Imagined Futures:

The impact of mlearning and access to mobile

technology on the role of the teacher

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Word Count & Formatting

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Referencing and formatting in this thesis follow the APA style as defined in the *Publication Manual of the American Psychological Association*, 6th edition. Three formatting exceptions, which deviate from the APA style for ease of reading, are made for:

- Direct quotes from participants are presented in the typeface `Courier New` at 9 or 11 points.
- Categories in the data are presented in italics, for example '*... the school as an institution*'.
- Grounded theories are presented in bold, for example '... their use was **shaped by the examination system**'.

The epistemological position of constructivist grounded theory sees the researcher as part of the data, including the construction of codes and categories. Therefore, the study is written in the first person.

Abstract

The use of mobile devices in education has long been predicted and imagined. Recent technological changes and increased affordability have enabled pioneering schools and educators to embark on mobile device initiatives. In the Irish educational context, schools were able to link their use of devices to anticipated curricular reforms, but lacked national guidance on the use of those devices for teaching and learning. This study concerned itself with the impact of mobile learning and devices on relationships of learning. The literature review revealed a significant gap in the research on the use of mobile devices in certain contexts and a lack of theoretical understanding of their use.

The study employed a constructivist grounded theory methodology to explore the experiences of schools, teachers and students in Ireland. A sample of two post-primary schools and seven teachers, with their students, were recruited to the study. Data were gathered using interviews, video analysis, online observations and physical observations of classes. Some methods were extensions or innovations on traditional grounded theory approaches. These data were analysed through the process of constant comparison, from which codes and categories emerged. The categories demonstrated the importance of school context, the value of teachers' virtual classrooms and the requirement to understand teachers' beliefs.

The findings add new knowledge to the field of mobile learning, and innovation in the methods of grounded theory, and yielded insights of value to school leaders and policy makers. The grounded theories which emerged placed emphasis on understanding a teacher's beliefs, and demonstrated that those beliefs largely shape their use of technology. They also establish that mobile devices, despite substantial new benefits to users, were not intrinsically agents of pedagogical change.

List Of Acronyms

DES   Department of Education and Skills (Ireland)

ESRI   Economics and Social Research Institute (Ireland)

ICTs   Information and Communications Technologies

NCCA   National Council for Curriculum and Assessment (Ireland)

OLPC   One Laptop Per Child Programme

PCK   Pedagogical Content Knowledge

TAM   Technology Acceptance Model

TCI   The Teaching Council of Ireland

TPACK   Technological Pedagogical Content Knowledge

TL21   Teaching and Learning for the 21st Century

TVCs   Teachers' Virtual Classrooms

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Chapter 1: Introduction

1.1 Introduction

It was a simple thing to do. Many of the parts of the miniputer were synthetic bio-chemical units, their 'controls' built into Jed's aural cavity; he 'switched on' by simple neural impulse. At once the mighty resources of the machine, equal to the libraries of the world, billowed like a curtain on the fringes of his brain...Its 'voice' came into his mind, filling it with relevant words, figures, and pictures ... 'Of all continents, the Antarctic has been hardest hit by ice.' As it spoke, it flashed one of its staggeringly vivid pictures into Jed's mind. Howling through great forests, slicing through grasslands, came cold winds. The landscape grew darker, more barren; snow fell. (Aldiss, 1963)

The extract above comes from a children's short story by Brian Aldiss (Aldiss, 1963), a science fiction writer. In it, he describes how children are learning through guided project work instead of formal schooling. In the fictional field-trip, Jed who was 13 years old, and his father visited Antarctica to survey the melting glaciers: "the sad masses of rock were heavily scarred where the ice flow had once rubbed them, for in this year of 1994, the glacier was smaller than it had been even a century ago." Jed directed his attention to his right ear and activated a device which guided his exploration of the world in front of him; in his mind a stream of immediately-relevant information filled his thoughts. While the story may appear far-fetched, it is rooted in a progressive vision of education where children learn more effectively in challenging environments by pursuing questions of real interest (for Jed, the consequences of global warming). A vision where there is a role for an adult guide as a facilitator and where mobile technology provides rich and relevant information in context, and where they can make connections between formal knowledge

and personal experience. This vision represents a radical shift in education, it redefines traditional roles between students and teachers, and requires an epistemological shift in their relationship with knowledge. Aldriss's vision for a virtual field trip would arguably be possible with today's technology (aside from the 'biochemical' elements), yet the work to implement the progressive vision for education implicit in the story is far from complete as this thesis will explore.

This introductory chapter presents an overview of the study which took place in two Irish post-primary schools who were among the very first in Ireland to begin mobile device initiatives. As early-adopter schools, they could not learn from other reference sites or rely on a template to follow; when they deployed devices to students in June and August 2012 they became pioneers. This chapter will show how the study intended to examine the impact of mobile learning on relationships of learning between students and teachers, and it will foreshadow how, in response to the data, the focus of the study changed over time. It begins with the background to the study, which encompasses both trends in the use of educational technology, and my personal experiences of working in the area which fostered my interest and provided a practical pathway for research. This is followed by a discussion of the study's methodology and methods, and also the significance of the study. It concludes by providing an overview of the chapters of this thesis.

1.2 Background

It is easy to understate the impact that internet-connected mobile devices are having on society. The mobility of these devices is the first of several characteristics which sets them apart from previous generations of 'portable' devices. A portable device may be used

at point A, closed down, and opened up again at point B, while a mobile device may be used at point A, point B and everywhere in between, without stopping (Puentedura, 2012). Given that one can possess and use a device in almost any circumstance, it follows that ubiquitous mobile internet access will have major impacts on society. Prominent examples include our patterns of human interaction (Castells, 1999), which adapt to the networks we are part of; the ways we form human identity (Ghosh, 2013), where connections with like-minded people are easier to form and maintain, with both positive and negative consequences; and on our cognitive processes (Sparrow, Liu, & Wegner, 2011), where readily-accessible or 'Googleable' information is no longer transferred to long-term memory. Traxler (2009) discusses the economic impact, when describing changes in the nature of work. Employees who are required to use mobile devices for productivity and professional development have become 'knowledge workers' living and working knowledge economies.

The use of internet-connect mobile devices in education has long been anticipated, initially in science fiction, and later by educators. Heppel's 1998 prediction that students would possess personal learning devices in the classrooms of the future is an early example of educators re-imagining the traditional structure of education (Heppell, 1998). Fourteen years later, the Horizon Report (L. Johnson, Adams, & Cummins, 2012) noted that mainstream adoption of tablet computers, as a class of mobile devices, was not only imminent but should be welcomed and seen as complementary to attempts at educational reform:

> Recent research indicates that tablets, because they are designed to easily
> share their screens, foster key 21st Century Skills in students, including

creativity, innovation, communication, and collaboration. (L. Johnson et al.,

2012, p. 16)

The introduction of mobile devices into education offers a compelling vision of educational reform in both academic literature and popular media, and presents the possibility of mobile learning as a new educational practice. In some examples of research (Heinrich, 2012; The Irish Times, 2015a), mobile devices have supported revitalised teaching practices and changed classroom environments where a teacher's role as the source of knowledge evolved to a facilitator of learning for students (L. Johnson et al., 2013). Media reports of revitalised schools, reformed educational practices, increased attainment and a renewed commitment to teaching and learning by students and teachers makes for attractive reading and also invites rigorous academic research in the area (Cellan-Jones, 2012). This narrative of revitalised teaching and learning practices (and the creation of a new practice) from the popular media, often although not universally reported, oversimplifies both the complexity of education reform and of introducing new and disruptive technologies into a highly-structured environment as we will see from the review of the academic literature presented in Chapter 2.

There is an alignment between the abilities that mobile devices afford their users, most notably the degree of personalisation that is possible (Kearney, Schuck, Burden, & Aubusson, 2012), and somme recent reforms in some educational programmes. The focus of educational programmes has shifted be more student-centred for political, theoretical, ideological and institutional reasons (Benson & Voller, 2016) A student-centred focus is not new, it is an idea with a long history from Socrates, through to the modern theories of experiential learning from Dewey (1916), and on to Freire's (1970) theories of

emancipatory learning. Student-centred environments have therefore been a widespread reality as a result of these shifts in focus and Chapter 5 will discuss this experience in Ireland. ICTs support the ability to learn anywhere, anytime and across multiple modalities, and therefore support the political and emancipatory ideology of allowing and encouraging students to develop their independent learning capacity (L. Johnson et al., 2014). While that intention is laudable, it does change the traditional hierarchical roles and relationships between teacher and student, and the requirements and demands of both. An examination of this shift in the relationship was one of the initial intentions of this study. At a societal level, widespread use of mobile devices changes the nature of knowledge and ways of delivering the information. Learning that used to be delivered 'just-in-case,' can now be delivered 'just-in-time,' 'just enough,' and 'just-for-me' (Traxler, 2009).

The study's initial intentions were informed by my vision for the use of information and communications technologies (ICTs) in education and my professional work as an educational technologist. My belief that ICTs would play an increasingly important role in education was informed by my reading of the academic literature and ongoing dialogue with educators, as well as the prevalence of technology in the modern world and its rapid pace of development. ICTs already provide for learning at great distances or outside of conventional classrooms (University-level VLEs like Moodle or Blackboard are examples), but I felt that its potential had yet to be fully realised. My professional experience over 8 years showed me that within education institutions, the use of ICTs enabled greater equality between students of varying abilities; it enabled students with special educational needs or physical disabilities to participate more fully in learning environments and, in that process, made those environments more diverse and inclusive. I

believed that by effectively using ICTs, educators could encourage their students to learn in new ways and to find new means to express their creativity. I was therefore guided in my work by the belief that ICTs could enhance teaching practices and create new ways of learning for both students and teachers and would develop a capacity for lifelong learning.

My professional work as an educational technologist coupled with my background in the technology sector have critically influenced both my professional development and this research. In my journey from the technology industry to education, I was drawn by the sense of purpose at work in education, but to a greater extent by the possibility of seeing my passion for technology applied in a way that could enable educators to use ICTs for teaching, learning and assessment effectively. My work provided a practical pathway to research as a consultant in a private company working with schools. I was involved with the earliest trials and mainstream adoption of 1:1 mobile devices in Ireland, working with 12 post-primary schools commencing in 2012 and more in subsequent years. My professional focus was two-fold. First, I was consulting with and advising those schools on the design, implementation and support of their one-to-one mobile learning programmes, where each student has a personal mobile device. Secondly, I designed and co-delivered professional development workshops for schools, the purpose of which was to enable educators to develop competence and confidence in their use of technology and support their aspiration to create modern, vibrant and technology-enhanced learning environments. That role afforded me sustained contact with schools and teachers and enabled me to observe (admittedly at a remove from the classroom) the impact of technology on teaching, learning and assessment. The articulation of these beliefs was a critical step in

ensuring reflexivity throughout the research process, and I will discuss this in detail in Chapter 5.

1.3 Mobile Learning - An Imagined Future

Mobile learning emerged into the mainstream of educational practice relatively recently (Young, 2016), but its origins can be seen in the writings of science-fiction authors over previous decades. Those authors present a vision of technology seamlessly extending the capabilities of users through a variety of means; some examples include the remote-sensing Tricorder in Star Trek (Roddenberry, 1966), the video-conferencing tablet in 2001: A Space Odyssey (Kubrick, 1968) or Hari Seldon's mobile device with gesture-based interface in Asimov's Foundation (Asimov, 1951), and of course the example from the opening of this thesis. In these examples the usage falls into categories of information retrieval, remote sensing, communication and collaboration; yet they all share a common characteristic of seemingly natural or effortless user experiences. While many of the interactions that connected a user and their device seemed far-fetched at the time (and some still are), the impact is the same; the technology is an augmentation of the user, placing new and useful capabilities at their disposal. In writing these stories, the authors were not limited by what was technically possible at the time, but with imagination and creativity they were able to focus on a vision for how technology could be used. It may be a stretch to suggest that the authors were focused on technology in any way; instead, we are reading the answer to a question in their minds – *'Wouldn't it be great if ...?'*

Unsurprisingly, the *'Wouldn't it be great if ...?'* question was posed in an educational setting by Dr Alan Kay in 1972, who answered it by providing a vision for the application

of technology to education. Kay's (1972) concept of the Dynabook, shown in Figure 1.1

below, was as a personal computer for children of all ages with an ambitious technical and

educational design, both of which were advanced (and aspirational) for their time.
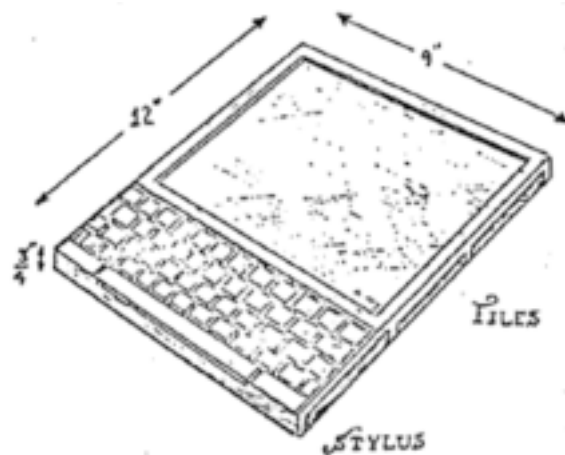
Figure 1.1. Conceptual drawing of the Dynabook (A. Kay, 1972, p. 6).

The educational aspiration was informed by the learning theories of Seymour Papert, in

particular his beliefs about the importance of computer programming in developing

children's thinking skills (Papert & Solomon, 1971). That educational vision is obviously

at odds with the concept of Skinner's behaviourist learning machine (1958), which was an

earlier implementation of educational technology where students completed simple drill-

style tasks with the aid of early computers. Kay (1972) draws out this distinction as

computer-aided intuition (or inspiration) as opposed to instruction via computer. Kay

(1972) imagined the Dynabook as a personal device that embodies an educational vision,

where the device was interactive and enabled playful, self-directed, collaborative and

informal learning which could take place anywhere and anytime. The technical aspiration

was for a mobile device no larger than a notebook and weighing less than 1.8kg, which

would require a flat panel display with quality similar to a book. The Dynabook would

have storage capacity for at least 500 book pages or several hours of audio, high

bandwidth communication and a connection to a global wireless network, powered by rechargeable batteries and designed to cost under $500. Kay was working at the Xerox Palo Alto Research Centre[1] when he conceived the Dynabook and went on to work at Apple and more recently brought his vision closer to reality on the One Laptop Per Child programme (2005).

In the decades since Kay's vision for mobile learning was first presented, including his conceptualisation of a device capable of enacting it, there have been significant technological advancements to the point where elements of that vision now exist. Recent developments include high-speed connectivity, affordability of devices, an abundance of storage capacity, the interactivity of content or collaborative learning environments, and have they reached a level of maturity where it is both practical and affordable to imagine students with devices capable of augmenting their learning experiences and allowing the educational vision to flourish. The implications of students having and using these devices and internet connectivity can now be considered; what are the impacts on the nature and purposes of education, relationships of learning, and relationships with knowledge These questions must now be posed and answered, beginning in this thesis and with pathways for future research in the field.

1.4 The Research

The methodology employed by this study was grounded theory, in particular, the constructivist approach to grounded theory developed by Charmaz (2014). The use of grounded theory outside a positivist theoretical perspective is a departure from the origins

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1 The Xerox Palo Alto Research Centre (PARC), founded in 1970, was instrumental in the development of the modern personal computer. The modern graphical user interface (GUI) is one of a number of research accomplishments at PARC.

of grounded theory as initially developed by Glaser & Strauss (1967). Chapter 3 discusses the research methodology in depth and will justify this pairing, as well as the application of grounded theory to educational technology.

Methodology & Methods

Purposive sampling was used to select participants for the study, which ultimately included two schools, and within those schools, seven teachers with their associated classes. The study employed a range of data collection methods, including those most typically associated with grounded theory, for example, transcribed interviews. Some methods were innovations to the traditional methodology, namely online observations and video observations of classrooms. The data were then coded, and through the process of constant comparison, focused codes and categories emerged. The coding process continued throughout the data collection phase, with memo writing and constant comparison guiding the process and leading to new data being added. The coding processes covered all the data, across the diversity of methods and were analysed both by hand and with qualitative data analysis (QDA) software. From the codes, a series of categories emerged, which supported the grounded theories which will be presented.

