then- then go away, but actually over a sustained, even number of days, if they modelled that, they could come in and show us, or show our staff, you know, how it could be used to drive forward pedagogy, sweep through the theory of that, show us it, and then actually model it in the classroom with kids as well, I think. And also come back, because often with workshops you're like, "Ooh, this is great" but if somebody, if I know as a teacher, you're going to come back and check on me in 2 months as to what I've been doing with that iPad over the next, in the last 3 months, then I think I'm more likely to do something about it than if I just go to a workshop.

In this particular discussion about SAMR the point regarding training, follow-up and accountability is made very clear, it is the absence of these that is bemoaned in this and other interviews, as a missing element that is seem by most as being intrinsic to successful implementation, this is corroborated in the interview with **TI3**:

TI3 So, I think what schools need to do is basically have better strategy and basically showing rather than telling people what to do and how to do it, and the formative follow up, and be very supportive in the way they provide professional development, which is useful and meaningful. ...I did attend a session on the SAMR model and that's when I realised, actually, there's much more I can do with the iPad. I didn't work it out by myself, even though I was quite enthusiastic about using the iPad... the SAMR model inspired me and it really pushed me, and I thought, 'Ok, so what else can I do? It's not just a device, ok, I can do x, y and z.

In summary, we can see that the SAMR model can be a powerful tool both positively and negatively. It depends (as with so many other tools) how it is 'operated'.

ТРАСК

The TPACK model was less well known than the SAMR, however there was a more positive view on its usefulness, especially regarding the issues previously discussed about teacher's pedagogical knowledge and working with the process holistically, acknowledging every point on the model as something that needs to be specifically addressed. In the interview with **TI2** they note that TPACK is good for training teachers, which as we are seeing is a major part of any implementation or reform. Moreover, **TI2** does state that the TPACK model can also give you an indication of the problems that can occur with implementation:

TI2 So even if they're new teachers in the first year QTS, or the first year of teaching, they- they have subject knowledge but their subject knowledge is too high mostly for the classroom, so they're already going through a massive learning curve as it is, like a Physics teacher or a Maths teacher, right. So, they've been taught to teach, they've got subject knowledge, they might have some technical knowledge. But if one of the three is weak, like, the teaching experience or the- the subject knowledge, you can't

throw tech at people, you can't ask them to do that, they have enough things to deal with, dealing with the world of education and making sure they know their stuff when they go in a classroom. Um, so it's a lot harder to- to teach teachers. So, for me the biggest let down, and I agree with what you've just said, is- is training,

this does not mean that you cannot introduce technology to a newly qualified teacher, it means that the approach to training must take this into consideration, especially if the new teacher cannot be categorised as the innovator and early adopter in Roger's Diffusion of Innovation curve. Anecdotally speaking, I have delivered training that involved sizing the circles on the TPACK model, as a self-reflective indication of ability in each of the areas as a launching point for the training in digital pedagogy. Proof of concept is incredibly important when training, proving value and achievement for buy-in from the people involved, as a part of this the technology being touted needs to be utilised as part of the training, this is in much the same way as certain classroom pedagogies are used to deliver the content of PGCEs. However, having looked at the uses of both models - TPACK and SAMR in the interview with II3 they state, 'So, the models, theythey differ slightly but the end result is always similar', which is an interesting statement and one that perhaps others may disagree with, as one exists as a taxonomy / classification of the pedagogical activities, based on how developed the technology use is on a scale of achievability with and without technology, the other is a relationship-based model of technology integration. The purposes or uses of both models are different, for example SAMR can be used for, explanation, examples and evaluation, whereas TPACK can be used for focussing on the development and integration of skills. If there were scope in this study, the use of the two models for pedagogical change would have been looked at more closely, as well as the student view. Based upon the interviews and online questionnaires, it may be that specifically looking at the models might require a more focussed case study at individual institutions, as the models did not seem to be an embedded part of what was occurring inside the schools.

Adopters and Champions: Diffusion of Innovation and Adoption Models

There was a lot of allusion to the principles of Rogers' theory throughout the interviews. It appeared to be the case that the technology adoption within schools and institutions fits this model, that there are a few people in each school or organisation who are driving the process.

II6 I think tech- I think education is slow moving in some schools, in this particular area. In this region, you've got a school like **** who it seems are – I don't know, even within ****, how many staff are particularly on board with it. But you always

seem to get a 10, 15% of staff who will drive it forward and use it, and then there's [sic] some that don't.

Digital Native v Digital Immigrant and Resident Visitor

The interview with **TI1** epitomised the sentiments throughout the other interviews, that students may be used to owning and using a digital device, but they don't know how to use it in a school context, this is a deeply important issue as the assumption of digital literacy skills could impact greatly on the success or failure of a technology integration.

Metacognitive processes in teaching and learning

Interestingly the majority of the comments in this area came from the teachers who were interviewed. There was discussion around students taking more ownership of their work, developing responsibility and the development of the personalisation of their education. There were a few comments on confidence and motivation and the statement by **TI2** summed them up as the technology being a positive influence:

TI2 Cause some of these kids, like, barely spoke, they were just moody teenagers half of the time, and yet when we were doing this stuff they really came into their own. And some of them found it a lot easier as well, so it was definitely confidence boosting for them as well.

There is currently a movement in education towards a more cognitive-based approach to how we learn, as this is still in early stages I did not expect to see it referenced much, but it was mentioned by **II6**. The relationship between cognitive science approaches and technology are an area that need further investigation:

> **II6** I was using Quizlet, actually, and because I'm an English teacher, and we would doand because I think it's excellent for retrieval, for space practice... But I think it- it's- it ties in nicely with the latest what cognitive science says about how we learn... I think what- what our students here struggle with is retention.

4.3.3 Observation

The observation tool was designed to address research question one, however there were a few points to note regarding research question two. The observation of classroom activities indicated that only surface level change was taking place, based on simplistic integration of the most common tablet tools. The lessons observed utilised similar flows with production based on using Apple iMovie. There were no assessments facilitated via the tablet devices, whilst it was the pedagogy that was being observed, the factors of influence seemed to be that the pedagogy was being driven by what was 'easy to do' on the device.

4.3.4 Summary of question two

In the findings from the three data collection tools, we see there are several areas that impact or influence the use of tablets in the classroom. The areas we see across the data are *change processes, leadership, devices and operating systems* and allusion to *models of use*.

For the *process of change* the data showed that there was rarely a 'perfect storm' of teachers and leadership who were both drivers of tablet use simultaneously, there was a push from one side or the other, mainly coming from the leadership. The data regarding the push from management for change showed that buy-in was rarely achieved and as all school scenarios are different, 'proof-of-concept' stories were rarer. In a lot of cases in the data tablets were implemented compulsorily and relied on volunteers to act as 'champions' for trialling the technology. Most teachers in the study owned a smart device before using it in the classroom, they felt that the increase in work was front-ended during the initial set-up phase of a technology roll-out. Whilst nearly all the participants felt that attainment, achievement and engagement all increased, there was a feeling that there was a novelty factor attached to these improvements.

The *Leadership* was considered a critical impacting factor. It was felt that leadership needed to be technologically and pedagogically aware, have vision and the ability to plan ahead. Cost impacts were felt to be influential with regards to the type of technological ecosystems that schools were willing to invest in, which in turn impacted on how teachers were able to use the tablets. Some schools started small with a few subjects to start as proof of concepts, more schools did not and went straight for full roll-out without piloting or proof of concept at all. Training will be covered in subsequent sections; however it is worth mentioning that during a two-year period during data collection, 50% of participants in the online questionnaire had educational technology professional development targets, whilst 27% had none, it was also interesting to note that 77% of teachers marked self-taught as a source of training.

In consideration of *Devices* and *Operating Systems and Platforms* iPads were the dominant tablet used in the study. Affordances and functionality were discussed in regards to accessibility,
ease of use and most importantly portability / mobility of the device. The devices were disseminated in multiple different ways in different schools. The choice of device was important in several ways, including the connectivity of the ecosystem which impacts on the flow of learning. It was felt that age had an impact on the choice of device, with the evolution moving towards younger students using iPads and older students using laptops, or suites of devices that replicate how we use them in the world of work.

In the data, when *models of use* were directly mentioned or alluded to it could be seen that the SAMR model was the most familiar, this aligns with the iPad being the most popular tablet used in the data, as Apple use the SAMR model in their official iPad training and support. TPACK is referenced rarely in the data despite being a model of use for pedagogical integration. The Diffusion of Innovation model ratios were discussed in the data (although the model was not referred to) and this may indicate that technology use in education follows the same patterns in other sectors of society.

4.4 Key Themes Emerging from the full data set:

A mixed methods approach to research design and data collection was utilised for this research. From the mixed methods, synthesised with a grounded theory approach, key themes emerged from the data through the thematic (Braun and Clarke, 2006) and constant comparative analysis (Birks and Mills, 2015) that was undertaken in this research. The analysis allowed for exploration of the narrative that emerged from the data, within which key themes were observed, these themes are detailed within this section and they are: training and assessment.

Ranking the frequency of coding the top three codes across all the interviews were: training, pedagogy and assessment (See Appendix H). Training was the most coded with 87 codes, and found in all 14 interviews, meaning it was the highest ranked for the amount of codes and appearances in interviews, this was expected as training was set out in the literature review as being a key factor when affecting change on a teacher's pedagogical grammar. Pedagogy had 69 codes that appeared in 10 interviews (although the data collection focused on this, so this is to be expected) and assessment had 43 codes, appearing in 12 of the interviews. Assessment had not been a key part of my original framework and it emerged as a key finding, through the additional use of a grounded theory approach (Pedagogy and training was part of the core framework) this conceptual density added to its explanatory power (Cohen, Manion and Morrison, 2011). It is interesting that when you look at the ranking for appearances in files the top three are: training, assessment and then personalised learning, which was coded in 11 interviews, but only with 25 codes, from this it could be discerned that the academic perhaps takes a slight precedence over

the device and infrastructure. The following sections cover training and assessment as key findings in the data.

4.4.1 Training Interview Responses

Throughout the data it was clear that the participants felt that the starting place for training was with an external source, provided by large technological companies such as Apple and Microsoft. I note that Google barely featured in the data despite offering training and certification, it would be interesting to conduct further research as to whether this is due to their hardware (the Chromebook) not being used in classrooms in the U.A.E. with Apple and Microsoft remaining dominant. In the interview with **II1** they discuss their Memorandum of Understanding (MOU) with Microsoft and the move to have all teachers certified as MIE or MIEEs, with the leadership team unable to seek promotion unless they receive training in digital pedagogy. The purpose of this is to build up capacity internally within the organisation, this is similar to the interview with **II3** who states that Apple Teacher training is compulsory for all staff members, this ties-in with the assertion of TI2 that the trainers need to be a valid source for staff members and in this case a selection of the implementers interviewed have demonstrated an understanding of this. TI3 highlighted that systems were already established at their institution when they started work and outside speakers were a regular feature of professional development, as TI5 said teachers place value sometimes on external trainers from organisations over in-house trainers; thus, confirming what **TI2** states about trainers needing to be a 'valid source'.

In the interview with **TI2** the need to focus on 'the teacher' in ways that are as supportive as possible are discussed, they mention the need to address Maslow's hierarchy to ensure that training begins by creating and building on a solid foundation of confidence. Focussing on training that demonstrates techniques that are 'functionally low and pedagogically high', teachers are able to build up their skills; this is further reinforced by participants who said teachers needed a safe play to play and fail whilst using the technology. In their interview **II2** spoke about the creation of an internal 'Digital Strategy Leadership Group', which focussed its support on a professional development framework of coaching and mentoring, it was generally felt throughout the data that this approach was the most viable for success. **II6** elaborated on this point by stipulating that you should start small and focus on your early adopters and develop a tool kit that models use with the students. **II7** talked about what is referred to as DFTs (Department Focussed Training Projects) which were month-long projects designed around a needs-analysis, focussing on weakness and needs of the curriculum, this revolved around delivery through the technology being taught. Anecdotally I have found that with the teaching body in the U.A.E. proving concept is an incredibly important part of the process. **TI5** asserts that teachers need time to prepare for a

transition and **TI3** said, that a key person in the department needed to lead based on subject specific pedagogical knowledge, otherwise teachers will not use the technology or at least not to its full potential.

In the interview with **TI2** they highlight what may be a fundamental cause for lack of success with educational technology implementation, in that 'there aren't many who actually teach digital pedagogy or understand it', they assert that this then leads to merely substituted learning and lazy teachers, especially where you have situations such as with **TI1**, whose first training session was to 'read the user manual' or **TI3** whose first institution gave them the device and then told the teaching staff to 'just get on with it', this echoes with **TI1**, who said that no training was available for new incoming staff. Incidentally **II3** indicated that 'not always' providing training was a mistake, a mistake they had made in the early days and rectified once they realised the affect this had on attitude to using the device by the teaching staff. In the interview with **TI1** we get an anecdotal example of what happens when the implementation is not executed well:

TI1 I remember the first training session they basically made us read the user manual for an iPad, which was a waste of time ... but then there's no longer any formal training for teachers.

In the interview with **TI3** it is said, 'The way it was introduced there was basically you came back from summer holiday and we were just given the tablets and told to get on with it', which as we know had a detrimental impact on the roll-out and the teachers' attitudes towards the technology, which along with **II3** already mentioned that not providing the required support affected the teachers use. Another consideration is the actual quality of the training received. In the interview with **TI2** (who discusses training the most) they point out the detrimental effect that bad training can have:

> **TI2** ...and I sat through some of this training and it was painful. It was a guy who had no connection with education going through a list of about eight Apps that the school had organised- they'd decided that that was what they wanted them to use ... but not really showing you how to use it in class, or how it would change your learning environment, or anything like that. It was just, this is technical, this is how you use it, we want you to use it, that's it.

There were several comments about institutions moving onto the 'next flashy thing', before teachers had even embedded the basics, this can create barriers between the stakeholders. It can affect training focus and therefore implementation as a whole, and there was a feeling that tablets were no longer 'flavour of the month' and teachers were not being given a chance to fully

explore their potential. There was a feeling that the perception of Educational Technology as being I.T. is creating barriers, this needs to be addressed with all stakeholders involved in an implementation project.

4.4.2 Summary of Training and Value Theme

Training is of paramount importance during a technology roll-out - but care needs to be taken. It seems that poorly constructed training is as bad as no training at all when it comes to impact on the process, there needs to be a well thought out structure for the training, that addresses the needs of all stakeholders and also synthesises the needs of the curriculum. In the online questionnaire we can see that most participants were self-taught (with a mix of different types and sources of professional development selected) and it was good to note that 50% of the participants, had development targets that revolved around the use of the technology for a twoyear span around which the data was collected.

From the data, teacher training seems to be the largest factor affecting integration and pedagogical change, this makes the person or people responsible for the training one of the biggest factors of a successful roll-out. The teacher training strategy was in most cases decided by the leadership of the school, and in a small number of cases given to the individual in charge of the project to decide.

The data appears to show that training exists on a spectrum. Particular placement on the spectrum appears to equate to either a successful or unsuccessful integration of tablets. However, it appears there may be a need to move from one end of the continuum to the other for the most successful training, as teachers have a range of experience and a range of attitudes towards the technology. The findings have been placed into a table to show how the data sits in the continuum (which can be found in Appendix F). The right-hand side of the spectrum is where the most successful projects seem to be, whilst the columns would indicate absolute distinctions it needs to be considered as a spectrum / continuum, as there are aspects of cross-over and fluidity.

An additional part to this is choosing when to give the tablets to teachers and students. The most effective strategy appears to be when the teachers are given the tablets before the students. The interview with **II4** states 'So before we implemented a fully one-to-one roll-out, for the year before, we started off by giving the teachers the devices only'. **TI2** states that when this is not done and the devices are given at the same time, they found this 'bizarre'.

One of the comments I found interesting about training from the interviews is the idea of pre-service training. **TI2** says '...but the way PGCEs are or teaching degrees are, there's no tech embedded in them', this is also addressed in the interview with **II3** who says 'I feel that I'm

teaching within an ethos that I was never trained to teach. There is no book or manual on how to do it'. One of the concepts of delivery on a teacher training program is that you are taught through the method you are meant to be learning, for example learning how to use OneNote by accessing course materials on OneNote, or collaborating with colleagues on an assignment using Teams or Google Drive. However, it does not appear that pedagogical use of tablets has backwashed into teacher training, and why **II3** says that the 'ethos' to teach with technology is absent.

In the interview with **TI2** they discuss the anxieties of technology integration being alleviated through initial-teacher training 'and if it was taught from the beginning as part of their learning pathway, then they would never have these anxieties, because they would never know any different', this is an area that would be of further study if time and scope allowed, as combined with the concepts in the TAM model, it would appear to play a large part in the success or failure of any integration program.

4.4.3 Assessment as a key finding

Starting this study I did not expect assessment to emerge so strongly from the data as an impacting factor on the use of the tablets. On one hand assessment as pedagogy (driven by tablet use) appears to have a distinct impact in the classroom, on the other assessment as it currently exists (on a national and international level) is a limiting factor on pedagogical development of tablet use.

Exploring data coded as assessment, it appears that the key aspect of tablet use is in the 'proximity to the student'. If the context of the assessment is further away it has less impact and at its furthest point it tips over into having a negative impact. The closer the assessment is to the student it seems to have a greater impact on assessment outcomes when using tablets.

The key elements for assessment were: 360°, competency, limiting, final assessment, data, increased assessment opportunity, formative, assessment as pedagogy, MFL (memory for learning), Spaced Practice, Retrieval Practice, formative AFL, live AFL, misconception / intervention and personalisation. The code closest to the context of the student is personalisation, the furthest are 360° and final assessment, as with the training there is a spectrum of impact that could be drawn out from the data (see table 10).

360° view of competency	Summative / final data	Formative
Farthest proximity		Closest proximity
Acts as a Limiting factor as	Data	Personalisation
national and international		Misconception / intervention
exams do not use tablets. PISA		Live AFL
is moving to PC based testing.		Formative AFL / AaL
These exams do not utilise		MFL. Spaced practice. Retrieval
digital skills gained through		Assessment as nedagogy
tablet use and therefore do		Assessment as pedagogy.
not act to positively influence		
use in the classroom. The lack		
of technology use in national		
and international assessment		
has a negative impact on		
tablet use.		
	Increased assessment opportunity	
Tablets do not impact here.	Tablets do not impact	Tablets impact pedagogical
	pedagogy but they do impact	practice with assessment as
	general digital literacy in some	pedagogy.
	final assessments.	
1		

Table 12: Assessment spectrum

An aspect to note is that formative and summative assessment act together to produce a 360° view. Considering assessment as a limiting factor the interview with **II2** shows how this is the case:

II2 I think the issue that we all have in schools is the restriction on that would be assessment. Yeah, yeah. So, formal assessment, is what I mean. Our current assessment is obviously the British system, we have GCSEs, we have, you know, CAT tests, whatever tests you have down at A Levels, etc, which are assessed in a very structured, in a very restrictive way. So, we have children sat in a room, in rows, in isolation, regurgitating knowledge that they have learnt, in order to assess their learning. The problem with technology is that it doesn't fit into the- into that system, really, in terms of new pedagogy, in terms of, if I'm- if I want to assess a pupil's

learning, well what really- it's not necessarily to do with their knowledge ... that assessment is the limiting factor. 'Cause we're all judged by that, no matter how much we like to do, you know, all of this- all of this, you know, all of this stuff, at the end of the day the kids have to sit and they have to do that. And if they can't do that, then we are- I won't say we have failed – but we are seen to have failed as a school if they can't sit and get those exam results.

4.4.4 Additional points about the future of assessment

Two of the implementers interviewed discussed future movement for assessment through the use of AI to aid in the 360° view of the child, involving student, teacher and parent input. There is a cross-cutting code of engagement in the assessment, this is usually discussed in reference to game-based assessment such as Kahoot. In the interviews there was discussion around moving towards more authentic assessment, which aligns with the way we use technology:

> **II2** So until we get to a point where assessment can be done through allowing pupils to access the resources that they would normally access in the day-to-day, so going to an exam, if we're calling it an exam, and here's your task, complete your task, you can communicate with whoever you want, you can collaborate with whoever you want, you can use the technology however you want to use it. And we're assessing how you implement the learning that you've- that's taken place in completing this task. Yes, there will be subject knowledge as a result-based- as a result of that, but we're also assessing their ability to collaborate, their ability to communicate, to find out, to interpret what is good knowledge, what is not good knowledge, to be innovative, you know.

This is further discussed in the interview with **II5** who says we should have holistic assessment centres, focused on assessing the skills that are actually required in the workplace:

II5 *I* think assessment has to change, has to be transformed, because we're changing and transforming what we're assessing.

In the interview with **TI3** it is discussed that the institution maintains tight control over all aspects of assessment, therefore none of the data was able to be used formatively and they were not able to run any other types of assessment:

TI3 they really want to, kind of, censor and see everything we produce. Um, um, so I'm not- yes, so the summative ones, yes even formative ones, they are- they would rather give it to us- give them to us. When we receive the results, we – unfortunately, we aren't- we're never able to see, let's say, where students were wrong, ok, we're just given the figures. Which, you know, are they nece- well, they're not that useful because if you- if a student is told that they get, I don't know, 15 out of 20, how helpful is it? Ok. So, we haven't really been able to- we haven't been- we haven't been able to- to use assessment that well, which is a shame.

This is a further example of how assessment requirements can have a negative impact on developing the use of the tablets.

We have seen within the data that training and assessment are key areas within a programme to integrate tablets into the classroom, both are highlighted within the data as being important factors which are not always adequately considered or addressed during the implementation process. The following themes sit alongside the findings as outlined in this chapter, where a student-focused personalised environment in which content creation and formative assessment are common features, is a key feature in a tablet-based classroom. The influencing factors on these classrooms are: change processes, leadership approach and device ecosystems. In the next chapter these findings will be discussed alongside the literature.

Chapter 5: Discussion

5.1 Overview

In the previous chapter the findings from each of the three tools, online questionnaire, interview and observations were set out under the headings of each of the two research questions and then summarised as below.

The summary for question one indicated that changes in pedagogical practice had occurred, furthermore there were aspects of pedagogy that the use of tablets appeared to align with and this facilitated more use, these being that change involves becoming *more student-led, inquirybased research* and *looking to content creation over consumption*. Additionally, the *formative assessment* aspect of instant or live feedback for action in real-time (that is supported by the devices) is prevalent in the data. The functionality of the devices themselves was further influencing the type of use in the classrooms.

The summary for question two showed that the *process of change* was rarely done with a smooth consensus and collegiality. The *leadership* (in the educational establishment) was felt to be a critical impacting factor in the data, with success or failure of a tablet roll-out appearing to depend on the decision-making process at a managerial level, making leadership a key aspect of a successful program. In regards to the devices themselves the tablets were deemed to be more appropriate as a sole technology for younger users, with them being integrated into a suite of devices that replicate the world of work as students move through their schooling. The *functionality of the device*, including portability and ease of use in a workflow ecosystem, was also a factor on how the devices were used and perceived, this perception aligns with *models of use* regarding the TAM (Technological Acceptance Model).

The data showed how teachers viewed 'how the technology was introduced and supported', impacted on how the teachers used the tablet which is an important aspect of the TAM (Technological Acceptance Model). In addition the data showed an alignment of use in line with the Diffusion of Innovation ratios, however the use of tablets was subject to the detractors as outlined by the model itself: weaknesses in the innovation, competition, rigidity of networks and high degrees of heterophily resulting in poor diffusion, which may go some way to explaining why tablet integration is not always successful. The TAM and Diffusion of Innovation Models appear to give explanatory power for factors of influence, whilst the TPACK and SAMR Models provide a framework for looking at how tablets are used pedagogically. The high degree of heterophily identified through the Diffusion of Innovation Model, may be why a lack of training in both general and focused contexts was a major detracting factor in the successful use of the tablets. The use of a grounded theory approach meant that 'training' emerged from the data as a

key factor of influence, alongside inflexible assessment which circles us back to the 'rigidity of networks' from the Diffusion of Innovation model. All of the factors outlined above will now be discussed further alongside the existing literature.

5.2 Research Question 1: Has the pedagogy used in the U.A.E. G6-12 classrooms in government and private schools changed with the use of tablets

Question one explored whether pedagogical practice had changed with the use of tablets, and if so in what way. The answers to this question showed that many aspects of pedagogical practice had changed although some had remained the same. Some of the changes that came up repeatedly in the data were: becoming student orientated with more variants of personalised learning, more inquiry-based research practice and lessons changing to activities which were focused more on content creation over consumption. The increased use of formative assessment, facilitated by tablet device functionalities was a key aspect of pedagogical change, especially when considering formative assessment as a type of formative adaptive teaching, these aspects are discussed in subsequent sections.

Student orientation

Student-orientated learning was discussed widely throughout the findings in the three tools. The ideas of student-centred, student-facilitated, student-led and student-controlled learning were all extolled in the data as being a change in the pedagogical practice, facilitated by the use of the tablets this is consistent with the assertions of Greer, Crutchfield and Woods (2013) that student-centred pedagogies are required for pedagogical transformation, and they highlight self-reliance and autonomy as one of the four themes of pedagogical change in their study. It is also seen in the study by Albers, Davison and Johnson (2017) where students were allowed to select the tool they wished to use in an inquiry-based learning project, in this case WhatsApp for collaboration. The data showed that teachers considered themselves as moving into the role of facilitators of learning with lower 'teacher talk time', and they viewed themselves as a 'Guide on the Side', meaning that teacher-centred pedagogical practice was lessening with the use of the tablets. In the observation data we see several activities where the teachers operated in a supporting role whilst students completed work. The 'Guide on the Side' view is problematised in the literature on pedagogy, this reduction in teacher-centred or direct instruction practice maybe

one of the reasons that the use of tablets has not taken hold. In the field of education there is a disagreement regarding the role of a teacher, both as an activator and direct change agent versus that of a facilitator (Hattie and Yates, 2014). In the meta-analysis that Hattie created, he looked at effect sizes based on student's attainment and found that for activities where teachers were the activator the average effect size was .61, whilst the average effect size where teachers took the role as facilitators was only .19, none of them over .4, which Hattie deemed to be the point at which something could be considered a viable intervention or practice (Hattie and Yates, 2014, p. 73). The types of activities in which teachers are the activator can be seen in the area of Direct Instruction. In their book Effective Teaching, Muijs and Reynolds (2018) dedicate a whole chapter to Direct Instruction, they highlight that it has been shown through multiple research studies to be a highly effective form of instruction when moved through the principles of social constructivism, with subsequent individual or group practice taking place and the students remaining active participants during the lesson, this is juxtaposed against a student-centred definition in the case of Anderson and Anderson (2017). The research studies highlighted by Muijs and Reynolds (2018) feature in the meta-analysis conducted by Stockard et al. (2018) where they explore the effectiveness of Direct Instruction across fifty years of research, as defined by Rosenshine's (2008) exploration of differing meanings of direct instruction, as with Muijs and Reynolds (2018) they found that in the large body of research available direct instruction was a highly effective educational pedagogy. There are some interesting points raised in their research paper such as the assertion that within this pedagogy 'all students can learn new material when (a) they have mastered prerequisite knowledge and skills and (b) that instruction is unambiguous', this echoes with educational psychologist Ausubel's belief that 'the most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly' (Ausubel, 1968, p. vi). A further point made by Stockard et al. (2018, p. 481) is that 'discrete skills and concepts are taught in isolation but are then brought together in increasingly more sophisticated and complex applications', with which Christodoulou (2016) concurs in her discussion on measuring progression models, with an analogy of a sporting coach who does not train through repeated attempts at the final goal, but rather through a mix of activities designed to achieve the final goal, with a few adapted replications along the way. However, as with any pedagogical practice direct instruction has its place, it is up to the practitioner to establish the best pedagogies and techniques to use when designing schemes of work and lessons, hence the importance of pedagogical content knowledge (Shulman, 1986; Didau, 2015). This is an important consideration for this research, as the pedagogies of: personalisation, individualisation, inquirybased learning, collaborative learning and content creation (all of which appear to be significant factors in this research) do not adhere to the concepts within teacher-centred or Direct

Instruction, this may go some way in explaining why tablet use has not been successfully embedded in most of the participants' experience.

Personalised learning

Leading on from the concept of student-centred learning, personalised learning was discussed in the data with 73% of online questionnaire participants indicating, that use of personalised learning had increased in their classrooms with the use of tablets. The idea of personalised activities revolved around the students being able to self-pace or work at their own pace, or experience learning through differentiated instruction. Johnson, Adams and Cummins (2012) state that personalised learning has been a growing trend in the area of educational technology, which is mirrored by the discourse of the CCL project (2015) who featured personalisation of learning as one of their pedagogical foci during the course of their research, finding it to be a significant factor in the successful use of tablets.

The concepts of personalised learning link to additional findings in this research data, where teachers indicate that the tablets were best used for individual and pair work, which concurs with the findings of Pedersen (2004, p. 333) who states that 'in spite of the pedagogical intention to promote cooperation, the technology seems to strengthen individual work'. In my lesson observations there were several occasions when students were able to create work as per their personal preference, such as the content and formation of iMovie products.

Back in 2014, the Horizon Report noted that personalised learning is not yet supported robustly by technology or classroom practice, echoed by this research data where in one example, none of the teachers had created lessons or class videos for use in their classrooms with the tablets, this appears to be a missed opportunity for students to take ownership of their learning (Willocks and Redmond, 2014) as Ng and Nicholas (2013) found that recorded lessons enabled more able students to develop at a faster rate, with lower attaining students able to review more often - thus making retrieval practice, practical and accessible. The discussion around personalised learning reflects the findings of the NBER report (2017) which stipulates that personalised learning is a key use of technology. The report elaborates that this is particularly the case in math, as is seen in the quasi-experimental research by Aldossry (2020) that looked at the impact of iPads in math teaching and found a statistically significant positive difference, in posttest scores between those students who had used iPads and those that had not. Furthermore Johnson and Williams (2020) found an 8% increase in the number of students who felt that the mobile device supported their learning of math, these ideas formulate part of the argument towards a curriculum design that has multiple theoretical underpinnings and therefore multiple pedagogical designs, as the parts of a curriculum that can be automated through repetition

indeed should be and they can be greatly enhanced through the use of technology with possible adaptive / AI applications.