Evolution Of The Focus Of The Research

The coding process began to reveal a change in the focus of the research, casting doubt on the presence of mobile learning as a practice, and therefore the ability to answer research questions which were based on its existence in the study's schools. As a grounded theory study, a change in focus that is led by the data does not pose a methodological problem. Indeed, a strength of grounded theory comes from privileging data over a

hypothesis or literature, allowing a more accurate understanding of the phenomenon to emerge free from such constraints. Kenny & Fourie (2015) note that this ability is a feature of grounded theory since Glaser & Strauss (1967) first discovered it.

> ... during the simultaneous collecting, coding, and analysis of data, unexpected concepts may emerge which change the direction of the study considerably, thereby redirecting the research, and necessitating further data-collection that could not have been anticipated in advance. (Kenny & Fourie, 2015, p. 1270)

To faithfully recount the research journey, I will allow the change in focus to unfold over the first five chapters which provide a near chronological account of the research. I will, however, signpost three points to alert the reader to the change in focus. The first is Chapter 1, where the preceding sections presented the initial intentions of the study, including identifying the influences for the framing of the research question and sub-questions. These intentions guided it through methodological design, discussed in Chapter 3 and the beginning of the coding process. The coding process, discussed in Chapter 4, is the second point and it is here that codes and categories emerged which demonstrated that the schools had not intended to introduce mobile learning as a practice, instead they planned to introduce mobile devices. Chapter 5 will engage in a detailed discussion on the mobile device initiatives, and through the presentation of grounded theories, will show the change in focus to be final. The remainder of the data chapters and conclusion reflect the final focus of the research, which is mobile device initiatives.

1.5 Significance Of The Study

The significance of the study can be seen in the three distinct contributions it makes to the body of knowledge in the discipline of educational technology, the educational

practice of teachers employing technology for teaching and learning, and the methodology of grounded theory. This section will introduce the first of those contributions, which concerns gaps in the research which informed the design of the study. In addition to addressing gaps in the research, the study responded to the self-directed initiatives from schools, which in some cases echo Fullan's (1993) 'ready, fire, aim' approach to educational change. Fullan (1993) described a process of educational change that privileged action, arguing that it is better to begin and refine an initiative than to plan endlessly:

> Ready is important, there has to be some notion of direction, but it is killing to bog down the process with vision, mission, and strategic planning, before you know enough about dynamic reality. Fire is action and inquiry where skills, clarity, and learning are fostered. Aim is crystallizing new beliefs, formulating mission and vision statements and focusing strategic planning. Vision and strategic planning come later; if anything they come at step 3, not step 1. (Fullan, 1993, p. 43)

Those initiatives in the schools can therefore benefit from novel research approaches in addition to more traditional approaches. The study will also demonstrate strong links between the challenges that come with educational technology and the broader challenges in education, suggesting that philosophical, sociological and historical lenses may be appropriate additional perspectives for practitioners and school leaders. These ideas, identified here as signposts, will be discussed throughout this thesis and collectively revisited in Chapter 8 which concludes the thesis.

Research Gaps

In 2009, Traxler spoke of the challenge for the emerging field of mlearning in "developing the substantial and credible evidence-base that will justify further research and development" (Traxler, 2009, p. 3). Academic research in the field was also limited, in scope and rigour if not in quantity. At a theoretical level Oliver (2013) notes that the research community, with a few exceptions, has failed to articulate a theoretical framework for researching educational technology: "The consequence of this is a failure to provide convincing accounts of the link between technology use and learning" (Oliver, 2013, p. 31). Two theoretical models are most often used for this research: (a) affordances of technology which Oliver describes as "the environment provides possibilities for actions that are self-evident" (Oliver, 2013, p. 33), and (b) Vygotsky's (1978) activity theory, which seeks to understand human activity as a complex and socially-situated phenomenon. Oliver (2013, p. 41) contends that both models are "uncritical or oversimplified accounts of technology". At a practical level, Rushby (2012) notes that the majority of current research on mobile learning is rejected from peer-reviewed publication:

> The majority of these focus on the acceptability of the technology to the learners and are best summarised as 'We asked the subjects whether they liked learning with mobile devices and they said that (a) they did and (b) they would like to do more of it … The majority of these studies do not move us significantly beyond what is already known and widely published in the field—and they are rejected'. (Rushby, 2012, p. 355)

Rushby identifies the research failings as (a) being based on small sample sizes, (b) focused on user acceptance, (c) providing positive results - that is, the learning outcomes were usually slightly better or no worse than with other forms of e-learning, and (d) being rewritten from a Masters or PhD thesis. Many of these studies focus on the affordances of

devices and how they enable communication, information retrieval or distribution of teacher-generated content and are short-term in scope (Cochrane, 2013). Rushby goes on to establish that the research agenda should focus on providing:

> 'proof of educational, economic and social outcomes and impacts (short term, long term and systemic) or show how and why such applications fall short of expectations or fail to gain traction'. (Rushby, 2012, p. 355)

Cochrane's (2013) review of mlearning projects from 2002 to 2012 concluded that academic research lacked, amongst other characteristics, depth of underlying pedagogical theory, a lack of longitudinal study and a lack of awareness of the epistemological shifts required for both the learners' conception of learning and the educators' conception of teaching. These epistemological shifts, initially identified by Chi & Hausmann (2003), have the potential to affect the relationships of learning between students and educators and are of critical interest to this study.

1.6 Situating The Researcher

Power relationships are a legitimate concern when engaging in research involving human subjects. In this study, I had a relationship with the schools due to my professional role as an educational technologist, and had prior contact with approximately half of the teachers, therefore there was a pre-existing relationship to consider. However, it will be evident in the discussion of methodology and methods in Chapter 3 that steps were taken in the research design to ensure that the relationship did not distort the data.

The potential for researcher bias is present in all research, especially in the social sciences. Rather than assert that researcher bias has been eliminated, in itself an impossible feat,

grounded theory acknowledges that the researcher is part of the data. By adopting a systematic approach to collection and coding, the research can ensure rigour and validity in the analysis of the data. A researcher may still bring assumptions and biases into a study, but by acknowledging those and requiring the researcher to develop a reflexive capacity, a research study can minimise the impact on the analysis.

The study was an observational one, it did not seek to introduce changes in practice, but only to observe and analyse the initiatives that the schools independently decided to embark on; a process described in Chapter 5. The study, therefore, collected data on classroom or educational practices as they happened, rather than collecting controlled data.

1.7 Structure Of The Thesis

This thesis contains eight chapters, whose structure and content are outlined below.

Chapter 1 - Introduction. This chapter introduces the area under investigation by presenting the background to the study which will provide context and an understanding of the intentions of the research.

Chapter 2 - Literature Review. This chapter provides a review of the relevant research on mobile learning and relationships of learning. It will examine how early concepts for mobile leaning had an origin in the works of science fiction writers, and will evaluate recent literature to establish a theoretical framework to understand mobile learning. Changes in the roles of teachers, including educational relationships will be examined.

Chapter 3 - Methodology. This chapter presents the case for using grounded theory as the methodology for the study. It will describe the epistemological position of the researcher as an interpretivist one and makes the case for how grounded theory, and its constructivist variant in partic r, fits within that theoretical perspective. It will describe how the research methodology shaped and directed the development of the study, as the collection and coding of data directed the research process. The research methods will be discussed, including the development of novel approaches for collecting data in a grounded theory study. The ethical standards, as well as other concerns which emerged during the study, will also be discussed.

Chapter 4 - The Coding Process. This chapter provides a chronological account of how the data were coded, and how the methodology directed the generation of codes. It will also provide a detailed account and justification for the innovations in using grounded theory to observe physical, video and online spaces in educational contexts. The chapter reveals data to support the change in research focus of the thesis.

Chapter 5 - Participants in Context. This chapter provides a contextual view of the codes and categories which emerged from Chapter 4, and will also discuss the technological solutions employed by the schools. The complexity of the educational environments under investigation warrant an analysis of the contexts for teachers and schools, where it will be established that schools and teachers feel a range of external influences. Analysis of the codes and categories will also reveal a substantial challenge to the assumptions of the study; nevertheless, rigorous analysis of codes and categories will reveal theories which reflect the lived experience of the participants and a change in focus of the study.

Chapter 6 - Informal and Formal Communications. This chapter examines students' ability to get online and create informal networks. It will introduce the use of teachers' virtual classrooms as spaces for formal communications and examines the caveats of their use which contribute to tensions in teachers' professional practice. It will develop a framework to classify the uses of virtual classrooms, and will reveal the need to examine additional data in Chapter 7 to extend and complete the classification framework.

Chapter 7 - Teachers' Virtual Classrooms. This chapter introduces further codes and categories to the classification framework for teachers' virtual classrooms, which will reveal the functions they performed and their patterns of use. The chapter will present the examination system as an external force which shaped the patterns of use. It will also identify limits to the thesis and identified areas for future research.

Chapter 8 - Conclusion. This chapter presents a summary of the findings of the study as well as the grounded theories it generated. Through in integrated discussion, it will reconcile the formal requirements of a research study with the use of grounded theory. It will set out the significance of the study as a contribution to the discipline, and to educational practitioners, as also to the methodology of grounded theory. Finally, it will discuss recommendations for future research.

Chapter 2: Literature Review

2.1 Introduction

This study inquired into the effects of mobile learning (described as mlearning in the literature) and access to mobile technology on relationships of learning between students and teachers. The literature review presented in this chapter will establish a theoretical framework for the research by engaging with the body of knowledge in the field, focusing in particular on two areas: mobile learning as a practice and relationships of learning. To establish a definition of mobile learning, and the characteristics of it as a practice, I will review its historical origins and the contemporary discussion in the discipline. The relative novelty of mobile devices in education, and the lack of large-scale or longitudinal research, presents a challenge in stating a single definition or characteristic of use for mobile technology in education which will be discussed in depth.

2.2 Literature Review Methodology

An initial challenge for any researcher engaging in grounded theory research is deciding how and when to undertake a review of the literature in the discipline. There are currently three central positions on this question as outlined by Bryant & Charmaz (2010) in their review of the methodology. The first position comes from Holton (2010), who believes that a researcher should approach a grounded theory study with "no preconceived problem statement, interview protocols or extensive literature review". Holton's position is the classic approach to grounded theory, where the literature is engaged with at the end of the study. Introducing a measure of pragmatism to this approach, Stern (2010) recognises that funding applications and ethical approval processes may impose the need for a literature review on a research study, and therefore accepts them in limited form. The last

position is exemplified by Charmaz in her constructivist approach to grounded theory (2014) and endorsed by Lempert (2010); they believe that past research has a role to play as it prevents repetition in future research and may provide new insights into evolving research scenarios. Charmaz therefore argues for engagement with the literature to commence at the outset of the study for both methodological and practical reasons.

This study adopted the constructivist approach (Charmaz, 2014; Lempert, 2010), and in doing so it recognised that I, as researcher, had prior knowledge of the field of educational technology and mobile technologies in particular. The approach was justified for two reasons:

- my prior experience in schools working with mobile devices, and
- My belief that insights from the literature may constructively contribute to the quality and direction of the research.

The research process was aided by having a useful starting point as Bryant & Charmaz (2010) indicate, and that the progress of the research was guided by insights and indeed questions that arose out of the literature review or data analysis process. A further discussion on the rationale for choosing the constructivist approach to grounded theory will take place in Section 3.2

The early review of the literature began with a general search on mobile learning, with a focus on more recent uses of tablet devices to match the context of this study. The review was broad, including formal and informal education contexts. A search of the leading academic databases was conducted, including but not limited to: Education Research Complete, ERIC International, Google Scholar, JSTOR, Sage Journals Online, Science Direct, SpringerLink, and Taylor and Francis Online. The review draws on an eclectic

range of sources, from traditional academic journals articles and published books to practitioner blogs and popular media. Practitioner blogs are noteworthy in that they show the practice-level uses of technology. Even though their strength of evidence is anecdotal and they would fail short of Rushby's (2012) standard for research on mobile learning, they sit well with grounded theory in that they show actual experiences of practitioners. The context of Ireland's educational landscape, including policy and curricular reforms, would emerge from the data to be highly relevant and will be included.

It is important to note that the literature review had an impact on both the research design and the analysis of the data. Gaps in the research in certain areas and an imperative for more meaningful research, as noted by Rushby (2012), prompted me to select grounded theory as an appropriate methodology to gain new insights in the discipline, a process that will be discussed in depth in Chapter 3. Grounded theory has a strength in areas where there is an absence of a clear understanding or a lack of existing research, as it can reveal fresh insights from an open position. This literature review was therefore conducted in line with Charmaz's (2014) constructivist grounded theory, where the literature was consulted from the beginning. The coding process, memo-writing, and theoretical development would be enhanced and more accurately concluded by returning to the literature to examine certain concepts, in particular on relationships of learning. It must also be acknowledged that the literature review did unconsciously shape some of the expectations of the technology under observation, but the process of grounded theory ensured that those preconceptions could be identified and mitigated. The literature review continued beyond the conclusion of data analysis and grounded theory generation; it provided a framework

to integrate the study's findings into the most recent developments in the field and to show what contributions this study has made to the discipline and to the methodology itself.

Within the constructivist approach to grounded theory, the literature should "be compiled in a specific literature review chapter" which is presented here in Chapter 2, and should also be "interspersed throughout the entire thesis" which will enable insights from the literature to illuminate some of the grounded theories generated (Charmaz, 2006, p. 166). For the benefit of the reader, I will signpost the critical pieces of literature, pointing to where they are discussed in this thesis. Many of them will be interspersed with the data and used to enhance the discussion on grounded theories. In Chapter 2, I begin with an exploration of mobile learning as a practice, using a synthesis from the literature to attempt to establish a definition and framework for analysis. To understand relationships of learning, I introduce Hogan's (2009) framework and focus on a teacher's relationship with their students, and with their subject/knowledge. Shulman's (1986) work on pedagogical content knowledge (PCK) enhances the discussion on a teacher's relationship with their subject and allows for the introduction of Koehler and Mishra's technological pedagogical content knowledge (TPACK) (2005; 2009) which extends PCK to show the use of educational technology. In his discussion on a teacher's relationship with their students, Hogan (2009) invokes an element of Freire's (1970) 'banking' theory to illuminate the discussion.

The policy review will be presented in Chapter 5, where the impacts of those policies and reforms will support the first grounded theories presented in this study. This review emerges from the data, where the impacts of a range of educational policies and nation

issues has an impact on the initiatives in the schools. While discussing the reaction to the introduction of mobile devices, Ertmer's (1999; 2012) work on barriers to technology integration and Fullan's (1993) work on educational change illuminate some of the experiences of teachers and the schools; both will be revisited throughout the thesis. Later chapters will continue to refer back to the literature presented in this Chapter.

In Chapter 6, Castells' (2007) writing on networked societies offers an understanding of new types of networks which are enabled by technology, and Lynch & Lodge's (2002) research on power and equality indicates that historical structures of power can be replicated in new networked spaces. Chapter 6 also raises new ethical questions for teachers, which are explored through the lens of policy and philosophy (Hogan, 2011; Teaching Council of Ireland, 2012). In Chapter 7, the ability for technology to act as an agent of change in a deterministic way is discussed guided by perspectives from Pegrum (Pegrum, 2014) and Oliver (Oliver, 2013). These signposts, which are not exhaustive, show how the literature both frames the starting discussion and then illuminates the grounded theories as they emerge throughout the thesis.