Formative assessment

Assessment is a fundamental part of the education process and is of major importance to the integration of educational technology, as asserted by Farrell and Rushby (2016, p. 106) who state 'because assessment pervades the learning process, the application of technology to assessment can be a major driver for change throughout the process' however assessment is also much undervalued, underutilised and contentious (Muijs and Reynolds, 2018). High-stakes summative testing is a key driver in education, however there is quite rightly a critique of current assessment practice, that pushes towards an agenda of formative assessment above an overemphasis on summative testing (Tanner, Jones and Tanner, 2006). In consideration of this it was interesting to see that assessment alongside training emerged from the study as an overarching key theme. In this section I will discuss the formative aspect of assessment as a pedagogical practice as it emerged from the data.

In the online questionnaire and during the interview process, it was seen that the use of tablets to support formative assessment was viewed as a positive change, with 79% of the online questionnaire participants, indicating that the tablets had impacted on formative assessment in a positive way. Teachers indicated that the formative assessment aspects of instant or live feedback for action in real-time, had a positive impact on their teaching and learning experience, as they felt that the immediacy of actionable class or student-based feedback was invaluable. In addition there was opportunity for better formative assessment, written, audio, video and annotation, this process of formative assessment is situated within the Augmentation and Modification of the SAMR model (Portnoy 2018), as the tablets allow for significant task redesign to take place and student feedback can be more seamlessly integrated into the lesson. In their 2018 study Atas and Delialioglu found that integration of a question-answer system into lecture-based instruction, improved student engagement and enhanced their learning experience past the traditional learning structures.

The observations of the lessons appeared to contradict the other data, as when observed only two of the nine lessons appeared to have any significant formative assessment that was carried out on the tablet, this contradiction would be useful to explore in further research as a particular finding of this research.

In addition there was a feeling that the authenticity of assessments had increased alongside the ability for students to choose (with parameters) the types of assessment or production

methods of assessable work. Some aspects of the data showed crossover with other themes, such as assessment for learning enabling students to re-do tasks in a personalized and self-paced way.

Within the data one of the key things we see regarding assessment both formative and summative, is comments like the one made by **II5** 'I think assessment has to change, has to be transformed, because we're changing and transforming what we're assessing' this however is a difficult process which concurs with the CCL (2015) in their report on pedagogical use of tablets in the classroom:

Assessment is an important driver for educational practice and change, and over the last years we have seen a welcome rise in the use of formative assessment in educational practice. However, there is still an assessment gap in how changes in curricula and new skill demands are implemented in education; schools do not always make necessary adjustments in assessment practices as a consequence of these changes. (CCL, 2015, p. 27)

However, the lack of change in assessment is in part perhaps due to a cultural focus on high stakes testing in assessment (an observation that came from my experience of working in assessment at a federal level) therefore people are less willing to explore new methods of working in this area, as Bennet *et al.* (2017) assert, deviating from established practice in any aspect of assessment is difficult and risks derision and criticism from key stakeholders, especially if this change has associated risks. In relation to summative assessment in the data, we could see that 57% of online questionnaire participants felt the tablets had impacted this type of assessment, this only appeared to be on low stakes summative tests for workflow, content and data, as most participants indicated that high-stakes exams were fully controlled by the school or institution and these were usually kept as paper-based tests, mirroring the above assertions of Bennet *et al.* (2017).

Pedagogy

In 2020 Alsswey, Al-Samarraie and El-Qirem released their review of mobile learning in Arab Gulf countries (AGCs) from 2010 to 2018. One of the recommendations they made is that research needs to explore the types of learning activities that students engage in and with, and how those are linked to other theories of learning and mobile learning research. Abdulrahman and Benkhelifa (2017) also state that there is little research that outlines the pedagogical approaches within mobile learning frameworks, and there are very few guidelines to help

practitioners design their instruction, these assertions are a key driver behind my research project which was originally initiated in 2012-2013.

In the introductory chapter I discussed my role in the U.A.E. and based on these experiences I expected to see collaborative learning and the flipped classroom models dominating the findings, as these were the models and pedagogies that were being discussed within the educational community. However, we see in the data and the discussion in previous sections, that it is the use of personalized learning that has been utilised and favourably discussed over collaborative and flipped classrooms.

One of the four themes identified by Greer, Crutchfield and Woods (2013) was collaboration in their study on technological pedagogical change, this aligns partially to the findings of this study regarding pedagogical change processes. Teachers felt that a change in pedagogy had occurred, however they also stated that as they have 'always taught this way' it was just considered that the 'possibilities are greater' with the tablets, this was seen in the lesson observations where mostly traditional structures were observed, this mirrors the discourse of Pegrum, Oakley and Faulkner (2013) who highlight how collaborative student-centred pedagogy can be improved by using technology, this is evidenced in the online questionnaire where 48% of participants felt that collaborative learning had increased, whilst the remainder felt it had stayed the same or decreased. It is unknown in the data if the decrease coincides with an increase of personalised learning, as this was outside the scope of my research. An interesting aspect to note is that the findings of this research are contrary to the review for the Education Endowment Foundation on 'The Impact of Digital Technology on Learning', conducted by Higgins, Xiao and Katsipataki (2012) in which they highlight that the pedagogy not the technology is the driving force behind the change. They promote the idea that collaborative use of technology is more effective than individual use, then stipulate that one day's training or on-going inquiry-based approaches to professional development are the best practices for training teachers, both of which are refuted by this research in varying degrees, as an aspect of 'play' in professional development is essential and will be discussed later. Furthermore practices such as allowing learners to discover key ideas by themselves were not supported by the Sutton Trust Report (2014) into what constitutes the best teaching and learning which extends to professional development.

Ultimately and contrary to other studies (Greer, Crutchfield and Woods, 2013; Goodwin, 2012; Murray and Olcese, 2011; Shuler, Winters and West, 2013) I believe that the approach to using tablets should look more to the personalisation of learning (and the paradigm of neuroscience) as with the findings of NBER (2017) and CCL (2015) who assert that personalisation with technology can be effective in helping students learn.

The second pedagogical practice that was divisive was the flipped classroom model. 59% of the online questionnaire participants indicated that they had never used a flipped design in their teaching and learning, further to this I did not observe any use of the flipped classroom model in my observations. There were several indicators in the comments section of the question as to why it was not a popular method, with reliance on student completion, motivation and ability seen as a detractor, along with the additional planning and preparation required to adjust to this type of learning. Teachers felt that with the learning sequence so open to failure when students fail to do the preparation, it was not a worthwhile pedagogy to utilise, despite the appreciation of its effectiveness when 'done' correctly. The teachers in the study who extolled the benefits of the flipped model, tie-in with Van Alten et al. (2019) in their meta-analysis of flipped classroom research where they discovered a small positive effect on student outcomes, but assert that to be an effective pedagogy it must be appropriately designed, including adding other pedagogical elements such as quizzes. If we consider the Van Alten et al. (2019) findings alongside the findings of this study, the lack of success of the flipped classroom model could be attributed to the lack of instructional design in the implementations that I discuss in this research. Additional issues such as the lack of preparation by students before class (as highlighted by the data) was also observed in the review of flipped classrooms by Akcayir and Akcayir (2018).

In regards to the other aspects of classroom practice, school timetables and curriculum and assessment expectations appear to prohibit any significant changes. The structures of the lessons were not changed with over 60% of online questionnaire participants indicating this. Where changes did occur they happened in extended creation phases rolled over into subsequent lessons, or a completely different structure such as project-based learning put in place, although this was rare I did observe this in the lesson observations. There was an indication that in some lessons the tablet was used just for the starter or plenary, which matches the disparate answers given to the question asking about the percentage of time spent using the tablets in class. In the lesson observations there were lessons where the tablet was used for just a short activity. Homework was not really affected by the tablets, except perhaps the type of homework given when students were allowed to access tablets at home, this was seen in the lesson observations where students were required to complete a project on iMovie over the subsequent two weeks. For some participants they felt that communication had improved between teachers and students facilitated by the technology and this had improved not just feedback opportunities with students but also it built rapport. The idea of improved communications is one aspect of this study that ties-in in Greer, Crutchfield and Woods (2013) who assert communication to be one of the four main success factors in pedagogical change.

In summary of question one the key factor appears to be the underpinning pedagogical grammar of the teacher, in this study the pedagogies of the teachers appear to be more focused

upon student-centred learning and therefore the success of the integration of the tablets becomes problematised by the avoidance or removal of direct instruction / Direct Instruction methods, this aligns with the findings of Boon, Boon and Bartle (2021) who found that teachers were not utilising the technologies in the most effective ways. Moreover, more needs to be made of the affordances of the devices for formative assessment strategies within whole class teaching scenarios, which further fits with the need to more fully consider the use of direct instruction methods.

5.3 **Research Question 2: What are the influencing factors on the** pedagogy of tablet use in this context?

Question two explored the influences on pedagogical practice with the use of tablets. The findings from this question demonstrate that the process of change itself must be considered with teachers placed as the core element. Leadership was important as both a potential driver and detractor for the process. Device affordances are viewed as an influencing factor in how the tablets are actually utilised. The models of use that exist around the use of tablets are also discussed, with degrees of influence addressed either explicitly or implicitly through the findings. Each of these aspects will be discussed in the subsequent sections. The key finding of 'training' as a factor of influence is discussed as the last piece.

Processes of Change

This research study placed teachers centrally in the change process and viewed this through the lens of teacher experience. Throughout the data it could be discerned that there were no overt attempts by schools and institutions, to place teachers truly as a central piece in the change process. The two scenarios that were mainly seen in the data, were that the 'push' to use tablets came from either a few teachers utilising and showcasing the use of tablets, or the instruction came from the 'top-down' in the management and leadership structure. The data showed that buy-in was rarely achieved and as all school scenarios are different 'proof-of-concept' stories were rarer. In several cases within the data, tablets were implemented compulsorily and relied on volunteers to act as 'champions' for trialling the technology.

In relation to these change processes Shattuck (2007) makes a synthesised distinction that there are two types of change which are: first and second order change, the definitions of which mirror the discourse of change which has emerged from this study. In 'first order change' current practice is externally processed and merely adjusted incrementally, moving towards more

effectual and efficient methods, without any change in underlying belief (or deep pedagogical grammar) and this type of change is where I would situate the majority of participants within this study. Conversely, 'second order change' is the internal and fundamental change that happens to a belief system resulting in new structures of practise. While some participants' data alluded to working towards this goal, with a few outliers putting methods in place that demonstrate the change in deep grammar, this was not the norm in the data and it is most likely going to remain the case in school level technological implementations, where people will most likely exist in the parameters of first order change. Cochrane (2014) suggests that this lack of change in ontological shift (deep grammar) is down to the time frames given to technology integrations, indicating that longitudinal support was required for synthesis in technology and pedagogy use, with Cochrane (2014) indicating that Communities of Practice were enough to facilitate this. In some cases in this research we can see that programmes were in place for a matter of months before being scrapped and deemed to be unsuccessful, unsurprisingly these were also the programmes which functioned with top-down management and minimal support, this would perhaps give further indication as to the reasons behind a lack of teacher pedagogical change, including providing context to the fact that 77% of online questionnaire participants indicated that their use of the device was in part 'self-taught'.

Levinson *et al.* (2017) note that the role of the teacher in education change is core if the change is to be successful, this has to be considered carefully in any technology implementation, as we can see from the data there was a common feeling amongst participants that:

II2 if you could give technology to a good teacher, it'll improve their teaching. If you give technology to a poor teacher, that teacher will still be poor.

In their person-centred model Ng and Nicholas (2013) stipulate, that teachers are central to the success and sustainability of mobile learning, which resonates with Chen, Looi and Chen (2009) who assert that teachers are the core aspect of technological integration in the classroom. Further to this Shattuck (2007) asserts that the belief structure (deep pedagogical grammar) a teacher holds about teaching and learning, is a fundamental element that can inhibit a change in pedagogy when using technology, therefore the teacher needs to take central stage and pedagogical knowledge must be a main focus during the process of change.

According to BECTA (2004) access to technology is a significant factor in teacher confidence and use of technology, whilst appreciating the age of this report, the responses to the online questionnaire question 'did you personally own a device before you started teaching' were 73% yes and 27% no, which may account for some of the positive experiences and comments in the online questionnaire. The report also states that inability to fully prepare technology-based

lessons due to time restraints, contributed to teachers not wishing to utilise the technology, which resonates with comments in interviews regarding the negative effects of not making space in the curriculum to adjust, re-design or prepare. The idea of teacher autonomy and the space to play resonates with Hargreaves and Fullan (2012) whereby autonomy is given as a key driver behind several successful reforms, as Shattuck (2007) observed:

> Ironically, a journalist Thomas Friedman (2005) said it best when describing the economic changes that are sweeping the globe, "People don't change when you tell them they should. They change when they tell themselves they must" (p. 462). Somehow, teachers must be convinced that implementing technology integration pedagogy will improve student learning because when they are, teachers will tell themselves that they must change. (Shattuck, 2007, p. 9)

The impact of leadership

The Leadership was considered a critical impacting factor within the data and as can be seen in the previous section a vital part of the change process. Abdulrahman and Benkhelifa (2017) found that poor attitudes towards all aspects of mobile learning by institutional leaders, had a detrimental effect on mobile learning across Higher Education Institutions in Saudi Arabia and this is something we see throughout the data in this research study.

In the data different management styles were discussed, from top-down to fully supportive and inclusive. The top-down leadership style was seen as being positive or negative depending on the nature of the leader and the decisions being made. In this research we have seen previously, that placing teachers as central agents of change is key, this resonates with Somech (2010) in that negative issues of top-down leadership can be ameliorated by placing teachers in a centralised position within the process, however this does not appear to happen within the data in this research study, and so teachers are unable to ameliorate what they perceive to be negative impact from top-down leadership, as they are not centrally placed. Furthermore the negative impact that leadership can have concurred with an observation by Ng and Nicholas (2013) that contested authority or contrasting leadership styles affected the success of a program, as tension existed between key stakeholders making sustainability of the project untenable.

In addition to this, within the data it was seen that the participants felt that leadership needed to be technologically and pedagogically aware, have vision and the ability to plan ahead. During the interview with **II7** the participant discussed the leadership and vision in choosing the device based on sustainability of the integration, in this scenario the move to Microsoft products from Apple was due to the constant product and software updates which rendered items

obsolete on a regular basis, thus affecting sustainability and possible wasted investment in school, an area Ng and Nicholas (2013) focused on with their framework for sustainable mobile learning. Cost impacts were felt to be influential with regards to type of technological ecosystems that schools were willing to invest in, which in turn impacted on how teachers were able to use the tablets. As could be seen from the data there were multiple approaches to technology implementation in schools, which mirrors the discourse of Ng and Nicholas (2013) who assert that there is no consolidation of approaches for sustaining the practices of educational technology integration. The data showed that some schools started small with a few subjects to start as proof of concepts, however more schools / institutions did not and went straight for full roll-out without piloting or proof of concept at all.

Ultimately the data from this research concurs with the findings of Ng and Nicholas (2013), in that leadership and management are one of the most important parts of a sustainable implementation. Furthermore Garstka (2011) asserts that an approach from management where employees come first would be the most effective for an educational technology project, which resonates with this research in that the least effective management styles highlighted were disconnected top-down approaches, this is also seen in the observations of Shattuck (2007) who stipulates:

> Furthermore, Becker (2001), Cuban (2001), and Hernandez Ramos (2005) all found that the educational technology reform movement was not causing a re-culturing in every classroom. One of the reasons for this, according to Fullan, is because for any reform to be successful at the classroom level it must have the support of the layer above – the school leaders – a position supported by Hernandez Ramos (2005), and Staples, Pugach, and Himes (2005). (Shattuck, 2007, p. 9)

Choice and use of devices

There were several sub-themes for devices, however consistent with Falloon and Khoo (2014) 'mobility' appeared to be the most favoured aspect of the device, with movement outside of the classroom and around the school a significant affordance, mirroring the discourse of Cook (2009) and Sharples (2010) and their assertion regarding the significance of the 'mobility of the learner'. In Greer, Crutchfield and Woods (2013) they state that students found that portability of the iPads enabled collaboration and resource sharing, which enhanced their experience of group and project work. Furthermore the findings demonstrate the importance of a continued environment of 24/7 learning outside of the school and at home, which ties in with the ideas of Bogdanovic *et al.* (2014) that the tablet provides enhancements both in and out of a formal learning setting. In

the data 'mobility' was a favoured aspect which was followed by improvement in workflow, creativity and content creation, due to system ecosystems and 'App smashing'; in addition, fostering better communications (as part of workflow) was also found to be a significant factor by CCL (2015).

The age-related aspect and associated pedagogical alignments, meant that a more conducive environment for tablet use was found in lower middle-school settings, as they were able to condense their curriculums to make subjects more integrated where practicality allowed. In upper secondary the restrictions placed on curriculum by terminal summative assessments, such as GCSEs and IB examinations meant that there was no room to make these changes. There was also a belief that as students progressed through school, they should develop digital skills on a suite of devices that replicate the world of work and digital skill expectations, thus taking away the focus on tablet use.

In the study by Greer, Crutchfield and Woods (2013) into iPad usage in four schools, one of their findings was that 60% of students were using the iPad to browse the web and 40% of the students used educational Apps at least six times a week. It is interesting to note that one of the online questionnaire questions, returned very similar results when participants were asked which they felt was more important - Apps or connectivity, the percentages were similar in that 40% felt Apps were the main focus and 60% felt connectivity was more important. It is also interesting to note in the Greer, Crutchfield and Woods (2013) study that students themselves indicated that the iPad was not suited to every element of learning, which is something crucial to consider when designing curriculum. Further to this Burden et al. (2012) found that research and the internet were one of the most important aspects of device use in a 1:1 iPad environment, along with the findings of Ng and Nicholas (2013) echoing with Burden et al. (2012) and in addition my data, the devices in their study (PDAs) were used for the internet, communication and organisation. The Burden et al. (2012) study also concurs with my data, whereby there was a concern raised regarding the care of the devices, with students not bringing them to class or taking the use of the device seriously, an issue highlighted by several interviews where students did not bother to charge or bring their devices to class.

Ultimately though the opinion was that the tablet should be used as a tool like any other teaching support in the classroom. The idea that the tablet is a tool and that the best tool that aligns with the learning should be used for teaching, concurs with the findings of Andrew *et al.* (2018) whose research indicated that a combination of digital and paper-based resources were the optimal way students wished to learn. Masarweh (2018) found similar attitudes from lecturers who preferred traditional paper-based methodologies.

Educational and theoretical models aligned with use of technology

In the data when the models of use were directly mentioned or alluded to it could be seen that the SAMR model was the most familiar, this aligns with the iPad being the most popular tablet used as Apple use the SAMR model in their official iPad training and support. TPACK is referenced rarely in the data despite being a model of use for pedagogical integration.

Greer, Crutchfield and Woods (2013) use the SAMR model as the focus of their study into iPad use and note the critique by Marcovitz and Janiszewski (2015) of the model focusing on technology rather than learning, this for me mirrors the argument of Blooms being used for a taxonomy of descriptors and not of learning as with the SOLO Taxonomy, I agree with this critique.

The SAMR model is a useful tool for self-evaluation and monitoring for evolving practice and at the outset of a technological journey it can be used to support framework development. However, when it comes to teaching and learning practice it becomes limited in its use, as can be seen from the lack of reference to the model within the data.

Whilst the TPACK model has been criticised for a lack of construct validity (Kopcha *et al.*, 2014; Graham, 2011) and further criticised for its lack of practical use (Brantley-Dias and Ertmer, 2013) it is a valuable tool for training and helping teachers to establish their own internal conceptual framework for using technology in the classroom (Koh *et al.*, 2015). Choice of a model whether SAMR or TPACK, appears to depend on the cultural academics and school capital of the teacher or implementer. The model can help to signpost, support and evaluate the transformation of teaching and learning.

The Diffusion of Innovation model ratios were alluded to and discussed in the data (although the model was not referred to) and this may indicate that technology use in education follows the same patterns as in other sectors of society. I highlight in the literature review that there were compounding issues already apparent when applying the Diffusion of Innovation model to the use of the tablets in the classroom and we see these emerging from the data. Firstly in the 'weakness in the innovation' as the iPads were not designed for use in education they are a generic digital tool to be used in multiple scenarios, as education is the driver for the technology use this meant that education establishments had to find and invent ways to utilise the tablets that could justify them as being more than expensive substitutes for existing tools. The SAMR model by Apple attempts to provide this framework for demonstration and justification that tablets can redefine education, this has proven to be a difficult task and within the data we can see that the higher end of the SAMR model was rarely reached. The second issue is 'competition' whilst iPads were dominant in the country towards the end of the research more schools were ceasing use or making the switch to other technology ecosystems - notably moving from Apple to

Microsoft. The functionalities and ecosystems are different for each school or institution, each change means new ways of operating have to be found, new training, new learning communities and pushing back the innovation to its conceptual infancy each time. The 'rigidity of networks' was also an important factor, we saw from the findings that inflexible curriculum and assessment on a national and international level, can prohibit change on a classroom pedagogical level as several teachers felt that they did not have the freedom to conduct learning activities or assessments that deviated from strict adherence parameters for both internal and external expectations. The fourth issue is that of 'degrees of homophily and heterophily' and whilst this did not emerge from the data explicitly, a macro view of the context of the study outlined at the start of this paper gives us an indication as to the degrees of heterophily that exists in the teaching body, as well as other country curriculum standards that make up both the public and private school systems prevalent in the U.A.E. based on its demographics. The degree of heterophily can potentially impact and affect all other aspects of successful uptake and use of the tablets, alongside other aspects such as a teacher's underlying pedagogical grammar, school and social capital and most importantly the need to place the teacher as the core to the process of change.

According to Shattuck's (2007) discussion of the Diffusion of Innovation theory only 10-20% of successful innovation is needed to reach a critical mass, however in this research this is not enough to deem most of the implementations successful. Shattuck (2007) further elaborates on Rogers' theory and the adoption rate by highlighting the effects of values, beliefs and the experiences of people in the social systems, emphasising that integration would take longer than usual due to the need to change a teacher's pedagogical grammar. We see in the findings that when teachers are not placed centrally, these values, beliefs and experiences are not core to the process, in some cases it is further compounded by the lack of time given to aspects of the roll-out, all of which may impact on the process of changing a teacher's pedagogical grammar.

Paiva *et al.* (2016) take the concept of diffusion one step further, where they stipulate that full integration has only been reached when the technology becomes 'invisible' and the 'e' is removed from descriptions of teaching with technology. In the findings within this study we are far removed from this kind of synthesis in education. Furthermore Paiva *et al.* (2016) discuss Moore's revised technology adoption cycle where a 'chasm' is placed after the early adopters, signifying considerable issues to overcome in the teacher's adoption of technology, this reworking of the model is perhaps more valid to the education sphere based on the deep-seated preventative issues as highlighted by Shattuck (2007).

A final key point to note here is the lack of explicit discussion of the Technological Acceptance Model (TAM) in the interviews or survey data. The dominance of research studies in the extended literature review that use and refer to the TAM, compared to the lack of reference in this study is an interesting point to consider. The grounded theory approach allowed

interviewees and those taking the survey the freedom to discuss any and all aspects of technological integration and use, and yet the mention of the TAM is almost inverse in this research as compared to the literature review, this may be aligned with the findings from the review by Khan *et al.* (2015) of mobile learning in Arab Gulf countries, in which they found that 54.8% of studies did not utilise any model at all. The systemic literature review on mobile learning in Saudi Arabia by Abdulrahman and Benkhelifa (2017) also found a lack of adequate theoretical frameworks with the research studies they reviewed, this issue could be indicative of a disconnect between literature and practice.

5.3.1 Key Finding: Training

Although training was considered within the literature review it was not expected to come to the fore as such an impacting factor upon data collection and analysis. In the findings we see the training of teachers is fundamental for both ongoing development and educational reform, this is consistent with Fullan (2011) and Fullan and Quinn (2010) who felt capacity building across the teaching profession was the core of any successful reform.

In the data it can be discerned that for a new technology reform training is a fundamental part of the process, which aligns with Thompson, Windschitl and Braaten (2013) who report that unless teachers receive training to develop their pedagogical practice with the technology, the desired educational benefits will not be achieved, this concurs with the review of mobile learning by Khan *et al.* (2015) and the relevance of their findings in the Middle East, where they assert in their final point the importance of developing trust and awareness through workshops, training and successful experience.

Training is part of a leadership decision and it should be mentioned here, that during the two-year period for the data collection for this research, 50% of participants in the online questionnaire had educational technology professional development targets for both years, whilst 27% had neither, regarding professional development it was also interesting to note that 77% of teachers marked self-taught as a source of training.

The findings indicate that training should start with an external source in this case technology companies, who are considered within the data as a more valid source at the start of an implementation than in-house training or expertise. During the second phase and in order for the training to continue to be successful, it needs to focus on the teacher in personally supportive ways, those institutions that had well supported working environments from both management and colleagues appeared to have a more successful implementation, this is consistent with Li and Choi (2014) who state that teachers were less likely to take risks with the technology without a network of social support within the school. The findings showed that teachers felt they needed a

solid foundation of confidence and a safe space to play and fail. Further to this and along the same idea of a network of social support, Henderson and Yeow (2012) believe that teachers should see a range of pedagogical practice, that they can analyse and then decide what is best practice in their context, hence the need for a network of practice within the institution, this aligns with the findings of Psiropoulos, Barr and Eriksson (2016) that faculty should collaboratively plan, as well as establish authentic professional learning communities that are timed in alignment with the introduction of new learning tools. The institutions in this study where it was very top-down and partially supported / unsupported, were spoken about negatively in the findings and any successes were seemingly driven by the teachers in spite of management and not because of it. There were comments in the findings that: there are not many people who teach digital pedagogy or understand it and therefore access to expertise is limited, with teachers just being told to read the manual and just get on with it, receiving no training at all – this was highlighted as a mistake by an implementer in the data.

The importance of providing a structured supporting program can be evidenced in Greer, Crutchfield and Woods (2017) who found that in their study of four schools, two schools offered a structured professional learning program and had teachers who were in the transformation stage of the SAMR model or moving towards it. The importance of providing a structured program could also be seen in the 2021 study from AlQenaei, Khalil and Aldekheel, who assert that with teacher efficacy being a key factor of success, a program cannot lack proper professional and technical training. The concept of self-efficacy was also the most important factor in the systematic review of the TAM by Alsharida, Hammood and Al-Emran (2021) covering 2017 through to 2020.

One of the aspects that emerged from the data is that teachers felt that the most effective personally supportive experience for them, came from a 'Coaching and Mentoring' approach, this aligns with the findings of Kraft, Blazar and Hogan (2018) who found that instructional coaching was an effective form of professional development and training, although this is problematic when scaled up. However, as professional development for use of technology would be specific to a school context, scaling up would not be a significant issue, this coaching and mentoring approach also concurs with findings of Archer *et al.* (2014) who found training and support to show significant results as an intervention in their tertiary meta-analytic review of ICT implementation. The data that informed the development of the Training Continuum (Appendix F) and the focus on school-based localised support at the most successful end of the continuum, concurs with the assertions of Li and Choi (2014) that changing the deep grammar of teachers pedagogical practice is not enough and requires more - stating that as well as various items of 'social capital' in school, access to expertise (someone with the pedagogic know-how for educational technology) is essential; this links to the themes in the findings where it is stressed

that the need for a subject specialist in each department in each school is an essential requirement for successful infusion of the technology (Li and Choi, 2014).

Whilst Burden *et al.* (2012) felt that formal professional development should be minimised in favour of experiential learning, the findings of this study found the opposite, that a structured multi-layered approach to professional development needed to be put in place in order to address the complexities of the technological pedagogical integrations, having said this space to play is vital (as is stipulated in the findings), but it should not form the basis of the training program. The data showed that for the teacher-focused end of the spectrum, starting small with early adopters and developing a tool kit that models tablet use (with the students in any particular school / institution scenario) is effective. In addition we need to ensure teachers are able to 'play' with or utilise the device before it is given to the students, as a simultaneous roll-out was perceived as having a negative effect in the findings.

One approach to successful professional development at an institution is this study, is one that placed teachers at the core of the process using an iterative needs analysis, that shapes and reshapes professional development programs / projects on an ongoing basis, this resonates with findings from the BECTA Report (2004) which stipulates that inappropriate training styles – cause a low level of educational technology use and that those lacking pedagogical components are more than likely going to be unsuccessful.

Taking a step-back to before teachers are qualified to enter the classroom, Sad and Goktas (2014) and Price *et al.* (2014) suggest that training and positive attitudes towards m-learning should be fostered at the stage of university-based pre-teacher training. However, we can see from the data that none of the participants (from the interviews and online questionnaires) had taken sessions on educational technology integration during their initial teacher training and there were no additional comments about this either. It is important to consider that a lot of the participants were teachers who had qualified 9+ years previously, however two of the teachers interviewed were recent graduates who had not been taught this either, although the experience of two teachers is not enough to generalise. Yurdakul and Coklar (2014) state that training must be in-line with the technology and therefore pre-service training is problematised, as choice and use of technology is completely disparate across educational institutions, this could make pre-service training very difficult to accomplish, therefore rendering any initial impact on 'deep grammar' Li and Choi (2014, p. 1) an impossibility.

As we have seen from the approach to training in the findings, Cochrane's (2014, p. 74) assertion appears to still be a limiting factor, whereby 'little focus on the aspects of technological and pedagogical support, and only a hint of the need for sustained interaction for teaching and learning reconceptualisations' means that the support required for true integration is still not commonplace or it is ineffectual in design.