2.3 Mobile Learning As A Practice

This section will examine the literature on mobile learning, or mlearning, to establish a definition and an understanding that is relevant to the context of this study. The question of what is mobile learning will be addressed from two angles, first to develop a theoretical understanding of it from the literature, while the second draws on the imagined future of mobile learning discussed in Chapter 1. By considering these views of mobile

learning, as well as the characteristics that will emerge from the literature, this section will establish a conceptual framework for mobile learning, or mlearning, as a practice.

mlearning is not merely the conjunction of 'mobile' and 'learning' (Traxler, 2009, p. 1) but can be viewed as an emerging practice, defined by the context in which it is used. Traxler (2007, p. 182) offer a series of eight 'use cases' which can allow one to form a definition of mlearning based on these uses. The examples I deemed relevant to this study include: (a) connected classroom learning, (b) informal, personalised, situated mobile learning, such as in museum spaces, or (c) miniature but portable e-learning; other use cases relate to professional settings. Naismith et al. (2004) offer another definition which has close links to learning theories in the contexts of use, namely behaviourist, constructivist, situated, collaborative, informal/lifelong and support/coordination. A further definition comes from Sharples, Taylor and Vavoula (2007, p. 225), who view mobile learning as "the process of coming to know through conversations across multiple contexts people and personal interactive technologies"; Pachler (2009, p. 5) highlights that this definition "privileges cognitive and social aspects over technical considerations as well as over perspectives that foreground content provision and transmission". Unsurprisingly, the literature does not provide a single definition of mobile learning. Instead, the various definitions presented here rely on context, and to some degree, the patterns of use of the technology to have meaning.

Theoretical Frameworks For Mobile Learning

Oliver (2013) contends that there is not yet a robust theoretical framework to underpin the use of ICT in education, which may present a challenge for the adoption of

mlearning. Traxler and Kukulska-Hulme (2005), who share that view noted the lack of an explicit foundation in learning theories in their literature review of mlearning up till 2005. Traxler also notes that creating that theory may be problematic 'since mobile learning is an inherently "noisy" phenomenon where context is everything and confounding variables abound' (2009, p. 5). Cochrane (2013) conducted a systematic review of 35 mobile learning projects which took place between 2006 to 2011. His analysis and findings concurs with the view that activity theory is an inappropriate theoretical framework, being too object-oriented and difficult to operationalise in practice (Cochrane, 2013; Oliver, 2013; Pachler, Bachmair, & Cook, 2010). At least one theoretical model emerged in Cochrane's study which argued for Vygotsky's (1978) model of social constructivism:

> Therefore, social constructivism (Vygotsky, 1978) was chosen as the fundamental pedagogical theory for the research projects. Vygotsky (1978) postulated that we learn most effectively by being actively involved in knowledge construction in groups with guidance from more knowledgeable peers; this theory of learning has become known as social constructivism. Mobile devices are inherently social collaboration and communication devices that provide powerful tools for enabling social constructivist pedagogy. Thus, the projects focused upon student-generated content and collaboration rather than the delivery of teacher-generated content to mobile devices (Cochrane, 2013, p. 8).

A further alignment between social constructivism and mlearning can be observed when students report that the authenticity of learning tasks raises their engagement with the content and activities (Martin & Ertzberger, 2013). Cochrane (2013, p. 9) argues that, for mlearning to be effective in changing pedagogical practices, there is a requirement for two epistemological shifts on the part of educators and learners:

> ... this involved a reconceptualisation of the roles of teachers (from content deliverer to facilitator of authentic experience) and learners (from passive participant to active co-constructor of knowledge).... (Cochrane, 2012, p. 9)

The transition in teaching and learning approaches from teacher-directed, through student-directed learning, to student-determined or negotiated learning, is a concept revisited in the literature (Blaschke, 2012; Luckin et al., 2011). Such a transition indicates the need for shifts in beliefs on the part of educators and Chi & Hausmann (2003) describe challenges in (a) demonstrating the need for a shift in beliefs that is addressed by building a community of practice (COP) that provides authentic experiences and builds a culture of trust, and (b) supporting such a resource-intensive endeavour with sustained pedagogical and technical support. The second shift in beliefs is the re-conceptualisation of mobile social media from the domain of informal social interactivity to collaborative tools that enable new pedagogical designs (Kukulska-Hulme, 2010; Laurillard, 2007). When combined, these beliefs move formal education from a focus on teacher-delivered content or instruction to a focus on designing collaborative learning activities or "what the student does" (Biggs, 1999, p. 57).

Based on a synthesis of the literature, I established a conceptual framework for mobile learning as a practice (Figure 2.1). As a practice, mobile learning has five characteristics: a mobile device, internet connectivity, socially-connected learning spaces, a change in the role of the teacher, and the use of constructivist pedagogies.
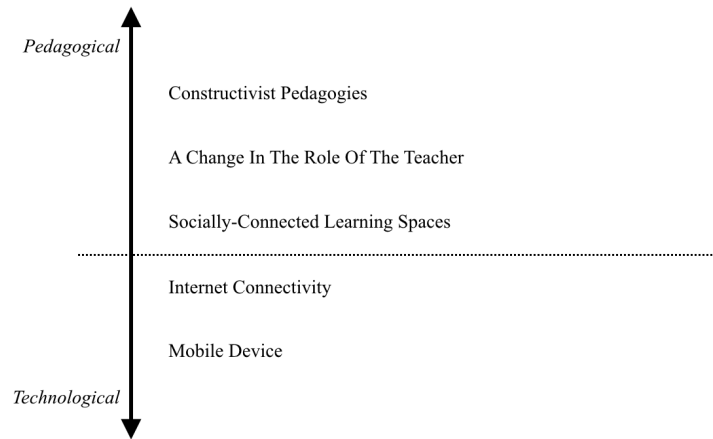
Figure 2.1. Characteristics of mobile learning as a practice.

This conceptual framework addresses some concerns by researchers, Oliver (2013) in particular, about the lack of theoretical engagement in the field. While it is a synthesis, rather than theorising, it does provide a means to view and explore the relationships and dependencies between the characteristics. The pedagogical characteristics have been introduced in the discussion of mobile learning as an imagined future (in Section 1.3) and will be reinforced in the following sections, while the technical characteristics will now be discussed in-depth.

Characteristics Of Mobile Learning

The emergence of mobile learning, regardless of definition or context, has been enabled at the technological level by the availability of a new generation of mobile devices and widespread or ubiquitous internet connectivity. The internet itself has undergone a simultaneous transformation with the adaptation of Web 2.0 technologies for mobile devices. Web 2.0 describes a recent generation of internet services (predominantly websites and mobile sites, but also including Apps) that offer a dramatically different experience of the internet. Content that was previously static had been replaced by

dynamically updated, socially-oriented, and interactive content. It is difficult to agree a single definition of Web 2.0 as it is based on context, technology, design and usage patterns (Cormode & Krishnamurthy, 2008). Richardson (2010, p. 155), in his book on Web 2.0 technology in education, writes that we "are at the beginning of a radically different relationship with the Internet, one that has long-standing implications for educators and students". Those technological enablers are evident in early mlearning projects where there was a strong emphasis on using newly-available technology. MoLeNET, an mlearning project from 2007 described mlearning as the 'exploitation of ubiquitous handheld hardware, wireless networking and mobile telephony to enhance and extend the reach of teaching and learning' (MoLeNET, 2007).

Cochrane (2013) argues that the ubiquity, connectivity and the intuitiveness of mobile technologies enable their use as disruptive devices that can act as catalysts for pedagogical change to incorporate new learning activities that promote 21st-century learning skills. The combination of a mobile device, connectivity and web 2.0 tools as complementary technologies act as a new tool to enhance learning experiences. They overlay their abilities onto existing pedagogical practices allowing for substitution, enhancement or redefinition of learning tasks (Puentedura, 2006) to facilitate Cochrane's (2013) vision of pedagogical change. Figure 2.1 above shows the characteristics of mlearning, beginning with the technological elements and moving towards educational practices. The boundaries between the characteristics are open to significant blurring, an example is that it is hard to distinguish a mobile device from the services it is connected to in the day-to-day use of its owner. Similar blurring exists between all the elements of mlearning.

Mobile Devices

Tablet computers have emerged to become the dominant form factor[2] for devices used in mlearning projects and programmes (L. Johnson et al., 2014). Since 2004, the choice of device to be used for mlearning has tracked technological developments as the capability of devices increased dramatically, including the introduction of 'multi-touch' screens and cellular connectivity. Cochrane's (2013) review of 35 mlearning projects between 2006 and 2011 provides a snapshot of the development of devices and their capabilities during that time. Early projects from 2006 used a variety of small handheld devices, in order of introduction: Palm Pilots, Symbian Devices (a mobile operating system from Nokia) and early iOS devices (iPod or iPhone). Following the introduction of the iPad in 2010, tablet computers (with smartphones to a lesser degree) began to be used and have since emerged as the dominant devices for mlearning. The popularity of tablets computers exceeds traditional desktop computers and laptops, and Pegrum (2014) notes that a strikingly different pattern of use is evident, one which is a likely contributor to this new popularity:

> In the desktop era, the internet seemed like a separate place partitioned off from everyday life by monitor screens. Mobile devices, especially our multiplying smart devices, integrate the virtual and the real as we carry the net with us, entertaining and informing ourselves and sharing our thoughts and experiences while we navigate through our daily lives.(Pegrum, 2014, p. 3)

Analysis of the range of factors that support and explain the emergence of the tablet computer into this dominant position reveals some overlapping and complementary theories, in particular: the *Technology Acceptance Model* (TAM) (Davis, Bagozzi, &

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2 The form factor is the size, configuration or physical arrangement of a computer hardware object.

Warshaw, 1989) and the *affordances* the devices offer to their users; both will be examined.

Studies by Park (2013) and Park, Nam and Cha (2012) sought to investigate the factors that influenced the attitude toward and intention to use tablet computers by applying the Technology Acceptance Model (TAM) to social psychology studies of tablet computer users. The Technology Acceptance Model, based on an extension of the Theory of Reasoned Action (Davis et al., 1989), is a model used to investigate how a user's beliefs impact their willingness or reluctance to use information technology. The model is based on measurements of five constructs: external variables, perceived ease of use, perceived usefulness, attitude and intention to use. In Park's (2013) study, TAM provided a model to measure the acceptance of tablet computers and provided a comparison to older or traditional form factors of devices. Park's (2013) study applied TAM and extended it by adding two principal characteristics of tablet PCs as external variables; perceived mobility and viewing experience, both of which were tested against traditional desktop and laptop PCs. Perceived mobility is characterised by the size, weight, connectivity and battery life of mobile devices – which have advanced considerably in recent years. The user's viewing experience is a combination of having a multi-touch interface (some include handwriting recognition) together with a high-quality display that allows for more natural and intuitive engagement with the device. Park's study concluded that:

> perceived mobility and viewing experience play an important role as core determinants of perceived usefulness and perceived ease of use. This means that users can use a tablet PC anywhere, anytime. Therefore, tablet PCs feature better usability and convenience and traditional laptop PCs. (E. Park & del Pobil, 2013, p. 10)

Puentedura (2012) shares Park's view and provides a practical way to appreciate the distinction between what is mobile and what is portable (as discussed in Chapter 1), where mobile devices may be used at point A, point B and everywhere in between, without stopping (Puentedura, 2012). The technology acceptance model is not without its limitations; in particular, there are external variables that affect technology usage that are not included in the model. Those variables include a financial cost to the individual, system characteristics, training, support, and management support (Handy, Whiddett, & Hunter, 2001). Van Biljon (2007) notes that social and cultural factors may also present as external variables that exert an impact on acceptance. The level of personal use of devices may be an acceptance factor, Pegrum notes that "mlearning can be more personal: the hardware and software are typically more customised by, and to, the individual user" (2014, p. 11). The technology acceptance model may also neglect to sufficiently acknowledge individual differences in a research population, including school context, experience, age, and gender, which can affect technology acceptance (Agarwal & Prasad, 1999). Despite these limitations, the model provides a useful way to begin to understand the choice of tablet computers for use in mlearning, although the study will ultimately validate most of Agarwal's (1999) critiques, in particular on the importance of school context.

Efforts to develop a theoretical basis for technology usage, and educational technology, in particular, have resulted in researchers (Pegrum, 2014) applying the idea of affordance, first developed in the field of ecological psychology, to the problem (D. Churchill & Churchill, 2008; Conole & Dyke, 2004; J. Kay, Meyer, Wagoner, & Ferguson, 2006). The ecological definition of affordance is "the affordances of the environment are

what it offers the animal, what it provides or furnishes, either for good or ill" (Gibson, 1986, p. 115); a definition more readily applicable to educational technology is "the environment provides possibilities for actions that are self-evident" (Oliver, 2013, p. 33). Klopfer & Squire (2008) believe that mobile devices produce unique affordances in educational contexts which enable mlearning to flourish. They define the affordances as (a) portability, (b) social interactivity, (c) context sensitivity, the ability to "gather data unique to the current location, environment, and time, including both real and simulated data", (d) connectivity, to data collection devices, other handhelds, and to networks, and (e) individuality, a "unique scaffolding" that can be "customised to the individual's path of investigation" (Klopfer & Squire, 2008). In his consideration of a pedagogical framework for mlearning, Park (2011), emphasised *'portability'* (mobility in our previous understanding) as the essential affordance from Klopfer's (2008) definition that supports the possibility of mlearning.

Greater emphasis is being placed the mobility of mobile devices, echoing Puentedura's (2012) description of mobility, which now have near-ubiquitous connectivity allowing any time access for users and those devices to become a person's gateway to a broader and more connected world (Klopfer & Squire, 2008; Male & Burden, 2013; Y. Park, 2011). Pegrum (2014) contrasts fixed technologies, 'which tend to be separate from daily life', from mobile technologies, 'which tend to be part of it'. Traxler (2010) lists a variety mobile devices, including tablets, smartphones, game consoles, digital cameras, media players, netbooks, satellite navigation and handheld computers, all of which are becoming connected to the internet. Ownership of any one from this menu of mobile devices is nearly universal (even in resource-constrained areas), and indeed many people

now have multiple devices. Traxler (2010) goes on to suggest that these devices are both pervasive and ubiquitous, conspicuous and unobtrusive, noteworthy and taken for granted. He argues that their roles are new and different from older, static and less personal information technologies such as desktop computers:

> Interacting with a desktop computer takes place in a bubble, and in dedicated times and places where the user has his or her back to the rest of the world for a substantial and probably premeditated episode. Interacting with mobile technologies is different and is woven into all the times and places of students' lives. Desktop technologies and landline phones are about buildings; mobile devices are about people. (Traxler, 2010, p. 5)

The use of affordance as a theoretical basis for education technology is not without its critics. Oliver (2013) notes that "accounts based on affordances, and even common-sense claims about technology, have been criticised for being technologically deterministic: in other words, they position technology as a cause of some change (such as learning) inappropriately"; a critique is shared by Pegrum (2014), who notes:

> New technologies don't lead to social changes by themselves (the technological determinism fallacy); nor can we say that social changes alone have led to the rise of new technologies (the social determinism fallacy). Rather, society and technology influence each other, a view often called a social shaping perspective. (Baym, 2010; Selwyn, 2013; Williams & Edge, 1996), quoted in (Pegrum, 2014, p. 6)

While rejecting technological determinism as a fallacy, Pegrum provides a theoretical justification for the use of mobile devices by invoking and defending the use of affordance, which he defines as "the purposes to which they seem most easily to lend themselves" (2014, p. 6). In educational contexts one can better appreciate the concept of

affordance by reflecting on the question *does the technology define the learning activity or does the learning activity define the technological tool to be employed?* Of course, such a choice may be over-simplistic, and in light of the critiques already expressed, there may be a range of social, cultural, political and environmental factors intertwined in this relationship. Anderson (2009) reviewed three generations of pedagogical approaches in distance education and identified the limits that technology can place on them. While distance education was the focus, Anderson saw a generalisability due to the reliance on technology as the medium:

> The availability of technologies to support different models of learning strongly influences what kinds of model can be developed; if there were no means of two-way communication, for example, it would prevent the development of a pedagogy that exploited dialogue and conversation and encourage the development of a pedagogy that allowed the learner and the course content to be self-contained. (T. Anderson & Dron, 2010, p. 81)

In a contrasting view, Traxler (2010) sees mobile devices moulding to the needs of the user, rather than previous generations of technology in which the user was moulded to conform to the technology. Chapter 7 will revisit the subject of technological determinism and from the data in this study will present a grounded theory.

Traxler (2010, p. 5) foresees a layering of technology, connectivity and social interaction which are visible as the characteristics of mobile learning, shown in Figure 2.1. He predicts dramatic changes in social interaction by creating virtual social spaces that augment and extend physical ones:

> We can ignore desktop technologies but not mobile technologies because desktop technologies operate in their own little world while mobile technologies operate in the world. Mobile devices demolish the need to tie

particular activities to particular places or particular times. They are

reconfiguring the relationships between public and private spaces and the

ways in which these relationships are penetrated by mobile virtual spaces.

(Traxler, 2010, p. 5)

While critiques of affordance are valid and its applicability is challenged at a theoretical

level, it does offer a means to begin to understand the practical justification for using tablet

computers as mobile learning devices.

Internet Connectivity And Networks

In a user's experience connectivity and the mobile devices have become almost

inseparable; when combined they connect a user to an array of online services, yet

occasionally isolate a user when a loss of connectivity occurs. The experience of turning

off a mobile device when taking a flight is one that many people can relate to; in an

instant, the value and utility of the device changes as it is no longer connects a user to the

wider world. A challenge exists in ordering connectivity either before or after the mobile

device as these elements are so firmly linked. Nevertheless, connectivity requires discreet

consideration in the areas where it has not overlapped with the device on one side or

socially-connected learning spaces on the other.

Recent trends in technology indicate the growing importance of mobile internet

connectivity. In October 2016, global traffic from mobile devices reached 51.3% and for

the first time surpassed desktop and laptop traffic (The Guardian, 2016). In Ireland, the

Broadband for Schools Programme (HEAnet, 2012) was initiated in 2005 to connect all

schools to the country's higher education network backbone (HEANet). Since 2005

Ireland's 4,000 approx. primary and post-primary schools have availed of HEAnet internet

connectivity, which includes a robust internet connection and ancillary network management services. Between 2009 and 2014, 730 approx. post-primary schools were upgraded to 100Mbit/s symmetrical broadband connections. In Ireland's 2016 census, domestic access to broadband internet connectivity was reported in 78.45% of homes (CSO, 2016). Between universal school-provided internet access and significant levels of domestic internet access, students in Ireland have frequent access to internet connectivity. Pegrum (2014) notes that the increases in connectivity across the world and in education settings allows us to say '*welcome to the mobile age...*'.

Recent increases in connectivity, both in scale and degree, have created new ways for humans to associate, communicate, interact and ultimately form networks; Castells (2008) notes:

> We now have a wireless skin overlaid on the practice of our lives, so that we are in ourselves and in our networks at the same time. We never quit the networks, and the networks never quit us; this is the real coming of age of the networked society. (2008, p. 448)

The 'wireless skin' surrounding us is a layer of internet connectivity created by cellular data or Wi-Fi connections in our homes, offices, schools and many public places. The 'networks' are formed from a multitude of people using their devices to become nodes in the network that overlay our lives. In Puentedura's (2012) discussion on mobility, the network becomes the enabling factor for the mobility of devices, allowing continued use between points A and B. Castells (1999) describes how technological innovations have had an impact on communities, how we view them, form them and interact with them. He theorises a change from a "space of place" to a "space of flows", where physical proximity is no longer a dominant factor in the forming of networks or communities. Castells defines

"space of place" as "the locale whose form, function, and meaning are self-contained within the boundaries of territorial contiguity" (1999, p. 296); however "space of flows" is a more complex and abstract idea:

> The space of flows is the material organisation of simultaneous social interaction at a distance by networking communication, with the technological support of telecommunications, interactive communication systems, and fast transportation technologies. (Castells et al., 2007, p. 171)

Castells (1999) strongly believes that technology has a catalysing effect on the "space of flows" yet he highlights fast transportation as a factor, implying that the ability to have physical proximity is still desirable and necessary. Castells (2007) believes that in the space of flows, the idea of place become an individual one:

> Wireless communication does not eliminate place. It redefines the meaning of place as anywhere from which the individual chooses or needs to communicate, even if these places are often the home or the workplace. Places are individualised and networked along the specific networks individual practice. (Castells et al., 2007, p. 174)

The development of a networked society with networked individuals is not without some debate, concern and even controversy. News media reports on both the benefits and costs of a networked society, citing civic engagement democratic participation as potential advantages yet expressing concern for social isolation and decreases in inter-generational contact as negative impacts (Ghosh, 2013). It should not be surprising that such fears have arisen when people are challenged to re-conceptualise their role in society as merely nodes in a web of inter-connected networks:

> It is comforting for people who crave stability to think of themselves as belonging to a small set of groups rather than as manoeuvring through

murky, shifting sets of relationships at home, work, and in the community.

(Castells et al., 2007, p. 25)

The process of re-conceptualisation may affect people in different ways; some will never be aware of the connected world around them, some will become aware of the existence of these network and tentatively participate (often at the urging of friends and family abroad) and others will become full participants. Castells offers some consolation, writing "the culture of individualism does not lead to isolation, but it changes the patterns of *sociability* in terms of increasingly selective and self-direct contacts" (2007, p. 143). Castells highlight the personal choice and selectivity that accompanies the networked society: "The critical matter is not the technology, but the development of networks of *sociability* based on choice and affinity, breaking the organisation and spatial boundaries of relationships" (Castells et al., 2007, p. 143). A fictional bus journey may illustrate this selectivity. A person participating in a networked community may decide not to talk to the person next to them who is not 'networked'. The networked person may forego the serendipity of that conversation and even draw the ire of their fellow passenger for being seen as rude, yet they may feel that the conversation they did have through their network was deeper, more engaged and relevant to them.

This discussion has examined the technological characteristics of mobile learning discretely. It has also considered some of the pedagogical ones, in particular, the change in a teacher's role and beliefs which will emerge strongly in the data and be discussed in Chapter 7. The next section on relationships of learning will add additional perspective to the pedagogical characteristics already discussed.

2.4 Relationships Of Learning

This study sought to examine the impact of mobile learning and access to mobile devices on relationships of learning. As the study did not set out to establish or classify those relationships, it relied on the literature to provide sensitising concepts and to provide a means to develop greater insights from the data and grounded theories. Hogan (2009, p. 59) sets out a framework to categorise and analyse the many relationships that exist in educational environments, which for a teacher are: (a) the relationship with their subject, (b) the relationship with their students[3]. Hogan concedes that a stereotypical view of teachers is at large; a view that lacks the complexity of a series of interwoven relationships embodying a heartfelt desire and vocational calling to teach. It is a view that presents teachers as: "needlessly bossy people: people who use a 'teachery' kind of voice that's higher and louder than natural speech". These stereotypical views of teachers will be echoed later in the data. Hogan's views on educational relationships are of a complex and inter-related web where viewing any single relationship, or even a subset would be challenging. The constraints of a PhD-level study require a narrow focus, or as Shulman puts it: 'to conduct a piece of research, scholars must necessarily narrow their scope, focus their view, and formulate a question far less complex than the form in which the world presents itself in practice' (Shulman, 1986, p. 6). While examining relationships of learning, the study's design focused on students and teachers as direct participants but acknowledges the potential for external influences for emerge. Such influences from the broader educational and social environment may include, economic agendas, prescribed forms of assessment and political policies of educational reform; Chapter 5 will explore these in detail.

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3 Hogan (2009, p. 59) also lists teachers' relationships with colleagues, members of a school community (parents/guardians) and the wider community; and the relationship with themselves, or their sense of self-understanding. These further relationships are beyond the scope of this study.

During the design phase, the relationship that was thought to be most significant was of a teacher's relationship with their students. The data, however, indicated that a broader view was needed, one that encompassed a teachers' relationship with their subject. Those relationships are not discreet or separate; indeed Hogan (2009) contends that they are intertwined as some teachers can derive authority from the didactic transmission of static and reified knowledge from secondary sources. Hogan goes on to propose that the more original and dynamic a relationship between a teacher and his or her subject (characterised by a 'vibrant understanding' and possessed of individual or multiple voices and continued discovery), the more that teacher can encourage a similar relationship with knowledge in their students (Hogan, 2009, p. 52). Hogan's invocation of a 'vibrant understanding' of a subject allows for a brief consideration of the epistemological beliefs of teachers. While examining the characteristics of mobile learning, Chi & Hausmann (2003) argued for the necessity of change in teachers' beliefs in order to fully harness the abilities (or affordances) of ICTs. Mobile learning has the potential to enrich the educational experiences and content, but a particular set of beliefs (amongst other factors) is required to value the vibrancy that can be enabled by the technology. An alignment between the two positions discussed here is evident as Chi & Hausmann's (2003) requirement for change in beliefs is directly relatable to Hogan's (2009) theory of a teacher's relationship with their subject. The relationship between students and knowledge may also need to be considered, a point that will emerge in Chapter 7.

Relationship With Knowledge

Hogan (2009) identified a continuum of teachers, of those who have a vibrant understating or love of their subject and those who do not. He also identified a dichotomy that may exist within a teacher who teaches many subjects, where they teach one with vibrancy and love but another without, and potentially teach it with a focus on the examination. The dichotomy in that teacher is both an orientation, as discussed in Hogan's work, but also a set of skills or knowledge. Marks (1990) describes those beliefs which ''represent a class of knowledge that is central to teachers' work and that would not typically be held by non-teaching subject matter experts or by teachers who know little of that subject'' (1990, p. 9). Marks description is referring to the work and theories of Shulman (1986) on pedagogical content knowledge.

Pedagogical Content Knowledge (PCK). Shulman (1986) developed the concept of pedagogical content knowledge (PCK). He believed that contemporary research on teaching and teacher education had become divorced from the content being taught "no one asked how subject matter was transformed from the knowledge of the teacher into the content of instruction" (1986, p. 6). Shulman believed that the research was focused almost entirely on the 'process / product work' of the classroom:

> 'In reading the literature of research on teaching, it is clear that central questions are unasked. The emphasis is on how teachers manage their classrooms, organise activities, allocate time and turns, structure assignments, ascribe praise and blame, formulate the levels of their questions, plan lessons, and judge general student understanding'. (Shulman, 1986, p. 8)

Shulman's 'Knowledge Growth in Teaching' (1986) programme sought to address the central question: 'How does the successful college student transform his or her expertise in the subject matter into a form that high school student can comprehend?' and produced Shulman's theory of PCK which 'identifies the distinctive bodies of knowledge for teaching' (1986) and refers to teachers' interpretations and transformations of subject matter knowledge to facilitate student learning. In contrast to educational practice which de-emphasises a relationship with knowledge, PCK restores the 'missing paradigm' to the study and practice of teaching. While developing his theory, Shulman drew on a variety of historical descriptions of teaching, including Aristotle and universities in the middle ages, in particular the universities in Paris, Oxford & Cambridge, where for those who were teaching, 'content and pedagogy were part of one indistinguishable body of understanding' (1986, p. 6). Indeed, the final examination of those called to commence a teaching career, or receive their doctorate, was an oral examination which tested not only the highest levels of subject matter competence but also the ability to teach the subject. Shulman (1986) described PCK as the blending of content, pedagogy, and knowledge into an understanding of how to teach particular topics which are adapted to learners' characteristics, interests, and abilities, see Figure 2.2 below.
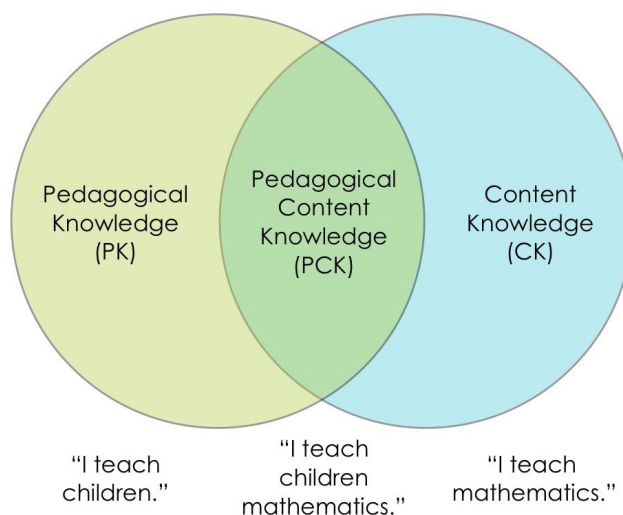
Figure 2.2. Shulman's (1986) Pedagogical Content Knowledge.

Teachers' knowledge of representations of subject matter and their understandings of students' conceptions and content-related difficulties constitute the key elements in Shulman's (1986) conception of PCK and can differentiate an expert teacher in a subject area from a subject area expert.

Returning to Hogan's (2009) relationships in education, and particularly to a teacher's relationship with their subject, one can see a substantial similarity in views as Hogan sets out the attitudes and relationships possessed by a passionate teacher who could also be said to have proficient pedagogical content knowledge. Hogan describes, through the practical example of a mathematics teacher, a relationship with knowledge where the teacher sees their subject as a 'fascinating world of exploration' and believes 'if only students were introduced to it in the right way by their teachers, mathematics could be one of the most popular rather than one of the least popular subjects' (2009, p. 61). It would not be difficult to imagine this teacher, having the desire and motivation to bring the subject to life for his students, undertaking the transformation of subject matter, which in Shulman's (1986) view, occurs as the teacher interprets the subject matter, finds multiple ways to represent it, adapts and tailors the instructional materials to students' prior knowledge and alternative conceptions. The teacher's transformation of subject matter knowledge allows it to be effectively and flexibly used in the communication exchange between teachers and learners. It must be acknowledged that external forces are still at work which encourages 'conformity to a regime of textbooks, notes and drill' (Hogan, 2009, p. 61). Hogan and Shulman both agree that those outside forces have exerted pressures on the teaching profession that have worked to remove autonomy, and even

passion, from practice. Shulman's (1986) original thesis, that the promotion of research-based practice by those outside the profession neglected the complexity of educational environments; a view echoed many years later by Hogan, who believes that 'an unprecedented performance-management machinery to enforce compliance marks a new form of colonisation and a new era of subordination of education as a practice' (2011, p. 28). Shulman's prescription was that '… we must develop professional examinations for teachers … they must be defined and controlled by members of the profession, not by legislators or laypersons' (1986, p. 13). The importance and impact of outside influences emerged unprompted from the data and will be evident from Chapter 5 onwards.

In classroom practice, PCK relates to the transformation of several types of knowledge, includes an understanding of what makes the learning of certain concepts easy or difficult, and 'embodies the aspects of content most germane to its teachability' (Shulman, 1986, p. 9). Teachers with a mastery of PCK are expert teachers in their subject areas and have an understanding of students' preconceptions and learning difficulties, know the most useful forms of representation, the most powerful analogies, illustrations, examples, explanations, demonstrations, and other ways of representing and formulating the subject in forms that are comprehensible to learners (Angeli & Valanides, 2009). Shulman (1987) included PCK in the general knowledge base of teaching, see Table 2.1, which, according to him, consists of three content-related categories: (a) content knowledge, (b) PCK, and (c) curricular knowledge, together with four other categories: (d) general pedagogy, (e) learners and their characteristics, (f) educational contexts, and (g) educational purposes).

Table 2.1

Shulman's knowledge base of teaching, including PCK.

Category	Title	Description
Content	Content knowledge	Content knowledge includes an understanding of the facts and structures of a content domain
Content	Pedagogical content knowledge	General pedagogical knowledge refers to broad principles and strategies of classroom management and organisation that appear to generalise across different subject matter domains
Content	Curricular knowledge	Curricular knowledge includes an understanding of the materials for the instruction, alternative texts, visual materials, and laboratory demonstrations
Other	Pedagogy	
Other	Learners and their characteristics	Knowledge of learners refers to their characteristics and preconceptions that they bring to a learning situation
Other	Educational contexts	Knowledge of educational contexts ranges from the workings of the classroom to the governance of the school district
Other	Educational Purposes	Knowledge of educational values and goals refers to the educational ends and their philosophical underpinnings

Notes: Adapted from Shulman (1986) and (1987)

While describing the genesis of PCK, Shulman draws out a dialogue on how teachers' practice can often be rigidly dictated based on simplified research models that neglect the complexity of the classroom environment: 'the experimental studies of teaching effectiveness have been guilty of prescribing lengthy lists of research-based behaviour for teacher to practice, without always providing a rational or conceptual framework for the set' (1986, p. 11). A similar process can also be seen to be at work in how teachers are introduced to technology and its application in the classroom, where technical skills are the focus rather than pedagogical application (Mishra & Koehler, 2006). The PCK model, while critical of contemporaneous educational research, did develop a conceptual framework to support teachers as practitioners; it has since served as the basis for further modification and theoretical innovation.