5.4 Summing up the discussion

The aim of this research was to explore the role of pedagogical practice in classrooms that use tablets across the U.A.E. and determine influences on the integration of the technology into the teaching and learning process, by synthesising this research data with existing studies we can begin to form an understanding of the processes by which pedagogical practice evolves and adapts.

The answer to the first research question 'Has the pedagogy used in the classroom changed with the use of tablets' appears to be 'somewhat', this is consistent with Veletsianos (2011) who stipulates that the affordances of technology will not always mean that pedagogical transformation will take place. It seems that the influencing factors on pedagogy from the second research question 'are too broad and too many' and the misalignment of a single factor can have a highly negative impact and therefore affect the use of the tablet. There is no 'one size fits all' answer to this and why perhaps schools and institutions are sometimes ill-prepared or illequipped with the technology or experience, as there is no guidance specifically for their scenario.

Critical factors extolled by the Diffusion of Innovation model (Rogers, 1962) appears to have an overarching effect on the use of tablets, as does the placement of training in the scenario of the roll-out, we have seen from the findings and the discussions that 'training focus' needs to be placed upon the teacher as a core tenet for success in pedagogical change.

Whilst the past few years have offered more literature in the area of mobile learning, the literature appears to place too much focus on constructivist paradigms, almost corralling the epistemic community down the same path. I believe this may have led to disillusionment with the use of tablets from practitioners, as they are not being used to reach their full potential. A full critique of the constructivist paradigm needs to happen within mobile learning and an exploration of instructional methods with tablets needs to happen.

Cochrane (2014) discusses and utilises frameworks in terms of absolutes with social constructivism as the framework of choice. Cochrane makes the rationale - that mobile devices are inherently social collaboration and communication devices. However, are they only that? As tablet mobility, navigation between tasks and space to work sets it apart from: laptops, pcs, smart watches or phones, moving it beyond what I feel is a 'reductive description' from Cochrane and the incorrect choice of constructivism as a framework. Moreover, this placement of educational technology into one theoretical framework for pedagogical use is perhaps one of the fundamental issues with the underlying success of educational implementation. Tablets should not be seen as one end of the spectrum or the other, but should be seen as both, with a viewpoint that tablets are pedagogically agnostic, whilst Cochrane (2014) accepts the Pedagogy-andragogy-heutagogy continuum, which Luckin *et al.* (2010) propose for measuring pedagogical change, I consider this

too extreme for technological change at this point, as there is no consideration that the implementation itself may require a continuum of framework design.

For people designing curriculum each learning objective and outcome should be placed onto a continuum of theoretical underpinning, moving from instructivist at one end to social constructivism on the other, this should not be done in isolation but with a team experienced in different specialisms, including: subject content, curriculum design, assessment design and technology. The specialists should then decide where on the continuum each object should be placed, this will allow for the best fit of pedagogical and assessment practice (which would inform design of assessment blueprints) and indicate the best choice of tool for the learning object.

5.5 New and adapted theoretical models created as a result of the analysis of the findings

I found emerging from the data that the process of pedagogical (educational) change is highly complex, with multiple facets influencing success or failure in a programme or project, whether or not technological change is more comparatively complex than other types of educational change, was not in the scope of this research.

The models that have emerged from this research come from both research questions. The research aims in question one identified that no significant fundamental change in pedagogy had occurred, only the 'type one external change' as discussed by Shattuck (2007). Based on assessment as the key feature (of where pedagogical change had occurred in question one) the first proposed model is an Adaptation to the existing TPACK model, where assessment is added as a fourth circle, highlighting the need for teachers to possess a core knowledge of assessment literacy which is then developed into digital assessment literacy. The addition of assessment to the TPACK model has been driven from the core findings of question one, that formative assessment or adaptive teaching was a key change that impacted teaching practice. The second model is a Continuum of Training, that demonstrates which types of professional development are best for technology implementation, however there needs to be a transition through some of the more practical external types of training before core internal professional development can take place, so that the training program builds one element on another along the proposed continuum. Each of the models proffers either a theoretical or practical support mechanism (or both) for attempting to ameliorate the factors that negatively affect a programme of educational technology integration.

When considering pedagogical change and influence it is perhaps too complex to map diagrammatically. However, the conceptualisation of the influential factors in this research, encapsulate the emerging themes from the interview data, this attempts to map how social

capital functions and where influential flow exists. Li and Choi (2014) found that the social capital of a school directly influenced the receptiveness of the teachers to the technology and their perceptions of the effectiveness of professional development, hence the need to place the teacher centrally which further extols the views of Levinson *et al.* (2017), Ng and Nicholas (2013) and Fullan (2001) that teachers are key to the change process.

5.5.1 Adaption to the TPACK Model (Derived from assessment as a key finding)

Although the SAMR model appears to be understood throughout the data, the TPACK model is less so and actually fairly rare. Considering all factors that make a successful learning environment (and additional aspects such as training and development) an adaptation to the TPACK model would appear to bring all aspects together. Models are constantly evolving with the continual change in education and should not be static, instead they should have a good amount of manipulability. In the case of the findings within this research the consideration of assessment as a separate and unique part to be added to the TPACK trifecta, could be made. In order to improve overall teaching and learning and to ensure that teachers develop their digital pedagogical practice correctly, they need to be aware of the specifics of their PAK (Pedagogical Assessment Knowledge) such as assessment for learning (responsive teaching) before they try to develop their TPAK (Technological Pedagogical Assessment Knowledge). The importance and relevance of teachers developing their assessment literacy has been outlined previously, and if this is not addressed it can be prohibitive for their digital integration as well as their own general professional development.

Utilising the new model (in figure 38) should provide teachers, mentors, coaches, trainers and leadership with a base-line framework through which to focus subject specific professional development programmes for using educational technology.



Figure 38: Adapted TPACK Model

5.5.2 Training Continuum Model (Derived from training as a key finding)

The data demonstrates that certain approaches to training and professional development were more successful than others for introducing and sustaining technology (see table 11). The professional development strategies of 'communities of practice' and 'personal learning networks' are not explicitly mentioned in the data and so they have not been added to this model, however in reality they should be considered an essential part of the training strategy for any institution. The fact that they were not mentioned could be indicative of why successful change was not commonplace across the data. The findings relating to the construction of this model are located in Appendix F.

Least successful		Most successful
Hands-off-leadership		Hands-on-Leadership
Centralised		De-centralised
Training	Coaching	Mentoring
Technical / Functionality	Generic App / Pedagogy	Subject Specific App / Pedagogy
External	External	Internal

	Internal	
Apple, Microsoft Generic	Apple, Microsoft Generic	Teacher choice / institutional
		requirement
		ADE MIE MIEE MCE

Table 13: Training Continuum

Chapter 6: Conclusion

This research study was designed to explore the pedagogical approaches as to how tablets are used in classrooms in the U.A.E. and in addition to look at the factors which influence its use. The conclusion chapter starts by revisiting the aims and questions of this research, it then outlines an overview of the contributions of the work to the existing literature, revolving around educational technology integration and implementation. Furthermore any implication for future research and policy are discussed along with potential areas of further scholarship, I then conclude with a personal reflection on the research.

6.1 **Research Aim and Questions Revisited**

The aim of this research was to investigate whether any change to pedagogical practice had taken place with the introduction of tablets across various educational institutions in the U.A.E. and if so, what were the changes and how were they influenced (either positively or negatively) this was explored through the research questions:

- 1. Has the pedagogy used in the United Arab Emirates G6-12 classrooms in government and private schools changed with the use of tablets?
- 2. What are the influencing factors on the pedagogy of tablet use in this context?

The contribution of this study adds to knowledge and understanding in the area of influencing factors, most prevalently in training and assessment and in no small way to pedagogy (as it has aligned to the affordance of the devices).

Overall pedagogy in the classroom has changed for some participants in this data in specific areas and domains, however there has been no alignment to a particular educational theory as some propose should happen, this is perhaps indicative of the people involved, knowing (consciously or otherwise) that moving along one approach would not be practical in terms of implementation, due to the myriad of methods and strategies teachers use daily across the spectrum of learning. In addition there was no shift to any particular model of use, such as Apple's Challenge Based Learning or Microsoft's Constructivist-Leaning Frameworks, perhaps this is because these are based in the constructivist paradigm, and as we saw in the data the pedagogies of this paradigm were amongst the least impactful or successful, meaning that these models may have been difficult for teachers to use practically. The lack of realistic commonly used frameworks might go some way in explaining the disparate methods of implementation found in this research, both Apple and Microsoft have constructivism as the underpinning theory behind their flagship frameworks, however in the data we see a need for theory-neutral or agnostic pedagogy, this may explain why there is no real engagement with Apple and Microsoft's models by the participants in the data.

In contrast the findings did align with some existing models which are utilised in discourse around technology use in education. Roger's Diffusion of Innovation model (1962) and Adoption timelines are particularly relevant when considering explanatory context behind the uptake of technology in the classroom, as the percentages and definitions appear to meet those in the educational contexts of this research. Whilst TAM was not explored explicitly in the scope of the research residual influencing factors were highlighted, we see the most positive attitudes from the teachers who had owned a smart tablet device before using them in the classroom, teachers who were more resistant had not owned or used one previously. The findings also confirm Shattuck's (2007) synthesis of the Diffusion of Innovation model with social systems, deep grammar and adoption:

> What must be remembered is that the diffusion of innovation is a social process (Rogers, 2003), and that "an important factor regarding the adoption rate of an innovation is its compatibility with the values, beliefs, and past experiences of individuals in the social system" (p. 4). With this understanding of the rate of adoption technology integration will most likely take longer than expected because most teachers would have to change their belief structure. What Cuban et al. also confirmed was that the time to learn how to use this technology, the lack of training in the use of this technology, and the unreliability of this technology were significant inhibitors to the adoption of technology integration strategies. (Shattuck, 2007, p. 4)

The findings also align with the notion that the teacher, leadership and training are essential components of any educational reform, not just educational technology implementation (Fullan and Quinn, 2010).

I have argued against a one-size-fits all theory for educational technology implementation and a move away from a narrow beam of constructivism, however it is important to acknowledge that social constructivism does have its place in this process, for example in the mentoring part of the training programme for the staff using the devices, the mentor acts as the knowledgeable guide in the zone of proximal development, we see this in the interview with **TI1** when they state that despite formal school training, it was the personal mentorship they received that really had the impact on their pedagogical practice.

The results of this study are indicative of the difficulties in any educational change, where there is no 'one size fits all' answer, as with most educational institutions and points of reform this is further compounded by cost, time and the immense amount of professional development sessions required in educational technology transformations (Shattuck, 2007).

Sharples (2013, p. 10) asserts that evidence from research into mobile learning requires a cautionary evaluation, this research study takes the same approach. Using time-constrained snapshots, with interview and questionnaire responses that potentially contain bias (in multiple arenas) and in conjunction with the 'rapidly-growing area of research' means that the findings of this research should be added to the evidence-base and not supersede any aspect of it.

6.2 Original Contributions

Despite that fact that this study took a full seven years to complete some of the findings of this study are perhaps less relevant to the field in a timely manner, what this study does contribute is the idea that tablets should be pedagogically agnostic, which goes against current educational trends towards constructivist learning constructs. The study further highlights (and evidentially supports) the core need to place teachers centrally in the process of educational technology change, with a fundamental and detailed focus on training as a core variable for successful use of technology.

The findings in this study have contributed to a field of research on pedagogical change and influencing factors in classroom-based tablet use, through synthesis of existing research papers and with the data that emerged from this thesis, implementation and support models were developed that should enable more successful tablet-based integrations in the future.

Empirical data that emerged from this study was consistent with the findings from other studies in the area of educational technology and inconsistent with others (as outlined in the discussion chapter). Despite the limited narrow context and limited suitable sources of data, the study expands on our understanding of what is required in order for a successful implementation to occur. Furthermore, this study looked at the realistic expectations of what can be achieved within macro and micro constraints placed on the system within which educational institutions must operate.

Situating the research

The location of the Middle East (U.A.E. specifically) only bears a limited cultural impact on this study, this appears to happen mainly in the area of communication with devices as the data is gathered from both international schools and government entities I consider this research

generalisable across various contexts. The United Arab Emirates is made up of seven Emirates, all with their own cultural approach to education, as such one of the strengths of this research is that the implementers that were interviewed came from the different Emirates, with Abu Dhabi, Dubai and the northern Emirates represented in the interviews, this coverage of the wide geographical location added an important set of perspectives to the data based on the experience in the unique Emirates.

Pedagogical Practice

This study highlights that the most prevalent issues with educational technology implementation are that of training, assessment and a non-adherence to a pedagogically agnostic approach to utilising the technology, as a result of these and the affordances of the device change was found to have happened but only in certain aspects of this study. The data suggests that the devices should only be seen as an additional tool in a teacher's tool kit and not be the sole driving force for change. The data shows too many restrictions are in place and that the attributed affordances are more closely aligned with constructivist practice, which may not always be the best method or strategy for the point of learning, but which teachers may 'shoe-horn in' in order to 'fit in' with the current educational trend for a purely constructivist approach to education. To summarise - technology use should be driven by the learning.

New and Extended Models

Utilising this data with new and extended models (which were constructed as a result), educational institutions can utilise these findings to build an evidence-based baseline of good practice, which would assist an implementation plan by encompassing and addressing potential points of success and failure. However, due to the limited context of this research there are several influential points which could be added, such as student voice and attitude to technology which were not explored in this thesis.

6.3 Implications for Policy, Recommendations, and further scholarship

The Horizon Report (2014) identified iPads as a technology that is likely to have a substantial impact on what they call Primary, Secondary and College in the U.K and K-12 in the U.S. however the lack of work around its pedagogic value has its own set of controversies (Clark and Luckin, 2013; Greer, Crutchfield and Woods, 2013). In my research study we see that not

addressing this can be hugely detrimental as it needs to be a central focus by the leadership and management team for a successful implementation.

Shattuck's (2007) assertion that teachers should have a shared meaning of any change construct in which they are directly involved is also vitally important, we see in the findings that the teachers need to see the benefit of any change before they become willing participants in the process, which means management must ensure a full rationale and proof of concept. Furthermore, Fullan (2001) believes a shared meaning dispels potential negativity towards the implementation of educational change, without which a reform programme may fail as ultimately it must be translated into transformational practice by the teachers.

Any approach to curriculum design must consider the best pedagogical methods for the point or object of learning, this needs to address whether the learning requires an individual or collaborative approach i.e. direct instruction, modelling, drills, content creation and decide on the best strategy / tool for achieving this. Kirschner, Sweller and Clark (2006) argue that:

the past half-century of empirical research on this issue has provided overwhelming and unambiguous evidence that minimal guidance during instruction is significantly less effective and efficient than guidance specifically designed to support the cognitive processing necessary for learning. (Kirschner, Sweller and Clark, 2006, p. 76)

Their research resonates with this study's findings (and my own beliefs), that the individual construct of the learning object drives the pedagogic method and associated tools with which to achieve the 'change in long term memory' that Kirschner, Sweller and Clark (2006, p. 75) state is required for effective learning. Curriculum designers need to decide where on the continuum (between instructivist and constructivist approaches) each aspect of their curriculum sits (including addressing learner, teacher and learning-centred pedagogies) and then alongside the tool (technology or otherwise) and the most appropriate assessment activity, put together a curriculum framework that addresses each of these, whilst simultaneously ensuring all aspects of horizontal and vertical alignment are achieved in a cohesive and coherent document.

School leadership and management must ensure that they function in a supporting role and provide no hindrance in any areas of the process, they must also ensure that training is a central tenet and place the teacher as the focus.

The findings of this research have shown that despite a drive by technology companies to instil new ways of teaching and learning, the pedagogical practice in educational institutions still has a long way to go, this is despite the push by Apple to use its Challenge-Based-Learning Framework, which incidentally was not mentioned in any of the data despite most participants working with the Apple iPad. Microsoft's method of working with technology includes:
frameworks for collaboration, communication, self-regulation, problem solving and innovation, use of ICT and becoming an effective educator. Neither of these frameworks were mentioned anywhere in the data, despite participants holding titles such as ADE (Apple Distinguished Educator) and MIE (Microsoft Innovative Educator) which is indicative of the technological companies recognising the need for these professional development structures, however as evidenced they drive too far towards a constructivist-based system of learning.

The models and systems of learning that have emerged from this research should provide educators with a more malleable framework to adapt to their own institutions and 'school culture' and in turn give ground for further research utilising these models.

The research focused on whether pedagogy had been impacted by the device, it also looked at many influencing factors that need to be addressed in order to successfully implement educational technology into education institutions, however there are areas of research that if scope allowed would have benefitted this study, these are listed below.

• Impact of the 4- part TPACK on pre and in-service teacher training

One of the main findings of this research was that training and assessment are key influencing factors in the use of tablets in the classroom, further research would ideally include looking at the use of the TPACK Adapted Model in pre and in-service teacher training, as I believe this would have a large impact on not only educational technology use but on a teacher's pedagogical knowledge overall.

Impact of use of the Training Continuum

Training was one of the most important issues arising from this data with indications that training should be styled along a continuum - from external training through to coaching and finally to a format of internal mentoring. Use of the training continuum map for proof of concept (for each of the areas identified as best practice) should be looked into further as to whether it is a viable and effective model in practice (as indicated by the findings).

• Achieving the Ideal Scenario (6.4.1)

Based on the findings in the data an 'ideal scenario' was conceptualised, and I believe an investigation into whether this is achievable would be beneficial research for gauging the process holistically.

• Looking at first and second level change

Investigation into the specifics of the change process by individual teachers would make an invaluable contribution to this area of research, as without second level change the sustainability of the process is deeply affected and with huge time and cost implications sustainability is an important consideration for educational institutions.

6.3.1 Practice implications

The focus of this research was two-fold, the first part of the research endeavoured to explore what pedagogies were being used by teachers (when they were utilising mobile devices in their classrooms), the second part of the research looked at the factors that potentially influenced the ways in which the devices were used for teaching and learning. The research asked specific questions around teaching and learning and facilitated a deductive approach using grounded theory approaches, this was to explore all potentialities of use and influence in the experience of those taking part in the research. The main findings as discussed are that assessment literacy and training in all aspects are a key part of a successful technology integration. The data showed which pedagogies are most suited to teaching with differing technologies (in the context of this research) this is alongside the overarching importance of leadership and management in the change process. In regards to the practical implications of this study in the aforementioned areas, it is important to look at 'who' the findings are significant for and in addition what the findings 'mean' in terms of practical application.

Finding on Assessment:

In the data we can see the use of the mobile device for formative assessment was a significant part of the teaching and learning process, as such some implications for differing stakeholders are outlined below.

Teachers: Teachers need to utilise formative assessment more within their teaching and ensure they are working with the technologies to maximise the affordances of the device and associated software or Apps.

Integration Leads: Those responsible for leading on technology in schools need to ensure that subject and curriculum leads are consulted and programs designed that forefront both generic and subject-based formative assessment principles.

Senior Leadership / Institution Leads: There needs to be a whole school / institution policy for formative assessment, which should include CPD programs as well as ensure evidence-based best practice is embedded into subject / department policy, including short, medium and long-term planning, these plans need to involve theoretical underpinnings as well as the practical implementation both with and without the technology. Using the adapted TPACK model would be impactful at this level.

Policy Makers / ITE Providers: Those who have a responsibility for writing policy or designing programs should ensure that assessment literacy is built into the outcomes of the program, with a specific element extending into educational technology and formative assessment. Using the adapted TPACK model would be impactful at this level.

Finding on Training:

In the data we see that training was a significant part of the implementation process and failure to provide adequate training opportunities alongside continuing support can be detrimental to a program, as such some implications for differing stakeholders are outlined below.

Teachers: The implications for teachers are that they need to be aware of the importance of the training and engage with the program in order to support a successful transition into the use of the technology as part of their teaching routine.

Integration Leads: Integration leads (alongside leadership) are the persons who need to ensure that the training programs are robust and cover the spectrum of training required, they should be a central focal point for coordination and communication and they should use the training continuum as good practice for designing training that will support implementation planning. The intention is that this is used to design and develop a training program that moves from one end of the spectrum to the other on the model. Any training programs that are devised should begin with general training on the technical and functional aspects of the devices and ecosystems, this then moves into a period of generic use and basic functions of the technology, giving time for both teachers and students to become accustomed to device processes. Once this is established a move to a mentoring structure and subject specific pedagogical change should be implemented, and this is the structure to continue with and utilise as updates and changes happen. New staff

should be allowed to run through the same spectrum of technical training and then join the mentoring structure.

Senior Leadership / Institution Leads: Leadership teams need to ensure that adequate time is invested in the training, coaching and mentoring of staff both leading up to and during the implementation phase. Using the training continuum as good practice for designing training will support implementation planning.

Policy Makers / ITE Providers: Policy makers and ITE/CPD providers should ensure that training programs cover the use of technology in the classroom and as device specific programs will be difficult - a generic approach will need to be taken at this level.

Findings on Pedagogy:

The main pedagogies that were used / enabled by the affordances of the device were: student-led, inquiry-based and personalised. The pedagogies also favoured content creation over consumption. Educational practitioners who make decisions on lesson and activity design, should consider the use of technology when the best lesson design uses techniques within this list of approaches. Please note that any educational practitioner from teachers through to policy makers and ITE providers, need to be cognisant of the findings of this research in its entirety, as some pedagogies emerged as ones that aligned with the affordances of the mobile devices, however they may not necessarily be the best choices for teaching and learning in the relevant subjects or disciplines. Careful consideration needs to be made of the pedagogical practices that are curated and implemented in schools and institutions, to ensure that the pedagogies are led by the learning and not the affordances of the device.

Finding on Leadership and Change Management:

Senior leadership and institution directors need to ensure that they have buy-in from all stakeholders in the process and make the correct investment of time as well as cost. As discussed in this thesis second level change of a teacher's deep pedagogical grammar is difficult to achieve. The leadership and management of a new technological integration needs to ensure that this is at the heart of the change process, using the ideal scenario model will help to achieve this. Furthermore, they need to ensure that the vision and plan for the roll-out is clear and achievable and that the correct digital ecosystem for the school is put in place with affordances and longevity in mind.

6.4 Limitations of the research

The limitations of this research began with the design of the study. The study forms part of the award for a professional practice doctorate with the scope limited by the regulations of the word count allowed, therefore the design needed to be narrow in its focus. Additional limitations were the time taken and the changes in design scope that needed to happen due to the situation with my employment. One of the limitations in data collection was that during the interview process I was only able to interview female teachers at the teaching level and so a male perspective could not be analysed, however there was representation of males in the survey (35%) and 5 of the 7 implementers interviewed were male. Access to schools for the observation phase was a further critical limitation, as I was only able to access one school for observations – I was not able to get a cross spectrum view of all the different educational systems across the U.A.E.

6.4.1 The Ideal Scenario (Model for implementation success): Theoretical / Practical

As seen previously pedagogical value and focus on training needs to be central to the leadership and management. Teachers need to be provided with rationales, proof of concepts and the benefits of the change. Most importantly - what needs to be learnt within the curriculum should drive the pedagogical choices and the technology use should support the strategy, not be the driver of it. The use of SMEs (Subject Matter Experts) in designing new approaches is critical, as they are already knowledgeable about best pedagogical practices and they are crucial in designing ways the technology can enhance the best practice structures for their subjects. A cross-school focus on assessment literacy both generic and domain specific is also important, as the technology appears to have a high impact on enhancement of assessment processes, especially formative assessment.

Whilst it was not the main focus of the study (from the data in the interviews, the online questionnaire and the observations) we can draw on several factors that need to be in place in order to successfully implement any technology into the classroom, if any enhancement to learning through different pedagogical practice is to happen (see table 12 below).

[
Leadership	- Must want to implement.	Leadership and teachers
	- Set vision, strategy, plan.	together need to:
	- Proper training, both external and	
	internal on device and possible ways of	- Draw down from the
	using.	Evidence Base and
	 Set training structures including by subject (remembering the TPACK model with Assessment should underpin) Allow teachers time and space to play / share / feedback as part of the training structure. 	 curriculum framework and all associated areas. Monitor and evaluate and adapt as necessary.
	 Select the correct devices for need with fully operational infrastructure and workflow ecosystem. Prove value to teachers, parents and students. 	
Teachers	 Must engage with training. Play / share / feedback. 	
Students	 Must be taught to use the device/s. Must be taught how the ecosystem / workflow operates. Must be taught how to use Apps / software both for functionality and for educational use. 	
Parents	Must support school with use and care of the device.	
Models	Practical: TPACK Adapted Model. Training Continuum. Theoretical:	
	The Ideal Scenario.	

Training and	Adhere to the Continuum for training and prove	
Value	value base.	

Table 14: The Ideal Scenario

The data for this study was collected within the United Arab Emirates and therefore the context is orientated towards the educational systems in the U.A.E. as such the audience for this research is those schools within the U.A.E. in differing Emirates and different educational systems. The themes presented here are the most condensed ideas to come out from this data and are representative of the experiences across the differing school systems from which the contributors came, whilst some cultural aspects need to be considered in some school scenarios (such as the use of cameras with photos and videos, and the amount of communication allowed through the technology between students) the application of the above model would be applicable to most schools in the U.A.E.

6.5 Concluding Reflections

The concept for this thesis evolved from a training session I attended in my first few years of teaching, where there was a session that introduced different potential disruptive developments in education. One of the things in that session was a video of the first Apple iPad, I remember watching the tasks demonstrated in the video, and my 'inner nerd' was in love. A few years later I was given an iPad2 as a Christmas gift, and once I had played with it and used it for study at home for my Master's Degree, and in addition taken it into to school (much to the chagrin of the I.T. team 'oh not apple') I knew that there was a massive potential for this device, or any similar device to make a significant difference in the educational experience of students.

The main reason for my move to the U.A.E. was to work for an institution that had eleven schools across the country and who had a system of 1:1 iPad for G10-12. However, after a year I was moved onto the Ministry of Education reform project, which meant my context and focus underwent a massive change, I no longer had free access to the original schools, only to specific colleagues, luckily this happened whilst I was still in the initial stages of the doctorate. I now had to look at other institutions to collect my data, which in hindsight was a far better approach and delivered what I can now see was a much better data set than I had originally intended.

The actual process of this research became quite arduous at times, starting with the literature review and methodology which showed a dearth of research in my specific area of interest and continual repetition of certain themes, so it became difficult to place the research into an epistemic community, this is why I made the choice to use elements of Grounded Theory as I was not aiming to produce an educational theory by the end of the research. Changing my role over to the Ministry of Education also had an impact on the design of the research, the amount of time I had changed massively, I went from working with eleven schools to working with 780+ schools and 250,000 students, I was then asked to 'sort the assessment' for multiple subjects with this request as my only guidance – it was a very interesting five years.

Upon reflection I found that working with technology in an educational environment and being part of the EdTech community in the U.A.E. through presenting at conferences, SIGs and training sessions, gave me more legitimacy especially when interviewing the implementers, as I felt they were more willing to give me their time as they went into more depth and explanation than I had expected.

In the seven years it has taken to complete this research I believe I have witnessed a cycle whereby tablets became 'all the rage' and then fell 'out of fashion', I believe in recent years they have become tools for younger age groups, or they have become a part of a 'suite of devices' emulating the 'adult world' or 'world of work'. I have been able to gather data from people at various stages of implementation (for instance those who had tablets thrust upon them only to have them taken away a few months later), this led to the collection of many varied opinions and 'lived experiences' with tablet devices and the various ways in which they have been introduced to schools, based on this I chose to look at the protracted amount of time spent on this study positively rather than negatively.

To conclude the final thoughts, I believe the outcomes from this research will provide a grounding source from which practitioners (at all levels) will be able to benefit, when designing and implementing an educational technology reform within their institutions. I would like to end with a quote I found, which I believe demonstrates my viewpoint towards educational technology after seven years of work, and my belief that the 'fence' of theory should be negotiable at all times.

In other words, an informed educator should be like a doctor, who diagnosis the learning situation and then chooses the most appropriate treatment - based on what will be best for the students. Following this advice, it is likely that educators will have occasions to find themselves on either side of the fence, from time to time. (Learning Theory, 2019).

Appendices

- A: The Online questionnaire
- **B:** The Interview Questions
- C: Participant Information Sheet and Consent Form
- D: Ethics Approval
- E: The Coding Map
- F: The Training Continuum
- G: Interview Participant Profile

Appendix A The Online questionnaire

This online questionnaire will be asking questions about how you use your tablet in your teaching context and issues that surround using a tablet. The purpose of this research is to help inform curriculum and instructional designers and also practitioners, on how the tablet is impacting education in the U.A.E. (United Arab Emirates) and the realistic use of tablets in planning learning sequences.

This research is affiliated to the University of Southampton, as such this abides by the University standards for research projects, this research is being undertaken as the final stage of the EdD. (Doctorate in Education) program.

To qualify to participate in this online questionnaire you must be a secondary school teacher in the U.A.E. (United Arab Emirates,) teaching 9 to 19-year olds and actively and regularly (3+ times a week) use tablet technology to teach in the learning environment.

Please consider that there is no right or wrong answer – just an honest response to the questions is all that is required.

This online questionnaire should take approximately 15-20 minutes to complete, by proceeding with the online questionnaire you have given consent for the data to be included. Your support is appreciated.

Thank you.

NB. All data is to be used for doctoral research only and is not institutionally driven. The online questionnaire is delivered using SurveyMonkey, which ensures the integrity and security of all information with respect to theft, piracy, and unauthorized access. Data is stored on servers in the United Kingdom. The online questionnaire will close at the end of November 2017. By participating in this online questionnaire, you are consenting to taking part in this research project and agree for the data to be recorded and used for the purpose of this study. Confidentiality: Limited personal information will be requested during the course of the questionnaire, such as age range and teaching context.

There is an opportunity at the end of the questionnaire to provide contact information if you would like to be notified of the online questionnaire results, or if you would like to take part in the subsequent interview and observation phases of the research. If you chose not to share your contact details, your participation in the online questionnaire will remain anonymous.