Technological Pedagogical Content Knowledge (TPACK). Mishra & Koehler's (2006) technological pedagogical content knowledge (TPACK) framework was developed as an extension of PCK to include technology and its integration with pedagogy and content, see Figure 2.3 below.
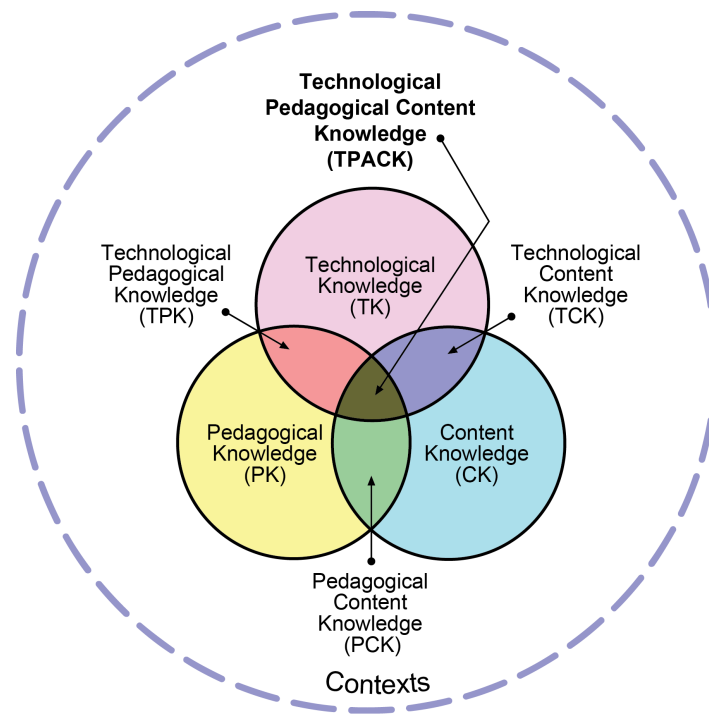
Figure 2.3. Technological Pedagogical Content Knowledge adapted from (Mishra & Koehler, 2006) and revised in (Koehler & Mishra, 2009).

Figure 2.3 shows a diagram of the TPACK framework, and is comprised of three sections: Technological Knowledge, Content Knowledge, and Pedagogical Knowledge. It is at the intersection of these three areas in a teacher's practice that Technological Pedagogical Content Knowledge (TPACK) is evident. Koehler and Mishra (2006) believe that three other sources of knowledge can also be derived from the interactions among technological knowledge, pedagogical knowledge, and content knowledge, specifically: (a) Technological Content Knowledge; (b) Technological Pedagogical Knowledge; and (c) Shulman's (1986) original Pedagogical Content Knowledge. These seven constructs, listed

in Table 2.2 blow, illustrate the different types of professional expertise needed for effective technology integration.

Table 2.2

Constructs of Technological Pedagogical Content Knowledge (TPACK)

Construct	Description
Technological Knowledge (TK)	knowledge of how to operate computers and relevant software.
Pedagogical Knowledge (PK)	knowledge of how to plan instruction, deliver lessons, manage students and address individual differences.
Content Knowledge (CK)	subject matter knowledge such as knowledge about languages, Mathematics, Sciences etc.
Technological Content Knowledge (TCK)	knowledge of how content can be researched or represented by technology such as using computer simulation to represent and study movement of the earth crust.
Pedagogical Content Knowledge (PCK)	knowledge of 'the ways of representing and formulating the subject that make it comprehensible to others'. Shulman (1986, p.9).
Technological Pedagogical Knowledge (TPK)	knowledge of how technology can facilitate pedagogical approaches such as using asynchronous discussion forum to support social construction of knowledge.
Technological Pedagogical Content Knowledge (TPACK)	knowledge of facilitating students' learning of a specific content through appropriate pedagogy and technology.

In their study, they note that 'since its introduction in 1987 [PCK] has permeated the scholarship that deals with teacher education and the subject matter of education. It is valued as an epistemological concept ...' (2006, p. 1022). In the same way as Shulman demonstrated a holistic approach that blends pedagogy and content, Koehler and Mishra overlay educational technology to enhance classroom practice. Koehler and Mishra (2006) noted that the potential for technology to dramatically change educational practices, and even outcomes, often falls short of expectations. They suggest a partial reason is the method of introduction of technology into teaching practice, which lacks integration with other areas of teaching and is often skills-based in its approach:

> The design and implementation of workshops or teacher training programs
> that promote the learning of specific hardware and software skills as being

sufficient to round out teachers' knowledge bases for teaching with technology are direct consequences of this perspective. (2006, p. 1025)

Their conceptual framework is the result of several years of research and interventions designed to assist with and understand teachers' progression towards rich uses of technology. In developing that framework, they used a particular methodology, 'Learning by Design', where teachers (amongst other activities) create artefacts and learning resources 'in contexts that honour the rich connections between technology, the subject-matter (content) and the means of teaching it (the pedagogy)' (Koehler & Mishra, 2005, p. 148). While constructing resources, teachers maintain a keen focus on the content, the technology and the teaching methods, all the time increasing their competence and confidence in using technology. The research process and interventions were beneficial for the professional development of practitioners and researchers and allowed for the TPACK model to be grounded in contexts of practice (Mishra & Koehler, 2006, p. 1019).

Koehler and Mishra believe that while Shulman did not explicitly consider technology, it was a logical extension as technology had become a prominent theme in education. Angeli and Valanides (2009) offered an elaboration of Mishra & Koehler's (2006) work by describing the use of technology as an interaction of five ellipses. While accepting the pedagogy and content domains, they renamed the technology domain as Information and Communication Technologies (ICT) to emphasise the type of technology considered in the model. They added two knowledge domains as a result of their research studies with in-service teachers: the knowledge of students and the knowledge of the context within which learning takes place. From their perspective, as teachers teach with ICT, they draw upon knowledge of students' content-related difficulties as well as the

intricacies of the relevant context—what works and does not work in their classrooms—and how they believe they need to teach to facilitate students' learning. Angeli and Valanides (2009, p. 156), in their consideration of epistemological and methodological issues relating to TPACK, contradicted Koehler and Mishra's view that Shulman's original definition did not include technology by quoting from Shulman:

> The curriculum and its associated materials are the materia medica of pedagogy, the pharmacopeia from which the teacher draws those tools of teaching that present or exemplify particular content and remediate or evaluate the adequacy of student accomplishments. [. . .] How many individuals whom we prepare for teaching biology, for example, understand well the materials for that instruction, the alternative texts, software, programs, visual materials, single-concept films, laboratory demonstrations, or ''invitations to enquiry? (Shulman, 1986, p. 10)

Despite their clarification on Shulman's original meaning, Angeli and Valanides (2009) go on to reach the same conclusion as they believe:

> Shulman (1986) did not explicitly discuss technology and its relationship to content, pedagogy, and learners, and thus PCK in its original form does not specifically explain how teachers use the affordances of technology to transform content and pedagogy for learners. (Angeli & Valanides, 2009, p. 156)

As they considered the nature of technology and its specific application in education, Koehler and Mishra (2006) noted that a variety of technologies in use in classrooms had become 'invisible' to those who used them. Those technologies ranged from textbooks to overhead projectors, from typewriters in English language classrooms to charts of the periodic table on the walls of laboratories; and had become so commonplace

as to become invisible to the teacher. Indeed many teachers no longer even regarded them as technology (2006, p. 1023). Recent advances in technology, including mobile devices, and a quickening pace of technological innovation is increasing the amount of new technology that teachers face in their classrooms and their practice. Koehler and Mishra (2009) reflected on Vygotsky's (1978) sociocultural theory of learning and would consider all resources to be technologies. Whether a pencil or a tablet computer, are both technologies despite significant differences between these two examples. A pencil has a specific use; it has stability over time, and its function is clear. In contrast, new technologies such as tablet computers 'are protean' or usable in many different ways (Papert, 1980), unstable (rapidly changing), and opaque with their inner workings hidden from users (Turkle, 1995). These features of new technologies present both new opportunities and challenges to teachers.

Oliver's (2013) contention that the research community (with a few exceptions) has failed to articulate a theoretical framework for researching educational technology has already been noted. One of his specific charges is that 'current accounts of technology provide poor explanations of how technology use leads to—or fails to lead to—learning' (2013, p. 31). Koehler and Mishra shared this concern, believing that most educational technology research consisted of case studies, examples of best practices or implementations of new pedagogical tools. They believed that while these may individually be good pieces of research, they were only the first steps toward the development of a unified theoretical and conceptual framework which would hold across diverse cases and examples of practice. They drew a distinction between 'what' teachers

need to know to use technology and 'how' the technology is used and interacts with the other elements in a complex environment. They went on to quote Selfe (1990):

> [An] atheoretical perspective ... not only constrains our current educational uses of computers, but also seriously limits our vision of what might be accomplished with computer technology in a broader social, cultural, or educational context. Until we examine the impact of computer technology ... from a theoretical perspective, we will continue, myopically and unsystematically, to define the isolated pieces of the puzzle in our separate classrooms and discrete research studies. Until we share some theoretical vision of this topic, we will never glimpse the larger picture that could give our everyday classroom efforts direction and meaning. (Selfe, 1990, p. 119)

Koehler and Mishra's TPACK framework begins to address these research deficits in educational technology, although it must be acknowledged that as a relatively new theoretical innovation it has not yet gained universal acceptance. Schulman's (1986) PCK framework, which is the theoretical underpinning of TPACK, has enjoyed significant acceptance in the education community: 'An analysis of Teacher Educator's Handbook (Murray, 1996) shows Shulman as the fourth most cited author' (Mishra & Koehler, 2006, p. 1022). Schulman's work on PCK is now regarded as seminal in the area of teachers' knowledge and preparation:

> The notion of PCK since its introduction in 1987 has permeated the scholarship that deals with teacher education and the subject matter of education … It is valued as an epistemological concept that usefully blends the traditionally separated knowledge bases of content and pedagogy. (Mishra & Koehler, 2006, p. 1022)

Parallels can be seen in the process of development of both PCK and TPACK; current discussions about the role of technology often share the same concerns that Shulman

identified in the 1980s. In particular, Shulman identifies how content knowledge and pedagogical knowledge were treated as separate domains of knowledge in the same way as technology knowledge can often be treated today. Koehler and Mishra acknowledge other author's arguments that technology knowledge cannot be treated as content-free but claim novelty in the developing and furthering the concept:

> What differentiates our approach apart is the specificity of our articulation of these relationships between content, pedagogy, and technology. In practical terms, this means that apart from looking at each of these components in isolation, we also need to look at them in pairs. (Mishra & Koehler, 2006, p. 1026)

Within this study, TPACK provided insights into the design of background research instruments and sensitisation to the challenges of effectively integrating technology in a teacher's practice. The application of this framework in research design and fieldwork will be further examined in Chapter 3. Hogan (Hogan, 2009) has identified a teacher's relationship with their subject as one of four relationships of learning. In the case of a teacher with a passion for their subject and a desire to give it life in the minds of their students, it is clear that PCK and TPACK provide the practical means for the teacher to do so. For such a teacher they would possess a love of their subject, the breadth of knowledge to make it accessible to students in the ways that are most effective and the ability to employ technology as one of the pedagogical tools at their disposal. Koehler and Mishra succinctly state the importance of all these concepts to quality teaching: 'quality teaching requires developing a nuanced understanding of the complex relationships between technology, content, and pedagogy, and using this understanding to develop appropriate, context-specific strategies and representations' (Mishra & Koehler, 2006, p. 1029).

Relationships With Students

Hogan argues through practical examples, that there are two extremes along a continuum that defines these relationships of learning, where a teacher can: (a) focus on content and transmitting a body of accumulated knowledge to students, ensuring adequate recall and mastery with a keen focus on the form of assessment, or (b) fostering a positive disposition to learning that harnesses a student's imagination and encourages progressive achievements, for example, in 'problem-solving, problem-identification and logical thinking' (Hogan, 2009, p. 61). Hogan's first example draws upon Freire's (2000) criticism of what he calls the 'banking model of education', where knowledge is deposited with the student to be withdrawn in the examination. Hogan's use of Freire acknowledges the deeply political background of Freire's work, and while he does not draw on the political views of empowerment or emancipation at state level, he invites a pedagogical consideration of relationships of power at the individual and philosophical level. Hogan's approach is relevant to this study as invites us to consider Freire's description of an intellectually oppressive relationship of learning that objectifies both participants and knowledge and lacks creativity, personal transformation, and knowledge.

> It turns them into containers, into receptacles to be filled by the teacher. The more completely he fills the receptacles, the better a teacher he is. The more meekly the receptacles permit themselves to be filled the better students they are. (Freire, 2000, p. 72)

In contrast to the 'banking model', Hogan (2010) vividly describes the students' journey of discovery as entering a new imaginative neighbourhood and an entrancement which is perceived and experienced as a continuing, unpredictable process of personal change as the neighbourhood is explored and opens out new possibilities of learning. Freire (1970)

describes both the qualities required of the teacher and the relationship that must be constructed with the student to encourage that experience:

> ... To engage in critical thinking and the quest for mutual humanisation. His efforts must be imbued with a profound trust in the people and their creative power. To achieve this they must be partners of the students in the relations with them. (Freire, 1970, p. 75)

Returning to the movement from teacher-directed to enabling student-determined or negotiated learning (Blaschke, 2012; Luckin et al., 2011) may bring about further tensions or even conflicts in those relationships of learning. Hogan sees challenges in changing relationships of learning, "including testing of a teacher's interpersonal skills while managing and negotiating that change; especially in a changing and often fickle world where the challenge of wooing students' imaginative efforts may be more difficult" (Hogan, 2009, p. 56). A teacher with a 'love' of their subject would be unthreatened by students' exploration (2009, p. 57), to the contrary, they may see that as a particular achievement.

2.5 Mobile Learning & Classroom Practices

The role that technology, and mobile learning or devices in particular, can play in giving new and practical means to that continued journey of discovery is an area of interest to this study. At a conceptual level similarities can be drawn between the pedagogical characteristics of mobile learning (see Figure 2.1) and Hogan's (2009) view of progressive relationships of learning, The practice of mobile learning shares a view of a relationship with knowledge and the role of the teacher in guiding a process of discovery of knowledge and intellectual development that echoes Freire:

Knowledge emerges only through invention and re-invention, through the restless, impatient, continuing hopeful inquiry human beings pursue in the world, with the world, and with each other. (Freire, 2000, p. 72)

While the social constructivist aspects of mlearning predate Freire and are not explicitly considered by Hogan, it may not be unreasonable to infer them in their progressive views of educational practice; indeed they may offer a new means to deliver on that vision:

This brings the potential to appropriate new pedagogies that harness the potential of mobile social media to create powerful situated, authentic, and informal learning experiences and bridge these into formal learning. (Cochrane, Antonczak, Gordon, Sissons, & Withell, 2012) quoting (Vavoula, Sharples, Rudman, Lonsdale, & Meek, 2007)

Cochrane's (2013, p. 1) assertion that the development of mlearning has taken place at a faster pace than the research that underpins it, particularly longitudinal research, allows for Vavoula's (2007) hypothesis to be examined in the future. It may be beneficial to move from theoretical and conceptual understanding of mobile learning to a concrete example of it in practice.

Mobile learning in practice. One such example is the 'flipped classroom' that is emerging as a popular movement in education, in particular with teachers who want to adopt more constructivist teaching practices (Bergmann & Sams, 2012). The practice was conceived in 2007 by two schoolteachers, Bergmann and Sams (2012), and inverts (or flips) traditional teaching methods by delivering online instruction outside of class and moving 'homework' into the classroom. Students watch video lectures, or access other resources, at their own pace at home while communicating with peers. Conceptual engagement then takes place in the classroom with the assistance of the teacher. The

inversion of activities changes the role of the teacher from the person delivering content in a lecture style to a facilitator of learning in an activity-based classroom. A number of factors have enabled the flipped classroom: (a) technological improvements that allow teachers to record their instructional videos, (b) freely-available repositories of educational content (e.g., Khan Academy and iTunes U), and (c) increased student access to the internet and technology, in particular personal devices (increasingly mobile devices) (Bergmann & Sams, 2012). When the flipped classroom first emerged, it was consciously and deliberately adopted by teachers as a teaching methodology (Strayer, 2007); those teachers may be seen to have made the epistemological shifts that Cochrane (2012, p. 9) identifies as requirements for mlearning. As one example of mlearning in practice, the flipped classroom presents an observable measurement of epistemological shifts in teachers and the associated changes in relationships of learning. A further practice-level example comes from Cochrane's (2013) study. The role of the institutional learning management system (LMS) was changed in this study to provide tutorials and initial guidance for students in setting up their own Web 2.0 environments. The students then created their own collaborative learning spaces and in this way 'inverted the normal learning space ownership paradigm' (2013, p. 12) away from an institutionally-managed one to a dynamic student-generated one. From this review, one can begin to develop a view of the characteristics of a progressive teacher (who uses technology, elearning and/or mlearning) 'to create a higher quality of learning in his/her students' (Hogan, 2009, p. 55) and the pedagogical processes that may constitute their practice:

> Through dialogue, the teacher-of-the-students and the students-of-the-teacher cease to exist and a new term emerges: teacher-student with students-teachers. The teacher is no longer merely the-one-who-teaches, but one who is himself taught in dialogue with the students, who in turn while

being taught also teach. They become jointly responsible for a process in which all grow. (Freire, 1970, p. 80)

Throughout the process of analysis, this study will become concerned with the forces that cause, encourage or enforce those changes and whether mobile learning itself can meet Chi & Hausmann's (2003) challenge of demonstrating that requirement.

2.6 Chapter Summary

This chapter presented an account of the engagement with the literature, and reconciled that engagement with the methodological concerns of grounded theory. Despite challenges in establishing a single definition of mobile learning, I was able to synthesise a framework for mobile learning as a practice from my review of the literature. This framework provided for a structured examination of the characteristics of mobile learning, which ranged from technical to pedagogical. While examining the use of mobile devices, I explored concepts of affordance and technology determinism to begin to understand the use of these devices in education. Internet connectivity and networks have shown the capacity to change patterns of human association and interactions radically, and their potential to have a similar impact on education was explored. The pedagogical characteristics were examined by considering if epistemological changes are needed on the part of teachers to redefine their roles and educational relationships. Hogan (2009) and Freire (1970) provided a pedagogical lens with which to examine those relationships between students and teachers, while also acknowledging that subject knowledge often provides a source of power in those relationships. The potential for classroom practices to be transformed was examined by reviewing the flipped classroom as a popular set of

approaches which incorporate constructivist learning principles and substantial use of technology.

Chapter 3: Methodology & Methods

3.1 Introduction

This study inquired into the effects of mlearning and access to mobile technology on relationships of learning between students and teachers in post-primary schools in Ireland. This chapter will state the research question that guided the investigation and will provide a detailed account of the research process as it moves from the theoretical to the applied elements of that process. The conceptual framework of the study will be presented beginning with the epistemological position of the researcher and the underpinning theoretical perspective. Grounded theory, in particular the constructivist approach used in this study, will be explored. A review of the wider field of grounded theory will be carried out, providing context for the position of the research and the choices which ultimately led to the selection of constructivist grounded theory. The criteria for selecting the research population, including sampling and the role of the researcher, will be discussed. A detailed description of the methods of data collection will be provided, including the development of novel approaches in the grounded theory. The ethical and privacy concerns for participants will also be addressed. The chapter will also discuss issues that arose during the research process and how they impacted on the study.

Research Question

This research study is an enquiry into *the impact of mlearning and access to mobile technology on relationships of learning*. The research took place in two (from an initial sample of three) post-primary schools in Ireland that had adopted mobile learning programmes, where each student and teacher had a personal mobile device. This study had no *a priori* hypotheses to prove or test; rather it explored mobile learning in practice.

As outlined in the methodology for the literature review, there are challenges for the researcher who wishes to use a grounded theory approach, especially when writing research proposals, applying for ethical approval or writing funding applications, which often require detailed research questions and/or literature reviews. As a result of the formalities of engaging in research, the study had a more detailed set of sub-questions which also guided it during the early stages. The research sub-questions of the study were aimed to:

(a) identify the changes (if any) in relationships of learning between students and teachers,

(b) determine if these changes (if any) were brought about solely by the use of mlearning and adoption of mobile devices or if other factors contributed to the changes,

(c) identify any tensions that may have resulted from changes in students' expectations of teachers within an mlearning practice paradigm, and

(d) establish which theoretical framework(s) underpins the mlearning practice paradigm in the subject schools.

These questions were informed by my professional experiences working in schools observing the issues that arose, some of which were labelled 'challenges' by practitioners. Notwithstanding the methodological challenge, the questions perform two constructive functions in the research; providing sensitising concepts at the outset and enabling reflexivity throughout the study. Sensitising concepts give researchers initial, yet tentative, ideas to pursue and questions to ask about their topic; they "can provide a place to start inquiry, not to end it" (Charmaz, 2014, p. 30). The questions also form part of my process of reflexivity; their explication is an identification of knowledge, bias, and preconceptions, which can be acknowledged and mitigated. The impact of these questions on data

collection and analysis will be examined in subsequent chapters. Rather than commandeering my research, the questions guided it and should not be seen in opposition to a constructivist process of grounded theory. Indeed, it will be shown in Chapters 4 and 5 that these questions did not commandeer it, and that the data will lead a change in focus.

It is also important to identify what this study did not seek to examine. Rushby (2012) stated that a significant amount of research time and energy has been expended looking at aspects of mobile learning including learning outcomes, student attainment, and user acceptance. The impact of mlearning in those areas, which have had considerable research attention, was purposely excluded from this research study because of the significant body of research already carried out.

Research Design Process

Researchers in the social sciences, especially novice researchers, are often confronted with a bewildering array of contradictory and often confounding terms that describe methodologies and methods for research. Crotty (1998), notes that rather than acting as pathways to orderly research, they present as a maze that a researcher must navigate: "to add to the confusion, the terminology is far from consistent in research literature and social science texts. One frequently finds the same term used in a number of different, sometimes even contradictory ways" (Crotty, 1998, p. 1). The fields of education, educational technology, and mlearning are not exceptions to this trend; an examination of the literature reveals that researchers' methodologies or methods of choice are generally expressed as qualitative, quantitative research, mixed-methods and occasionally action research. The confusion for a novice researcher grows when authors of

research textbooks also adopt seemingly contradictory terminology; Crotty (1998) describes qualitative and quantitative research as methods, whereas Cohen (2007) lists them as methodologies or even theoretical perspectives. This study will adopt Crotty's (1998) approach and classification structure for research in the social sciences as it provides me with a 'pathway to orderly research' (1998). Engagement with the literature, to examine past research in the field as well as defending the research approaches and methods used in this study, requires that I, as researcher, and also the reader, understand and become proficient with the alternative terminology.

Crotty (1998) begins by suggesting that a researcher ask two fundamental questions in the research process: firstly, what methodologies and methods will the researcher employ in the study, and secondly, how is this choice justified? In creating a justification, Crotty suggests that a researcher must question their assumptions about reality and therefore consider a theoretical perspective. Furthermore there is a consideration of human knowledge and what kind of knowledge the research study can create. From these questions Crotty defines and interrelates the four basic elements of any research process as (1998, p. 3):

- *Methods*: the techniques or procedures used to gather and analyse data related to some research question or hypothesis.
- *Methodology*: the strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes.
- *Theoretical perspective*: the philosophical stance informing the methodology and thus providing a context for the process and grounding its logic and criteria.
- *Epistemology*: the theory of knowledge embedded in the theoretical perspective and thereby in the methodology.

Crotty's (1998) framework offers a useful way to tie together the many epistemological views, theoretical perspectives, methodologies, and methods of social research. Crotty presents a table with a representative sampling of topics for each component, see Table 3.1 below.

Table 3.1

Table with a representative sampling of topics of each component of the research process.

Epistemology	Theoretical Perspective	Methodology	Methods
Objectivism Constructionism Subjectivism *(and their variants)*	Positivism (and post-positivism) Interpretivism • Symbolic interactionism • Phenomenology • Hermeneutics Critical inquiry Feminism Postmodernism *etc.*	Experimental research Survey research Ethnography Phenomenological research Grounded theory Heuristic inquiry Action research Discourse analysis Feminist standpoint research *etc.*	Sampling Measuring and scaling Questionnaire Observation • Participant • Non-participant Interview Focus group Case study Life history Narrative Visual ethnographic methods Statistical analysis Data reduction Theme identification Comparative analysis Cognitive mapping Interpretive methods Document analysis Content analysis Conversation analysis *etc.*

Source: (Crotty, 1998, p. 5)

In the following section I will discuss my epistemological stance and theoretical perspective in detail as well as their influence on my approach to research and the design of this stud.

Theoretical Perspectives And Paradigms

Theoretical perspectives, or research paradigms, in the social sciences are dominated by positivism (and post-positivism) and interpretivism (Cohen et al., 2007).

Positivism holds that the scientific method and research by systematic empirical investigation generates knowledge that is objective, generalisable and free from bias. The interpretivist paradigm holds that reality is an artificial construct and inherently subjective; and to accurately measure that reality, research must be immersive, value bound and acknowledge that subjectivity. Crotty critiques research textbooks that pit qualitative and quantitative methods against one another and has argued that those terms have become conflated with their underpinning theoretical perspectives (paradigms) or even epistemologies. Creswell believes that the combination of worldview, strategies, and methods tends to be quantitative, qualitative or mixed (Creswell, 2009). Whether one is taking Crotty's (1998) view of qualitative and quantitative research as methods, or Cohen's (2007) view of them as methodologies, they are ubiquitous in research and literature widely understood. A brief examination of their characteristics and areas of similarity and difference will place them within the research framework of this study allowing me, as the researcher, and the reader to establish a common understanding of the topic under investigation.

Quantitative research. Quantitative research derives from the positivist tradition of scientific enquiry which sets as its goal: "objectivity, measurability, predictability, controllability, patterning, the construction of laws and rules of behaviour, and the ascription of causality" (Cohen et al., 2007). It places emphasis on *proving*, or failing to disprove, a hypothesis using systematic empirical investigation of phenomena with statistical, mathematical or computational techniques. Quantitative (or positivist) purists believe that the social sciences should be objective and that observations of phenomena should be treated as if they were physical observations. They further believe that generalisations, free from context, are possible, desirable and can be determined reliably

(Nagel, 1989). This school of thought believes that researchers in the education field should eliminate their biases while remaining emotionally detached and uninvolved with their subjects (R. B. Johnson & Onwuegbuzie, 2004).

Qualitative research. Qualitative research derives from the interpretivist (or post-positivist) tradition, places emphasis on the individual, and is often used to research patterns of behaviour (Cohen et al., 2007). Researchers use qualitative approaches, such as interviews, observations, and focus groups, to explore the perspectives, feelings, behaviours and experiences of people and what lies at the core of their lives; they usually "begin with the individuals and set out to understand their interpretations of the world around them" (Cohen et al., 2007, p. 22). Social scientists approach people not as individuals who exist in isolation from their environments, but explore their world within the subject's life context: they further believe that understanding human experiences is as important as focusing on explanation, prediction, and control.

'**The incompatibility thesis'.** Debates between advocates of each theoretical perspective and research methodology have led to purists on each side who argue that their theoretical perspective and methodology offers a superior basis for research. These purists, by arguing for the superiority of their chosen paradigm, implicitly support the incompatibility thesis (Howe, 1988). Sieber notes (1973) "Indeed, the two dominant research paradigms have resulted in two research cultures, one professing the superiority of '*deep, rich observational data*' and the other the virtues of '*hard, generalisable data*'" (ibid, p. 1335). The debate and division between those on either side of the ideological divide is often so strong that some believe that rapprochement is impossible: "accommodation between

paradigms is impossible … we are led by vastly diverse, disparate, and totally antithetical ends" (Guba & Lincoln, 1994, p. 81).

Common features between research theoretical perspectives. Despite the differences between the dominant research theoretical perspective, some researchers highlight that similarities exist between them. Both research styles use empirical observations; Sechrest and Sidani (1995, p. 78) state that both methods *"describe their data, construct explanatory arguments from their data, and speculate about why the outcomes they observed happened as they did."* Another common feature is that both research styles seek to establish validity and eliminate confirmation bias with research safeguards (Sandelowski, 1993). Indeed, recent developments in research philosophy have blended elements of the two dominant paradigms to create mixed-methods research; this *'third way'* can take from the strengths of both paradigms pragmatically, less restrained by ideological constraints (R. B. Johnson & Onwuegbuzie, 2004).

3.2 Research Approach And Methodology

In keeping with Crotty's (1998) approach, I initially decided on methods and methodologies for the study, which will be discussed and justified later in this chapter. The justification for those choices involves questions about reality, human knowledge and the type of knowledge this study seeks to create. What emerged was that the epistemological basis of this research is *constructionism*, with an *interpretivist* theoretical perspective, specifically *symbolic interactionism*.

Epistemology

Epistemology, worldview or paradigm; regardless of the term used, the same essential elements are required to design and commence research. Creswell (2009) describes research design as 'the plan or proposal to conduct research' which includes philosophical worldview, strategies of enquiry and specific methods (p. 5); Creswell adopts Guba's definition of worldview as 'a basic set of beliefs that guide action' (Guba, 1990, p. 17). Creswell, echoing Crotty's (1998) description of varied terminology, equates worldview with paradigms (Lincoln & Guba, 2000; Mertens, 2015); epistemologies and ontologies (Crotty, 1998), or broadly conceived research methodologies (Neuman, 2009). In keeping with the research approach of this study, based on Crotty's framework, I will examine the epistemological underpinnings of this study.

My epistemological position is a pragmatic one; I see that there are different types of knowledge and therefore are different ways to come to know and understand that knowledge. To take Crotty's (1998, p. 8) example of the tree; an objectivist would hold that a tree is a tree - free from our understanding of it or any conscious meaning, whereas a constructionist would argue that our constructed meaning of 'tree-ness' is what makes it a tree, otherwise it is undefined object. I would see that both are true; a tree is an objective label that describes an object and its physical properties, which are unchanging because of that label. The tree also has a meaning to those who avail of it; we may, for example, eat the tree's fruit or take shade under it. Its meaning is relative to its users and constructed by them. The tree, therefore, is both an object in its own right but also has a constructed meaning to those who avail of its benefits. A more simplistic view is that an atom of hydrogen exists whether it holds meaning to us or not, but hydrogen as a fuel in our star

creates a new meaning for us who live in that star's warmth. Strauss (1993), one of the originators of grounded theory, embraces a pragmatic philosophy, where one can study a phenomenon's intrinsic properties and its constructed meanings when he says: "This is a universe where nothing is strictly determined. Its phenomena should be partly determinable via naturalistic analysis, including the phenomena of men [and women] participating in the construction of the structures which shape their lives" (Strauss, 1993, p. 19). In articulating my own beliefs, I found them shared by Giddens:

> The differences between the social and natural world is that the latter does not constitute itself as "meaningful"; the meanings it has are produced by the men in the course of their practical life, and as a consequence of their endeavours to understand or explain it for themselves. Social life - of which these endeavours are a part - on the other hand, is produced by its component actors precisely in terms of their active construction and reconstitution of frames of meaning whereby they organise their experiences. (Giddens, 1976, p. 79)

Crotty offers a critique of the objectivist viewpoint, *"our discussion to this point suggests that our knowledge of the natural world is as socially constructed as our knowledge of the social world"* (Crotty, 1998, p. 56). He argues that the natural scientist comes to research with as much socially-constructed meaning of natural phenomena as anyone else and that those meanings and biases shape their views and research. While sharing these views, I would also argue that to say a natural phenomenon exists only as we perceive it to do so denudes it of its intrinsic meaning and form, while exalting consciousness as the creator of all meaning. Put another way, the existence of the universe for many billions of years before *human* consciousness has little or no meaning to us as individuals, but the universe existed nonetheless. I would, therefore, hold existence and meaning as separate and

independent on the one hand, yet in human consciousness symbiotically linked. Therefore I consider Gidden's views as close to my own and would disagree with Crotty.