All online questionnaire data will be stored in a secure location to which only the principal investigator will have access. Data will remain anonymous, be kept confidentially and not be used or kept for the purposes of marketing or third-party exchange.

Potential Risk:

There are no known risks or potential risks from participating in this online questionnaire.

If you have any questions, please contact Gemma Escott at: gae1g12@soton.ac.uk

Ethics Number: 14617

Ethics Committee Approved (2016)

1. Do you teach in the U.A.E.?

Yes

No

2. What is your age?

18 to 24

25 to 31

32 to 38

39 to 45

46 to 52

53 to 59

60+

3. What is your gender?

Female

Male

Prefer not to say

4. How many years have you been working in education?

1-3 years

4-6 years

6-9 years

9+ years

5. What are the ages of the students you teach? (Select all that apply).

- 9
- 10
- 11
- 12
- 13
- 14
- 15
- . -
- 16
- 17
- 18

19

Select if you teach up to 8-year-old students only

Select if you teach 20+ year old students only

6. If applicable, how many years did you work in industry before moving into education?

1-3 years

4-6 years

6-9 years

9+ years

Not applicable

7. Please indicate the type of institution you work in:

Public School - Academic

Public School - Vocational

Private School - Academic

Private School - Vocational

Other (please specify)

8. What is the main subject that you teach?

Arabic

Art

Biology

Business Studies

Chemistry

Computer Science

Design and Technology

Drama

English (First Language)

English (Second Language)

Geography

History

Islamic

Math

MFL - Modern Foreign Languages (French or Spanish etc)

Physics

P.E. Physical Education

Science

Vocational - Aviation

Vocational - Electrical

Vocational - Mechanical

Other (please specify)

9. Which tablet device do you use? Please select from the below.

Apple iPad

Android

Windows

Mobile phone - Please Specify

Other - Please Specify

None

10. How long have you been using a tablet as a learning tool in your classroom?

Less than 6 months

- 6 11 months
- 12-17 months

18 - 23 months

- 24 months (2 years) 29 months
- 30 months (2.5 years) 35 months
- 36 months (3 years) 41 months
- 42 months (3.5 years) 47 months

48 months (4 years) and over

11. How long have your students been using a tablet as a learning tool in your classroom?

Less than 6 months

- 6 11 months
- 12-17 months

18 - 23 months

- 24 months (2 years) 29 months
- 30 months (2.5 years) 35 months
- 36 months (3 years) 41 months
- 42 months (3.5 years) 47 months

48 months (4 years) and over

12. Please select from the scenarios below the one that best describes how the students are

provided with tablets in your school.

School provide a class set that can be booked

School provides 1 device per student - assigned but remains in school

School provides 1 device per student - student can take home but the device remains the

property / responsibility of the school

School provides 1 device per student - student can take home and takes responsibility for the device

School provides 1 device per student - student enters into a payment arrangement to purchase

this device

School has a BYOD (Bring Your Own Device) policy

Other (please specify)

13. How did you learn to use the tablets for designing learning sequences / activities? (Select all that apply).

Self-Taught

Blogs

Online Courses

Educational Technology Websites

Webinars

Conferences

School Organised Professional Development

Peer Observation

Social Media

Books (Hard Copy)

Books (eBooks / iBooks)

College (A level / IB / Diploma)

University

Friend

Family member

Child (16 years old or less)

Other (please specify)

14. Did you personally own and use a tablet or smart device before you started using one in the classroom?

Yes

No

15. Did the integration of tablet devices form part of your professional development targets, for either the last academic year (16/17) or this next academic year (17/18)?

Yes 16/17 only

Yes 17/18 only

Yes both years

Neither

I do not have professional development targets

16. To what extent do you agree or disagree with the following statement?

'My pedagogy (way of teaching) has changed since using tablets'.

Strongly agree

Agree

Don't know

Disagree

Strongly disagree

Please give a brief description for your choice

17. In regards to learning, what do you do with your tablet devices, that you could not do

before they were available? Please comment below.

18. What activities can be done on a tablet that cannot be done on another device or media?

Please comment below.

19. Has the tablet had an impact on the way you conduct summative assessment?

Yes

No

Please explain your answer:

20. Has the tablet had an impact on the way you conduct formative assessment or assessment

for learning?

Yes

No

Please explain your answer:

21. What impact has the tablet had on your workload?

It increased

It decreased

It stayed the same

Please explain your answer

22. Has the layout or design of your classroom changed through using tablets? E.g. movable

tables or open connected spaces.

Yes

No

If yes, please describe any layout changes and how you feel they may have affected the learning:

23. To what extent do you agree or disagree with the following statement?

'The use of tablets has changed my involvement in the class as a teacher'

Strongly agree

Agree

Don't know

Disagree

Strongly disagree

Please give a brief explanation for your choice:

24. Which of the following social media platforms do you use in your classroom for teaching and learning? (Select all that apply).

None

Schoology

Edmodo

Facebook

Twitter

Instagram

Google + / Google Hangouts

YouTube

LinkedIn

Pinterest

Reddit

Vimeo

Vine

Meet Up

WhatsApp

Snapchat

Virtual Reality

Other (please specify)

25. A standard lesson has a starter, main activity and a plenary. Do your tablet-based lessons have the same structure?

Yes

No

Sometimes

If no or sometimes, what structure do you apply?

26. Have you ever changed the timings / length of your lessons due to the use of tablet devices?

Yes

No

Please explain why and in what way?

27. In regards to tablet based lessons, has your teacher talk-time increased, decreased or stayed the same?

It increased

It decreased

It stayed the same

Please explain your answer

28. Approximately what percentage of your weekly average teaching time is spent using the

tablets?

- 0-10%
- 11-20%
- 21-30%
- 31-40%
- 41-50%
- 51-60%
- 61-70%
- 71-80%
- 81-90%
- 91-100%

29. In regards to tablet based lessons which core Applications (Apps) or websites do you use?

Please list below:

30. Do you choose the Apps or websites you use or are they assigned to you by the school?

Choose personally

Assigned by the school

Both

Other (please specify)

31. In tablet-based lessons, when using Apps, do you mostly use one App, or do you sometimes

use more? Please select:

I mostly use one App

I sometimes use more

If you sometimes use more, is there a flow between the Apps for the same activity or outcome, or

are you doing different activities on different Apps

32. In your opinion, what do you consider more important, the device Apps or the tablets ability

to connect to the internet?

Apps

Internet connection

Please add additional comments for this question where relevant to you.

33. Which do you use more: Apps or websites?

Apps

Websites

34. If you are aware of the flipped classroom model, have you ever applied it using tablets?

Yes

No

If yes, what do you think of it as a teaching strategy?

35. In your opinion, has the use of collaborative learning (e.g. Peer / Group work) in your

classroom increased, decreased or stayed the same with the use of tablets?

It increased

It decreased

It stayed the same

Please explain your answer

36. Has your use of homework increased, decreased or stayed the same, considering the use of tablets?

It increased

It decreased

It stayed the same

Other (please specify)

37. Has your use of personalised learning increased, decreased or stayed the same when using tablets?

It increased

It decreased

It stayed the same

Please explain your answer

38. Do you think that pedagogy is changing (as compared with traditional models of teaching), with tablets and the web connected devices that are now being used in classrooms?

Yes

No

39. If you think that tablet-based pedagogy is changing, how would you describe or define it?40. To what extent do you agree or disagree, that the following have been enhanced in your classrooms, due to the use of tablets?

Strongly agree / Agree / Don't know / Disagree / Strongly Disagree

Student Attainment Summative Outcome Student Achievement

Student Engagement

41. If you think there is an increased student engagement effect from using tablets, to what extent do you think there is a novelty factor? For example, if the students use Apps from age 10, will their interest sustain until age 18?

Strongly agree

Agree

Don't know

Disagree

Strongly disagree

42. In your opinion which aspects of teaching and learning will tablets or technology, never be able to replace?

43. If there is anything else you wish to add or consider important regarding the use of tablets in your classroom, please comment here:

44. If you would like to take part in the interview phase of this research, leave your details below. Please include your name and email address:

45. Additionally, if you would like to take part in the observation phase of this research, again leave your details below. Please include your name and email address:

Appendix B The Interview Questions

IMPLEMENTERS – Questions & Prompts

- 1. Please can you tell me about the context in which you work / teach?
 - a. Private / international/ government /vocational
 - b. Subject taught or subject background
 - c. Position held

2. Can you talk me through the process by which the tablets were introduced in the school?

- a. Why did you decide to introduce the tablet?
- b. What factors influenced the roll-out?
- c. What barriers or constraints were there teachers as well as technical
- d. How did you learn to use the tablet?
- e. Professional development for yourself and teachers
- f. What factors were considered in the management of the change to tablet use and how were these dealt with
- 3. The main focus of the study is to look at whether pedagogy has changed in the classroom. Please can you tell me about what happens in the classrooms in your schools now the tablets have been introduced? Please think about the differences if any between now and before the tablets were introduced.
 - a. Time spent using
 - b. Device affordances / use /
 - c. Lesson shapes
 - d. TTT teacher talk time
 - e. Models of learning flipped / collaborative / personalized / content creation /
 - f. Assessment / AFL
 - g. Classroom layout
 - h. Classroom time outside of class
 - i. Homework
 - j. SAMR
 - k. Social Media
 - I. Most impact Apps or Connectivity
 - m. How does this compare with your classrooms before the tablets?

Secondary questions

- 4. Do you think the use of the tablets has affected attainment outcomes / can you discuss why you think this?
- 5. Do you think the use of the tablets has affected achievement outcome / can you discuss why you think this?
- 6. Do you think the use of the tablets has affected engagement in the classroom / can you discuss why you think this is?
 - a. If yes: can you give examples
 - b. Do you think there is a 'novelty effect' involved here?
- 7. Taking into consideration everything we have spoken about what are your opinions on the uses of tablets in the classroom?
 - a. New pedagogy emerging
 - b. Negative aspects
 - c. Would you do anything differently in hindsight

TEACHERS – Question & Prompts

1. Please can you tell me about the context in which you teach?

- a. Private / international / government / vocational/ subject etc
- b. Subject taught
- c. Time with tablets
- 2. Can you talk me through the process by which the tablets were introduced in the school?
 - a. How did you learn to use the tablet?
 - b. Professional development
- 3. The main focus of the study is to look at whether pedagogy has changed in the classroom. Please can you tell me about what happens in your classroom now the tablets have been introduced? Please think about the differences if any between now and before the tablets were introduced.
 - a. Time spent using
 - b. Device affordances / use /
 - c. Lesson shapes

- d. TTT teacher talk time
- e. Models of learning flipped / collaborative / personalized / content creation /
- f. Assessment / AFL
- g. Classroom layout
- h. Classroom time outside of class
- i. Homework
- j. SAMR
- k. Social Media
- I. Most impact Apps or Connectivity
- m. How does this compare with your classroom before the tablets?

Secondary questions

- 8. Do you think the use of the tablets has affected attainment outcomes / can you discuss why you think this?
- 9. Do you think the use of the tablets has affected achievement outcome / can you discuss why you think this?
- 10. Do you think the use of the tablets has affected engagement in the classroom / can you discuss why you think this is?
 - a. If yes: can you give examples
 - b. Do you think there is a 'novelty effect' involved here
- 11. Taking into consideration everything we have spoken about what are your opinions on the uses of tablets in the classroom?
 - a. New pedagogy emerging
 - b. Negative aspects

Appendix C Participant Information Sheet, Consent Form



Southampton

CONSENT FORM - IMPLEMENTER INTERVIEWS

Study title: Digigogy [Digital Pedagogy] – A study into the changing pedagogy of tablet supported secondary classrooms in the U.A.E. Researcher name: Gemma Angela Escott Ethics reference: 14617

Please initial the box(es) if you agree with the statement(s):

I have read and understood the information sheet (6.4.2015 Version 1.) and have had the opportunity to ask questions about the study.

I agree to take part in this research project and agree for my data to be recorded and used for the purpose of this study $% \left({{{\mathbf{r}}_{i}}} \right)$

I understand that my responses will be anonymised in reports of the research

I understand my participation is voluntary and I may withdraw at any time [excluding final publication] without my legal rights being affected

Data Protection

I understand that information collected about me during my participation in this study will be stored on a password protected computer and that this information will only be used for the purpose of this study.

Name of participant (print name).....

Signature of participant.....

Date.....

23.10.2015 Version 2.

Appendix D Ethics Approval

Submission Number: 14617

Submission Name: Digigogy (Digital Pedagogy) A study into the changing pedagogy of tablet supported secondary classrooms in the U.A.E.

This is email is to let you know your submission was approved by the Ethics Committee. You can begin your research unless you are still awaiting specific Health and Safety approval (e.g. for a Genetic or Biological Materials Risk Assessment) Comments

1. I agree with the other reviewer's comment. Good luck with your study.

2. We strongly advise that you also receive local ethics approval in the U.A.E. Please look up the guidelines, check with a local university, and ask your contacts if they know how to gain local approval. In some countries, the penalties for not gaining local approval can be very high.

As can be seen from the comments there was an issue highlighted in comment 2 regarding getting local approval. I approached Dr Christina Gitsaki who is the Research Coordinator at the Center for Educational Innovation, Zayed University, U.A.E. Her information can be found at: http://www.zu.ac.ae/main/en/cei/Faculty%20and%20Staff/ ChristinaProfile.aspx http://christinagitsaki.info/. Upon discussion with Dr Gitsaki who has also held the position of UNESCO Chair in the region, she confirmed that approval to conduct research in the U.A.E. did not need to come from a centralised department, but should be obtained directly from those responsible for the school/s in which the research will be taking place. For the online questionnaire for the Ministry of Education school's permission was sought from Ali Al Yafai: Educational Technology Advisor to the Minister of Education and Andrea Shirley: Advisor MBRSLP For the online questionnaire in the GEMS school's permission was sought from Digital Strategy Manager. For the online questionnaire in the independent private schools, permission was sought on a case by case basis. For the interviews the participants were contacted and agreement to partake in the interview was taken as permission to conduct the research with them and their organisation. For the lesson observations, permission was sought on a case by case basis. All relevant information pertaining to ethics was included in the introduction to the online questionnaire. Regarding confidentiality and anonymity, it is important to distinguish the difference between confidentiality and anonymity, as this affects how possible participants in the research elect to partake, due to the purpose of this research confidentiality cannot be offered, however anonymity in the recording and reporting process was offered.

Appendix E The Coding Map

Name	Files	References
Curriculum	10	34
4.0	1	1
application of knowledge	1	1
artificial intelligence	1	5
AI and robotics in the operational side of education	1	1
AI responsive buildings	1	2
automisation of jobs	1	1
learning like a scene from the matrix	1	1
assessment	12	43
achievement	10	14
assessment transformation	1	1
attainment	9	15
authenticity	1	1
cheating	1	1
feedback	8	10
holistic portfolios	1	2
international examinations	1	1
misconception	2	2
portfolio	1	1
Provides data for the teacher	1	1
simulations false responses from student	1	1
context	3	6
creativity	2	6
play	3	4
transposition activity	1	1

Name	Files	References
defining terms	1	1
digital skills	1	1
digital citizenship	2	2
digital ecosystem	1	1
digital education journey	1	1
digital literacy	6	12
digital roadmap	1	1
future fluencies digital fluencies	1	1
mapping a student's journey	1	1
EFL unregulated industry impacts pedagogy	1	1
accreditation	1	1
engagement	10	25
enjoyment of learning	2	2
fun	1	1
happiness	1	1
evolution	1	1
niche unknown	1	1
paradigms of learning - new ones	1	1
global view	4	6
global international	4	7
international projects	1	1
higher education	1	1
impactful if invisible - tool	1	1
integration	9	26
interaction patterns	1	1
facilitate	1	2

Name	Files	References
interaction	1	1
teacher directed v student directed learning	1	1
teacher talk time	1	1
levels of integration	1	1
lifelong learning	1	1
21c skills	5	8
24 7 mindsets of learning	3	3
Critical thinking higher order thinking	3	5
out of school access - extended	1	3
resilience	1	1
skills acquisition	2	2
Soft Skills	1	1
soft skills not taught in school lead to knowledge gaps in careers	1	1
softer skills more valuable	1	1
transversal skills	3	4
world of work	1	2
mentoring	1	1
co-planning and mentoring	1	1
collaboration	5	14
communication	5	10
community	1	1
sharing	3	3
social	1	1
social media	8	8
working with other teachers	1	2
new pedagogy emerging	6	13

Name	Files	References
pedagogy	10	69
App smashing	1	1
change in lesson shapes	2	3
flipped classroom	5	6
Flipped learning 2.0	1	2
flow	1	2
homework	6	6
lesson starters	1	1
lesson structure	7	12
memory for learning	1	3
modelling	1	2
pace of lesson	1	1
pedagogy	1	1
procedural learning	1	1
teacher-led - bookended use of tablets	1	1
work flow	1	1
personalised learning	11	25
differentiation	4	6
independent	4	11
individual pathways	1	1
multimedia learning reflection	1	2
task augmentation for student needs	1	2
reading	1	1
reflecting the real world	1	1
Research skills	1	2
kids become researchers	1	5

Name	Files	References
saturation	1	1
spaced practice	1	1
spaces	5	10
classroom layout	3	5
learning environment	1	1
multimodal environment	1	1
support the content	1	2
content creation	6	11
not teach the content	1	1
text book and resource obsolete	1	1
time spent using device	1	1
beyond the classroom	1	2
boundaries formal and informal learning	1	1
continuous active learning	1	1
time spent using the device	2	2
value	1	1
benefitting	1	3
choice	1	1
enhance	8	15
open minds and experiences	1	1
positive effect	2	4
visual aspects	2	2
visual paradigm	1	1
vocational education	1	1
VR	3	3
devices	9	25

Name	Files	References
affordances	1	2
age groups	9	18
age related	8	16
Apple Samsung Platform	2	2
Apple Status	9	25
Apps	9	28
Apps v Connectivity	6	8
association with recreation	1	1
assisted technology SEN	1	1
basic use of an iPad	1	1
accessibility	3	4
consumption	1	1
device and operating system incompatibility	1	3
device neutral	1	1
ease of access	1	1
enterprise base to consumer-based device	1	1
equitability	1	1
familiarity with the device	1	1
functionality	5	6
interface	1	1
intuitiveness	2	2
iPad	4	7
laptops	5	8
Microsoft	4	12
Microsoft	1	1
mobility	2	2

Name	Files	References
novelty	7	11
portability	4	8
tactile kinaesthetic	2	2
teacher can access or check more student work	1	1
tool	4	5
evidence base and research	1	1
academics	1	4
buy in	6	11
champions early adopters	2	4
change	1	2
change agents	2	3
cognitive science	1	2
comparing answers with another student	1	1
confidence	2	3
data	2	2
digital natives or resident visitor	6	8
driver for change	1	1
early adopters	1	1
fear of failure -psychological	2	2
focus groups	1	2
google	1	2
google it - connectivism	1	1
ingenuity	1	1
intrinsic motivation	2	5
limitless access to knowledge	1	1
memory and retention	1	1

Name	Files	References
metacognitive	1	4
motivation	2	2
research based	1	1
SAMR	11	24
self-actualisation	1	1
self-regulation	2	2
shy students	0	0
small scale change	1	1
studies run in schools	1	1
ТРАСК	3	5
leadership	7	22
accountability	3	3
forced attrition	1	1
learning walks	1	1
management system	1	1
monitoring	2	2
performance management	1	3
responsibility	1	5
top down	1	1
tracking - big brother	1	2
cost	1	2
cost to impact	1	1
financial investment	1	1
implementation	8	36
length of implementation	1	2
pilot	1	1

Name	Files	References
scalable and sustainable	1	1
Infrastructure	9	25
BYOD	5	13
device management	2	2
e-safety	1	1
IT staff supporting	1	1
Wi-Fi	1	1
relationship with technology and pedagogy	1	2
coherence	1	1
keep it simple	1	1
no physical books	1	1
safe place to play	1	1
teaching assistants	1	1
testing and advising on products	1	1
success story	1	1
system wide change	1	4
transforming schools	1	1
visibility - data and engagement	1	1
vision	2	4
digital transformation	1	1
ownership	2	7
policy	2	4
school expectations	2	7
school philosophy	3	10
stakeholders	1	1
strategy	2	3

Name	Files	References
why	1	1
negative	11	41
babysitting tool	1	1
barriers	3	7
children want to be with their iPad	1	1
constraints	1	1
dangers of the internet	1	1
EdTech has hit a wall	1	1
EdTech is IT	2	2
flavour of the month	1	1
incoherent vision	1	1
iPad are not the saviours of education	1	2
iPads don't work	1	1
just for show	1	1
no common safety net	1	2
panacea	3	3
restrictions	2	2
risk	1	1
shelf life	1	3
tech changes too much	1	2
untainted by tech no place for the tech	1	1
what tech can't replace	1	1
Parent view	10	21
student as the factor	3	4
pride	2	2
student autonomy	1	4

Name	Files	References
student ownership and agency	1	1
student perception value	2	4
student using iPad	1	1
student voice	2	2
students as drivers for change	3	6
teacher as the factor	8	21
classroom management	1	2
experience	1	1
length of use	1	1
personal reflection	4	9
planning	1	1
saving time	1	1
specialisation for all educators	1	1
teacher autonomy	2	2
teacher role	5	20
teacher student relationship	1	1
workload	1	1
training	14	87
pre-service teaching degrees	1	2
U.A.E.	6	14
Appendix F Training Continuum

Least successful		Most successful
Hands-off-leadership		Hands-on-Leadership
		'We just put a structure in
		place as well to support
		training, so we have- across
		the school- the college, we
		have a digital strategy
		leadership group, which is-
		involves, representatives from
		the SLT from each of the
		school leadership teams, as
		well as the Deputy Head, and
		me, and the Head of- Head of
		IT support. And then we also
		have in each of the schools a
		digital team, and that's made
		up from- of me, and also
		teachers from that- that
		particular school'. II2
Centralised		De-centralised
Training	Coaching	Mentoring
	'Department-focused training	'Open door' II3
	projects. So, they're month	'Formative follow up' TI3
	long projects' II7	
	Formative follow up	'That to me is key. If- if you are
	'digital team member will go	an effective mentor with tech
	into the team meetings, we'll	and it's done properly, but
	have a discussion, say 'Ok, so	your source has to be valid. So,
	what are you looking at this	this is my biggest argument
	term?' and then we look at	with technology is that I've sat

how we can support that with	in training with somebody who	
training, with- in year team	literally I can tell has no idea	
meetings. So rather- rather	how to use what he's showing	
than it being a centralised	me, he's never used it in a	
model, we will have sessions	classroom. So, your sources	
where we'll have- next Sunday,	have to be valid, you have to	
we've got 70 staff doing, sort	have valid sources, you have to	
of, iPad training stuff just for a	have a proper structure, and it	
couple of hours. It very much	has to be that safe	
breaks down into more	environment, and that's when	
coaching and mentoring on	you can start to have impact'.	
individual and very small group	ТI2	
bases, 'cause that's the only		
way it's effective'. II2	'That comes with- with being	
	in that safe environment	
'and then a lot of it was just	where you can try and not be	
informal, so as in any time a	judged for it, and that comes,	
teacher can request, 'Now I	you know, from effective	
want to teach this lesson, what	mentoring and then effective	
App can I use?', and things like	training. Um, so yeah, I think	
that. Oh, and we got 10 power	just the initial, and then as	
users of teachers, that wanted	you- as you get used to it	
to be part of a group that	more, you'll try different things	
would help other teachers to	out, you'll try things	
be trained'. II4	differently, so, basically, you	
	never stop learning or	
	experimenting. I've used tech	
	for the last 11 years and it's	
	still an experiment now.	
	Sometimes it works,	
	sometimes it doesn't, um, but I	
	don't have anxiety of stuff	
	going wrong anymore. So, I	
	think from a teacher's	
	perspective, those- those	
	negatives um can he short-	
	negatives, and, can be short-	

		lived as long as you- as long as
		you're positive going in, um,
		you're guided properly, um, I
		think that's the main thing'.
		TI2
Technical / Functionality	Generic App / Pedagogy	Subject Specific App /
		Pedagogy
'First of all, looking at	'App-tastic' II3	Models of use
productivity' II4	'App-y Mondays' II4	Digital pedagogy
	weekly App training in school.	ТРАСК
	Monthly App training in	'Functionally low /
	school.	Pedagogically high' TI2
	SAMR RE 'Rolled out the SAMR	
	model, it was introduced at	TI3 – if this is absent 'Like, if
	the start of the – we have a	you're a person who's
	professional development	enthusiastic and happens to be
	launch at that school within	a Maths teacher or a Physics
	the first few weeks, and that	teacher and they use it, then,
	was launched. And also, we	you know, probably the whole
	had, or we devised a toolkit for	department will look up- go to
	the different, for the S and the	this person, and they can
	A, M and the R, and sort of	them. If there isn't one then
	strategies that we could use.	people won't use it'.
	And lots of modelling'.	
	TI5 'gallery, um, almost like a	
	speed dating setup of PD'	
	and then, once a month after	
	that, there were smaller	
	events held at all the various	
	campuses'.	
	TI3 'they run regular, they call	
	them conferences, twice a	

	1	
	year – one in January, one in	
	April. Most of the sessions	
	would be delivered by	
	colleagues, ok, from across the	
	ba- across the system. And all	
	the time those sessions were	
	terribly useful, because all the	
	people who put themselves	
	forward, had something to	
	show us, had something to-	
	well, show us, but practices.	
	So, we always – well, myself-	
	always looked forward to	
	these sessions. They would	
	take place over a day, so on	
	average we would attend four	
	sessions. Extremely useful and	
	I would return to my place of	
	work and feel, 'Yep, I can	
	enhance my delivery'.	
External	External	Internal
	Internal	
'Apple education trainers in	'Apple, Microsoft, content	Safe environment
our school who provide	providers will come in, they'll	Proper structure
sessions to our teachers So	train people, that's part of the	
they'll do, like, three-hour	equation. We will also try and	
modules where teachers	develop as much as we can	
actually take part, with the	internally because by	
trainer, and they are provided	developing- delivering	
those skills' II3	internally, you develop	
	capability and capacity'. II1	
'So, actually, um, getting Apple		
and places like that to come in		
and actually give the training	'there's so much responsibility	
and the PD, not something	that goes into the selection of	

that's in-house. I don't think	applications that we use. Also,	
people value it as much,	we communicate with the	
especially when it's something	other schools, I mean, we use	
new, when it's given in-house	social networks such as Twitter	
than they do when it's	and we are able to follow	
someone from those actual	other schools and they	
organisations come and give-	advertise their applications, or	
provide the training at first'.	we follow publishers of	
	applications, so also, we draw	
	on that aspect when selecting	
	applications. What's current'.	
	113	
	'iust trying with it, seeing what	
	works, seeing what doesn't.	
	Twitter was probably the	
	biggest way that I learned how	
	to – not how to use it, but	
	what things there are out	
	there. And then, in terms of	
	how to use it once I found	
	them, just myself, just messing	
	around with it'. II4	
	Concept of play	
	TI3 'The professional	
	development was varied, was	
	regular. It was delivered by-	
	well, other teachers. And every	
	now and then they invited	
	outside speakers. Not just	
	speakers to talk at us, but	
	actually it was practical tips on	
	how to use the tablet. I felt –	
	as I mentioned – I felt fully	
	supported, because what	

	happened in my previous	
	place, there were issues and	
	they were more technical	
	issues, and we couldn't really	
	fix those, and- '	
Apple, Microsoft	Apple Microsoft	Teacher choice / institutional
		requirement
		ADE MIE MIEE MCE
		'MIE status. That's the
		absolute minimum
		expectation' II1
		'Microsoft fellows' ll1
		'compulsory that all teachers
		do the Apple online training'
		113
		In the interview with II1 it is
		mentioned that the senior
		leadership team will undergo
		digital pedagogy training,
		which will be a requirement
		for subsequent promotion.
		-

Appendix G Interview Participant Profile

Identifier	Role	Context Org	Age Bracket	Gender
1	Senior Manager –	Multiple	32-38	Male
	Education Technology	Institutions		
112	Director of Digital	One Institution	39-45	Male
	Learning			
113	Technology	One Institution	25-31	Female
	Integration Specialist			
114	Department Manager	One Institution	25-31	Male
115	Head of Digital	Multiple	39-45	Male
	Education Strategy	Institutions		
116	Senior Leadership	One Institution	32-38	Female
	Team (Academic)			
117	Head of Digital	One Institution	32-38	Male
	Learning and			
	Innovation			
TI1	Teacher	EFL	25-31	Female
TI2	Teacher	EFL	32-38	Female
TI3	Teacher	EFL	32-38	Female
TI4	Teacher	Middle School	32-38	Female
TI5	Teacher	EFL	39-45	Female
TI6	Teacher	Middle School	25-31	Female
TI7	Teacher	Middle School	18-24	Female

Appendix H Aggregation of codes

Aggregating the codes together under each attributed theme, we can see how they rank in order of magnitude by mentions in the data. These codes have been subsumed within one another as part of a hierarchical coding scheme (Lewins and Silver, 2007). Creswell (2014) is against the idea of counting coding due to its lean towards quantitative methods, and as Saldana (2016) asserts, frequency does not necessarily denote significance. The choice to count here has been done as a useful indication of the importance of a code for further discussion (Harding, 2013).

Curriculum Framework is the most aggregated as it subsumed the most codes, below I show the rankings as per the themes (a) with a second ranking showing training and where pedagogy, assessment and personalised learning are placed, in rank from the curriculum framework theme (b).

(a)	(a)	(b)	(b)
Curriculum Framework	587	Curriculum Framework	587
Devices	206	Devices	206
Leadership	181	Leadership	181
Evidence Base	99	Pedagogy	112
Teachers	61	Evidence Base	99
Students	24	Assessment	93
Parents	21	Training	89
		Teachers	61
		Personalised	47
		Students	24
		Parents	21

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