Theoretical Perspective

The theoretical perspective, or philosophical stance, that informs the methodology of this research study is interpretivism. At this point, I refer to the quantitative v. qualitative debate and the earlier discussion on the role of interpretivism in the social sciences. The concept of *verstehen* and *erklären,* loosely associated with the work of Wilhelm Dilthey, deals with this conceptual dichotomy (Feest, 2010). It contrasts *verstehen*, or understanding, in interpreting phenomena in social sciences, with *erklären*, or explaining, in the natural sciences. This theory resonates with my views of the natural world which we explain and the social world which we must understand.

Symbolic Interactionism. Within the interpretivist theoretical perspective, this study will adopt symbolic interactionism as a perspective to inform the methodology. Symbolic interactionism, as a theoretical perspective, holds that interpretation is an integral element in human action and interaction. A person's response to any act will be determined by how they interpreted the original act and can be laden with past experience, biases or even irrational interpretations. Blumer (1969), one of the founders of the philosophy, provides a description and justification for focusing on the interpretation of actions and responses:

> The peculiarity consists in the fact that human beings interpret or 'define' each other's actions instead of merely reacting to each other's actions. Their 'response' is not made directly to the actions of one another but instead is based on the meaning which they attach to such actions. (Blumer, 1969, p. 19)

Blumer (1969) cites the three assumptions of symbolic interactionist research:

- that human beings act towards things on the basis of the meanings that these things have for them;
- that the meaning of such things is derived from, and arises out of, the social interaction that one has with one's fellows;
- That these meanings are handled in, and modified through, an interpretive process used by the person in dealing with the things they encounter.

This interpretative process consists of internal interaction with oneself and social interaction with people. In interactions with people, Psathas (1973, p. 607), talks about the practical need for 'role taking' (seeing from the actor's perspective) in the analysis, and to look at the significant symbols that are used by the actors. The combination of these and the overall approach is the essence of 'symbolic interactionism' (Crotty, 1998, p. 75):

> Methodologically, the implication of the symbolic interactionist perspective is that the actor's view of the actions, objects, and society has to be studied seriously. The situation must be seen as the actor sees it, the meanings of objects and acts must be determined in terms of the actor's meaning, and the organisation of a course of action must be understood as the actor organises it. The role of the actor in the situation would have to be taken by the observer in order to see the social world from his perspective. (Psathas, 1973, p. 607)

Symbolic interactionism provides this study with a means to understand how participants interpret, act, and interact with the studied phenomena (Corbin & Strauss, 2008), and it forms a theoretical underpinning to variants of grounded theory, which will be discussed next.

Grounded Theory Methodology

Grounded theory is a methodological approach for qualitative research developed in the 1960's by two sociologists, Barney G. Glaser and Anselm L. Strauss. The development of grounded theory was a result of Glaser and Strauss's attempts to bridge a gap between theory and research which they felt had not been solved by studies using logical deductive reasoning as a method of inquiry (Glaser & Strauss, 1967). Grounded theory methodology (GTM) is, therefore, an *inductive* research process in that it prioritises data over theory, allowing new theories to emerge from the ground up. Corbin describes GTM as "a qualitative research method that uses a systematised set of procedures to develop and inductively derive grounded theory about a phenomenon" (Corbin & Strauss, 2008, p. 24), the purpose of which is "to generate a theory that accounts for a pattern of behaviour, which is relevant to those involved" (Glaser, 1978, p. 3).

Grounded *theories*? As a research methodology, grounded theory is "certainly a contested concept" (Bryant & Charmaz, 2010, p. 3), subject to debate and criticism from those advocating for other methodologies and from those within the field who protest at methodological developments (Burawoy, 1991; Goldthorpe, 2000). The internal debates stem from the different paths taken by the originators of the methodology, Glaser and Strauss. These divergent paths led to methodological differences between the two as Strauss continued to advance his version of grounded theory with Juliet Corbin (Strauss & Corbin, 1990; 1994; 1998) in a manner that Glaser adamantly deems to not be grounded theory. Onions (2006) outlines some of the specific differences between what became two separate schools of grounded theory, as seen in Table 3.2 below.

Table 3.2

Key differences between Glaserian and Straussian approached in Grounded Theory.

"Glaserian"	"Straussian"
Beginning with general wonderment (an empty mind)	Having a general idea of where to begin
Emerging theory, with neutral questions	Forcing the theory, with structured questions
Development of a conceptual theory	Conceptual description (description of situations)
Theoretical sensitivity (the ability to perceive variables and relationships) comes from immersion in the data	Theoretical sensitivity comes from methods and tools
The theory is grounded in the data	The theory is interpreted by an observer
The credibility of the theory, or verification, is derived from its grounding in the data	The credibility of the theory comes from the rigour of the method
A basic social process should be identified	Basic social processes need not be identified
The researcher is passive, exhibiting disciplined restraint	The researcher is active
Data reveals the theory	Data is structured to reveal the theory
Coding is less rigorous, a constant comparison of incident to incident, with neutral questions and categories and properties evolving. Take care not to 'over-conceptualise', identify key points	Coding is more rigorous and defined by technique. The nature of making comparisons varies with the coding technique. Labels are carefully crafted at the time. Codes are derived from 'micro-analysis which consists of analysis data word-by-word'
Two coding phases or types, simple (fracture the data then conceptually group it) and substantive (open or selective, to produce categories and properties)	Three types of coding, open (identifying, naming, categorising and describing phenomena), axial (the process of relating codes to each other) and selective (choosing a core category and relating other categories to that)
Regarded by some as the only 'true' GTM	Regarded by some as a form of qualitative data analysis (QDA)

Source: (Onions, 2006, p. 9)

Contestation and discussion have broadened the methodological and theoretical horizons of grounded theory; Bryant (2010) believes that it allows the methodology to advance and even flourish:

> ... it accentuates the ways in which the method has redrawn the methods map, brought to the fore some of the central practical and philosophical methods issues, and initiated a flourishing interest in methods enhancement and development. (Bryant & Charmaz, 2010, p. 4)

New researchers have brought new theoretical perspectives to the field, although doing so in ways that are disputed by Glaser (Strauss passed away in 1996). Kathy Charmaz is one such researcher, who defines her constructivist version of grounded theory as:

> Grounded theory methods consist of systematic, yet flexible guidelines for collecting and analysing qualitative data to construct theories from the data themselves.... Grounded theory begins with inductive data, invokes iterative strategies of going back and forth between the data and analysis, uses comparative methods, and keeps you interacting and involved with your data and emerging analysis. (Charmaz, 2014, p. 1)

Table 3.3, below, presents an overview of the three variants of grounded theory, highlighting the principles which unify them, and the principles on which they diverge. Kenny and Fourie, in their (2015) examination of philosophical conflicts between the various approaches to grounded theory, noted that Glaser "was ambivalent about what research paradigm Classic GT corresponds to" (2015, p. 1274). Researchers will later ascribe 'soft positivism' to be the philosophical underpinning (Bryant & Charmaz, 2010; Charmaz, 2006).

Table 3.3

Key differences between Glaserian, Straussian, and Constructivist approaches to Grounded Theory.

Principle	Glaserian GT	Straussian GT	Constructivist GT
Common Principles			
Memo writing	*principle held in common*		
Constant comparison	*principle held in common*		
Theoretical sampling	*principle held in common*		
Divergent Principles			
Underlying Philosophy	'Soft' positivism	Post-positivism & Symbolic Interactionism	Constructivism & Symbolic Interactionism
Use of Literature	Abstain from literature until the end of the process	Use literature appropriately at every stage	Use literature at every state and compile a literature review
Coding Framework (CF)	Original coding framework designed to discover a grounded theory	Rigorous coding framework to create a grounded theory	Open-ended coding framework designed to construct a grounded theory

Source: Table synthesised from Kenny and Fourie's (2015) contrasting of Classic, Straussian, and Constructivist approaches to Grounded Theory.

I examined and considered all three approaches to grounded theory, but ultimately I chose Constructivist GT as the methodological basis of this study, based on two of the three principles on which the approaches diverged:

- A contradiction between my epistemological stance and theoretical perspective, which did not align with positivism, 'soft-positivism', or post-positivism, presented the first objection to both Glaserian and Straussian approaches to grounded theory.
- The second objection was the method of engagement, or absence of engagement, with the literature.

I have already described my epistemological stance and theoretical perspective and in the next section will discuss them in more relevant detail. The requirement to refrain from a review of the literature, or to exercise restraint while engaging with it was a challenge for me. These requirements simply were not practical for two reasons as outlined in Chapter 2, engagement with institutional review boards, ethics applications, funding applications and

even writing a research proposal to begin Ph.D. research requires an engagement with the literature. Secondly, and crucially, my personal interest and professional practice have given me a stock of knowledge in the field, much of it informed by the literature. To adopt a Glaserian or Straussian approach to grounded theory would require me to disregard that stock of knowledge, or to 'pretend' I did not have it; these choices are both impractical and unethical for me. Lempert (2010), when discussing this concern, presents her engagement with the literature as a guiding light rather than a constraint on her research:

> In order to participate in the current theoretical conversation, I need to understand it. I must recognise that what may seem like a totally new idea to me (an innovation in my research) may simply be a reflection of my ignorance of the present conversation. A literature review provides me with the current parameters of the conversation that I hope to enter. Utilising comparisons from the literature alerts me to gaps in theorising, as well as ways that my data tells a different, or more nuanced story. It does not however, define my research. (Lempert, 2010, p. 254)

While critiquing Glaser's approach, Dey (1999) put it more tartly: "there is a difference between an open mind and an empty head" (1999, p. 251), suggesting that it is better for a researcher to bring prior knowledge, and to make reasonable efforts to control for bias and remain reflexive, than to have no knowledge of the field.

Symbolic Interactionism And Grounded Theory In This Study

The research question '*The impact of mlearning and access to mobile technology on the role of the teacher*' does not easily fit into an objectivist epistemology or positivist (or similar) theoretical perspective. Such an approach would aim to test existing theories, or investigate cause-effect relationships and would place emphasis on measurement and explanation. In contrast, this study addresses relationships of learning which, as social

constructs, require a research perspective that emphasises an understanding of human behaviour, including the interactions and social processes that shape it. Symbolic interactionism allows this study to examine the lived experiences of the participants and enables their contexts to be understood from their perspectives. Creswell (Creswell, 2009) points out that this *bottom-up* approach allows for the observation and detection of patterns enabling theory generation, an approach that supports and enables grounded theory in this study.

Blumer (1969) believes that to understand the world, one must analyse the actions and interactions of the participants. To achieve that, the researcher must be able to interact with the people being researched, seeing things from their point of view, in their natural context. Symbolic interactionism, as a theoretical perspective, and grounded theory as a methodology, enabled me as researcher, to be actively involved with participants, and in this case, I was able to interact and observe in the educational settings of schools, classrooms and virtual classrooms. In these settings, Blumer sees symbolic interactionism as allowing a 'lifting of the veil':

> ... lifting the veils that obscure or hide what is going on. The task of scientific study is to lift the veils that cover the area of group life that one proposes to study. The veils are not lifted by substituting in whatever degree, performed images for firsthand knowledge. The veils are lifted by getting close to the area of study and digging deep into it through careful study. (Blumer, 1969, p. 39)

Grounded Theory Process

Despite the philosophical and methodological debate, the various 'schools' of grounded theory share their central processes and methods – although some terminology may differ. They share their use of constant comparative analysis, coding and categorising, memoing and theoretical sorting, and theory development and generation. These analytic processes of grounded theory will be explored below. The methods of data collection will be explored in depth in the next section, but in summary are: traditional grounded theory interviews, observations of physical and virtual classrooms, and video analysis.

Constant Comparative Analysis. Glaser and Strauss (1967, p. 193) list four steps in the constant comparative method: (a) comparing incidents applicable to each theme that emerges from the data; (b) integrating themes and their properties, (c) delimiting the theory, and (d) writing the theory. Sampling, data collection and analysis all occur as simultaneous processes within the grounded theory methodology. The process of constant comparison is used in the coding, categorisation and analysing of data. Constant comparison is not a linear process; analysis begins as soon as some data are collected, and ongoing analysis can shape further data collection and analysis. Jeon (2004) notes that while constant comparison and simultaneity are seen as essential characteristics of data collection and analysis, "contingencies of time, resources and the research setting may require flexibility and adaptability on the part of the research". As a key process of grounded theory, constant comparison formed the analytical backbone of this study's analytical processes.

Initial Coding. Coding is the process of "categorising segments of data with a short name that simultaneously summarises and accounts for each piece of data" (Charmaz, 2014, p.

111). The researcher is constantly comparing new data to old data in a way that can show the appropriateness of early codes, or the way that codes can be grouped together, or even that inter-relationships may exist between codes. At this early stage the researcher will begin to have a sense of clarity about the data; or if not, will have to refine or re-define the questions being asked of the data. Human processes, whether social or mental, are the object of study in research using grounded theory methodology. Mindful of this, Charmaz (2014) recommends line-by-line coding where gerunds (the noun or '-ing' form of the verb) are used to capture actions on the part of participants.

> Line-by-line coding, the initial grounded theory coding with gerunds, is a heuristic device to bring the researcher into the data, interact with them, and study each fragment of them. This type of coding helps to define implicit meanings and actions, gives researchers directions to explore, spurs making comparisons between data, and suggests emergent links between processes in the data to pursue and check. (Charmaz, 2014, p. 121)

In contrast with other forms of qualitative coding, which often test for preconceived codes, grounded theory emphasises emergent codes, elicited by focusing on the actions of the participants. The emphasis on actions helps the researcher avoid coding people as types, which can lead to a one-dimensional view of participants. It also helps prevent 'conceptual leaps' before the robust analytic work has been completed (Charmaz, 2014). In this study, the types of data collected presented challenges when trying to code uniformly, and Chapter 4 will discuss the innovations required to integrate diverse data types and allow constant comparison.

Focused Coding and Beyond. Following the initial coding, the researcher begins a process of 'focused' coding where categories are developed which subsume groups of previously generated codes. The theoretical stage then follows the focused stage; where the

researcher seeks to understand relationships between and within the categories. This part of the process allows for development of an understanding of the concepts at work and advances the analytic process towards theory generation. Even at this stage, the process is not linear; to address any perceived gaps, the researcher may gather additional data, revise codes or redefine categories. The researcher is constantly testing the data throughout the analysis. By this point, the core categories have formed; these are the categories the researcher will use to develop their theories. The systematic approach to analysis allows the research to define and re-define codes and categories until a point is reached where they are consistently visible in the data. This is the point of 'saturation', where the data collection ends, where there is no longer data that refute other data, and where the addition of more data will neither add to nor detract from the analysis. After the point of saturation, the researcher can generate theory about the concepts under investigation.

The researcher must cycle back and forth between the data, codes and categories to reach the point of saturation. A simplified schematic of the process is outlined in Figure 3.1, below. There is no set or prescribed number of cycles; instead, the process is determined by the data, the way the researcher handles it, and what emerges from the data.
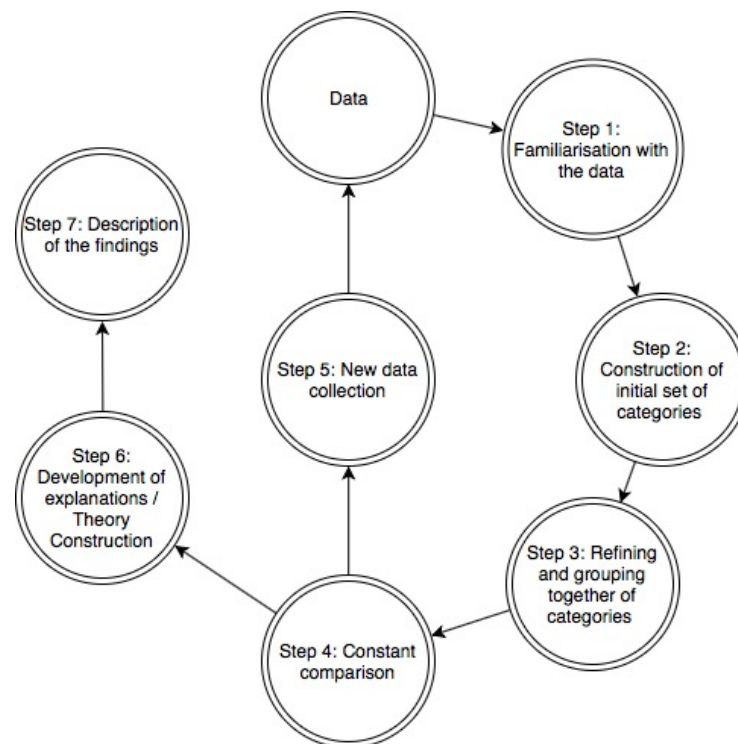
Figure 3.1

Simplified process showing constant comparison cycles.

Memoing and sorting. A memo in grounded theory is a written piece by the researcher, who records thoughts, insights and concerns about codes which are emerging from the data. The analysis in a grounded theory study can be a challenging process; memoing and theoretical sorting are crucial in raising focused codes into conceptual categories, Charmaz (2014) believes that:

> Memo-writing is the pivotal intermediate step between data collection and writing drafts of papers. When you write memos, you stop and analyse your ideas about the codes in any - and every - way that occurs to you during the moment. Memo-writing constitutes a crucial methods in grounded theory because it prompts you to analyse your data and codes early in the research process. (Charmaz, 2014, p. 162)

A series of memos, written throughout the research process, lead me to a better understanding of the data being examined. The process of memo writing allowed me to

form ideas, reveal gaps in the analysis, and identify relationships forming between codes and categories. Memo writing took place throughout the entire course of this grounded theory study.

Theoretical Sampling, Saturation and Sorting. Theoretical sampling, which begins to occur later in the analysis of data, is described by Charmaz (2014) as:

> ... seeking pertinent data to develop your emerging theory. The main purpose of theoretical sampling is to elaborate and refine the categories constituting your theory. You conduct theoretical sampling by sampling to develop the properties of your new categories until no new properties emerge. (Charmaz, 2014, p. 193)

Theoretical sampling is often confused with selecting a representative population by initial sampling, or other qualitative sampling steps (Charmaz, 2014, p. 197); in grounded theory its purpose is to direct the conceptual and theoretical development of the analysis by elaborating on and refining the tentative categories. Theoretical sampling requires a particular type of creative reasoning, abductive reasoning when attempting to account for surprising and puzzling findings. Abductive inferences are reached after considering all plausible explanations, forming hypotheses for each, and empirically testing these from the data (Charmaz, 2014). The use of abductive reasoning is a distinguishing feature of grounded theory. Gaps in the data and analysis, identified by memoing, are addressed by re-examining or adding new data until the categories are saturated.

Theoretical saturation is the point at which data collection may conclude. It is a milestone in a researcher's work that can be tested for and understood. Saturation is more than simply seeing the same patterns begin to repeat in the data; Glaser provides a rather sophisticated view of saturation:

Saturation is not seeing the same pattern over and over again. It is the conceptualisation of comparisons of these incidents which yield different properties of the pattern until no new properties of the pattern emerge. This yields the conceptual density that when integrated into the hypothesis make up the body of the generated grounded theory with theoretical completeness. (Glaser, 2001, p. 191)

The process of theoretical sorting is the culmination of ideas developed through constant comparison and memo writing; it is the final sorting of ideas and memos that will lead to theory generation about the concepts. Charmaz (2006, p. 117) suggests this approach:

- Sort memos by the titles of each category,
- Compare categories,
- Use your categories carefully,
- Consider how their order reflects the study's experience,
- Now think how their order fits the logic of the categories, and
- Create the best possible balance between the participants' experiences, your categories, and your theoretical statements about them.

The researcher may also wish to create visual representations of their memos, codes and categories, through the use of diagrams or mind-maps; such visual representations can help reveal relationships between categories, further supporting theory generation. The ability to create visual representations will be used to present a numbers of theories related to a category in a visual and accessible way. The development of 'theory from data' (Glaser & Strauss, 1967) is the ultimate outcome of a grounded theory study, where the outcomes reflect the lived experience of the participants. Creswell (1997, p. 56) notes that a

grounded theory "is articulated toward the end of a study and can assume the form of a narrative statement, a visual picture, or a series of hypothesis or propositions.

To summarise; concepts, categories, and propositions are the three essential elements of grounded theory (Pandit, 1996). Through simultaneous collection and examination of data, the researcher develops concepts which become the basic units of analysis. The process of constant comparison of these early data allows for the development of more abstract units, or categories, which are a series of related concepts. Strauss and Corbin (1990) (1990) exemplify this with their research on illness - "packing, self-medicating, watching one's diet, are some of the concepts discovered which then form the category '*Self Strategies for Controlling Illness*'" (p. 7). Ultimately, the researcher develops propositions, or emergent theories, from the data. The process of constant comparison concludes at the point of 'saturation', although to reach this point the researcher may have had to redefine concepts or categories. Saturation is the point after which new data will neither add to nor detract from the emergent theories and is determined "by the discovery that additional interviews [or additional data] are yielding so little new information that more interviews [more data] would be a waste of time" (Schutt, 2004, p. 199).

3.3 Scope And Sample

This section will discuss the approach to sampling, including the specific process used and how it was applied to the participating schools, teachers and students in the study.

Sampling of schools. Purposive sampling was used to identify three schools (see Table 3.4 below) from a panel of mlearning early-adopter schools as sites for study.

Table 3.4

Sample schools, showing sector and patronage, location profile and enrolment.

School	Sector	Patron	Location	Enrollment
Hillview School	Education and Training Board	An Education and Training Board (formerly Vocational Educational Committee)	Rural small town	800 - 900
Seafront School	Community and Comprehensive	Association of Community and Comprehensive Schools	Suburban Dublin	>1,000
Meadowbrook School	Voluntary Secondary	Edmund Rice Schools' Trust (Formerly Christian Brothers' School)	Regional Town	500 - 600

Note: Hillview and Seafront Schools are co-educational, while Meadowbrook School is single-sex. School enrolment numbers are shown in ranges to ensure anonymity.

Purposive sampling involved "selecting groups or categories to study on the basis of their relevance to your research questions" (Mason, 1996, pp. 93-94). The panel was composed of schools that began their mobile learning programmes in the 2011/12 academic year[4]. The identification of schools took place during 2013/14 with the intention that field work would take place in 2014/15. From the panel of schools three were selected because: (a) they represented the range of patronage[5] in Irish school system: a voluntary secondary school with a denominational patron, a state-run school under an Education and Training Board and a Community School, (b) the schools also represented a geographic spread from rural, suburban Dublin and a regional town, and (c) all schools were in their third year of mlearning programmes and every junior cycle student was equipped with a mobile device as well as their teachers. A further consideration was that each school showed the potential,

4 2011/12 marked the first year of mainstream adoption of mobile devices on a 1:1 (one device per student) basis with 21 (out of c.730) post-primary schools in Ireland initiating such programmes. Usage in the previous year, following the release of Apple's iPad, was limited to small class trials and feasibility studies.

5 The Patron of a school is the person or body that is legally recognised as the controlling authority for the school. The Education Act of 1998 retained the concept of patronage which dates back to 1831 and the foundation of the primary school system in Ireland. Post-primary schools are broadly divided into three sectors: voluntary secondary schools with religious orders, or faith-based foundations as patrons; Education and Training Boards, which are secular and state-owned, as patron; and Community and Comprehensive schools, also secular but run by communities or civil society groups.

based on the researcher's prior contact with them, to exhibit some of the characteristics of the practice of mobile learning as examined in Chapter 2. An example of a practical manifestation was each school's desire to employ their students' devices as more than simple e-readers for digital textbooks. The invitation letter to school leaders is attached in Appendix 3D.

Sampling of teachers. Purposive sampling was again used to identify teachers in each school to recruit them as participants in the research study. School leaders were asked to identify a panel of teachers based a set of criteria. In keeping with the research question, it was necessary to use some characteristics of the practice of mobile learning, identified in the literature review, to inform the selection criteria for participants:

- Teachers who were willing to volunteer and engage in the process and have their classes and online interactions with students observed.
- Teachers who were to teach the revised Junior Cycle, or for other reasons would have a significant knowledge of it, or would be teaching courses that were similar in nature. Chapter 5 will discuss the importance of the revised Junior Cycle in detail, but new forms of assessment which permitted the use of technology were behind the rationale for this criterion.
- Teachers who were using an online learning environment, examples included: Edmodo, Schoology, Moodle, or even Twitter.
- Teachers who had taught students with mobile devices for a numbers of years were preferable. This point did not require teachers with advanced technology literacy or fluency.
- A balance of age and gender in the selection was highly desirable.

The remaining criteria reflected the practical considerations of participating in the research study, including a willingness to participate and having classes suitable for observation. The teachers' invitation letter is attached in Appendix 3I.

Some changes were made to the above criteria as the recruitment process was ongoing. The criterion relating to the revised Junior Cycle, particularly English[6], was dropped as a result of industrial relations difficulties causing delays in the adoption of the new curriculum (discussed further in Chapter 5). Hillview School and Seafront School put forward lists of participants; four from Hillview School and three from Seafront School. Meadowbrook School nominated three participants, however upon further examination they did not meet the selection criteria as they did not use any online learning environments (or virtual classrooms). The literature review identified virtual classrooms, or similar online spaces, as characteristics of mobile learning, which informed the selection criteria for teachers. As the teachers in Meadowbrook School did not use them, they were excluded from the study; and as the school was unable to nominate any further candidates, it was excluded from further participation. The study, therefore, commenced with seven teachers from Hillview School and Seafront School.

Sampling of students. Students were selected only by being part of observed classes, no other method of selection was used.

3.4 Role Of The Researcher

Before undertaking PhD research at Maynooth University, I worked as an education technologist for a private company providing educational technology consultancy services to post-primary schools in Ireland. I enrolled as a PhD candidate during the 2012/13 academic year and at the commencement of the 2013/14 academic year resigned from my employment. In my previous role, I assisted schools to plan and

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6 English was planned to be the first subject to be taught and assessed under the revised Junior Cycle

implement one-to-one mobile device programmes. That role allowed me to have significant contact with schools (including those in this study) to shape and direct their programmes. The engagement with schools included the provision of continuing professional development (CPD) for teachers, strategies for curriculum integration and evaluation of those programmes. At the time of my resignation over 40 schools had initiated mobile learning programmes in partnership with my former employer, growing from seven in the 2011/12 academic year to 21 in 2012/13 and 40+ in 2013/14. The links between my previous professional practice and the area of my research in this study enabled the range and depth of study but required considerable reflexivity when dealing with data and analysis.

Insider research. I substantial parts of the CPD courses for teachers and was also one of the tutors delivering those courses. Some modules specifically addressed the relationships of learning between students and teachers by demonstrating technologies that can support a change from a strongly didactic role to a more facilitative role for teachers. Appendix 3K shows the description of '*The iPad Classroom'* as an example module. My role was limited to specific scheduled professional development courses for teachers, usually 6.5 hours in each academic year and therefore I had a minimal ability to direct or influence teachers to change their practice, rather, the courses exposed them to methods that may support a latent intention for a change in teaching practice or an intention developed in partnership with peers or school leadership. A further step to minimise insider research was taken by me when I refrained from facilitating any professional development courses in the participating schools during the academic term in which data collection was taking place and for the entire academic year prior to that. A significant period of time (18

months) had therefore passed since any participating teacher would have worked directly with me.

Before the research for this thesis commenced, I had an influence, in an advisory capacity, on the overall structure of the mobile devices programmes in the participating schools and the efforts to maintain and support them. As a consultant for a private company, I was engaged for the establishment of the programmes in the schools selected for research and had provided CPD for a subset of teachers (as one of the tutors) in each school since the programmes began. I did not deal with the day-to-day integration of mobile learning into the school culture. That role was – and continues to be – fulfilled by the school leadership, guided by each school's ethos, teaching and learning policies and elearning[7] plans.

3.5 Research Methods

A variety of data collection methods and instruments were selected for use based on the research question and context. The methods were aligned with the research approach which had an epistemology of *constructionism* and an *interpretivist* theoretical perspective, specifically *symbolic interactionism*. While grounded theory is often seen as a method for interview-based studies only, Charmaz (2014) argues for an eclectic approach:

> My notion of grounded theory includes a basic methodological principle: our data collection methods flow *from* the research question where we go with it … This principle brings methodological eclecticism into grounded theory and counters those scholars who have treated it as a method for interview studies only. (Charmaz, 2014, p. 26)

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7 Every school in Ireland was mandated to establish an elearning plan to guide the school's integration of ICT into teaching, learning and assessment. The usage of the term 'elearning plan' above does not set it out as a separate strategy, rather it is used generically in schools to include all forms of technology usage.

Therefore the methods employed include *traditional* interviews with participating students, teachers and school principals, but also a range of methods that may seem unconventional for grounded theory. The variety in the data support my quest for rich data, which are "detailed, focused and full ... they reveal participants' views, feelings, intentions, and actions as well as the context and structures of their lives" (Charmaz, 2014, p. 23). Classroom observations, online observations, video recordings and questionnaires are intended to provide supplementary evidence, often with points for comparison, which can add richness to the traditional interviews. This selection of types of data allows me "see the setting, observe interactions, witness research participants' non-verbal behaviour, and hear their voices as well as see written accounts" (Charmaz, 2014, p. 111). Three schools were selected as potential research sites: Hillview School, Seafront School, and Meadowbrook School (see Table 3.4 earlier).

The data collection was structured into two phases as shown in Table 3.5 below: (a) background and preparatory research phase, and (b) primary research phase; the table also shows the approximate chronological order of the phases and methods. The field work timetable for the study as attached as Appendix 3A. A detailed discussion of each method will follow and will describe the final way in which that method was used and administered. As a study using grounded theory, it would be reasonable to expect that some modifications were required in the research methods in response to the data. Where such modifications took place, they will be discussed in detail in Chapter 4, with an example being the addition of interviews with principals; the chapter will also describe the method of analysis for each type of data.

Table 3.5

Table showing research phases, data collection methods and instruments.

Description	Phase	Data Collection Method
Initial contact, ethical approval and recruitment	Background	n/a
Teachers' initial questionnaire	Background	Questionnaire
School evaluations & policies	Background	Documentary analysis
Interviews with teachers, students and school leaders	Field work	Interviews
Online observations of teachers' virtual classrooms	Field work	Observation of Edmodo and Schoology
Video recordings	Field work	Video recording of classes
Classroom observations	Field work	Observation with field notes

Teachers' Initial Questionnaire

A questionnaire, see Appendix 3B, was used to gather background information from the participating teachers. The information gathered included demographic information, technology literacy/fluency and beliefs about teaching and learning. These data were sought to allow me more fully understand each research participant, their educational experience, and self-reported views of their teaching philosophies and skills. Points of comparison, both between an individual's reported views and observed practice, as well as between participants were envisaged as being made possible with these data. The questionnaire contained the following sections:

Demographic Information. Participants were asked to report on the following: name, age (range), gender, teaching experience, subjects taught, further academic qualifications and if they participated in the school's extra-curricular activities.

Technology Literacy and Fluency. Participants were asked to indicate what level of technology provision existed in their schools and homes. Teachers were asked to indicate

on a 3-point scale their ability to use the internet, create educational resources (for example, presentations and handouts), edit video and audio, create interactive materials and to combine multiple resources into digital portfolios or online courses. Participants were also asked to indicate their educational use of learning management systems, social media, Web 2.0 tools and cloud services.

Technological Pedagogical Content Knowledge (TPACK). TPACK was measured with Schmidt's (2009) instrument[8] for the evaluation of TPACK in teachers. As discussed in the literature review, Shulman's (1987) concept of pedagogical content knowledge and Mishra and Koehler's (2006) extension with a technological dimension, can provide insights into some of the central processes of teaching. These frameworks often provide pathways for professional formation/development, but in this study, they may serve as points of comparison. Schmidt's instrument contained 51 statements grouped into seven categories: Technology Knowledge (TK), Content Knowledge (CK), Pedagogy Knowledge (PK), Pedagogical Content Knowledge (PCK), Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK) and Technological Pedagogical Content Knowledge (TPACK). Participants were asked to indicate their agreement with each statement on a 5-point Likert scale and averages were generated for each of the sections. The instrument was field tested by Schmidt (2009) and delivered internal consistency (alpha) scores ranging from 0.78 to 0.93 which indicated a high level of accuracy and reliability. The original instrument was customised and localised for use by Irish schools in this study. To improve the relevance of sections relating to content knowledge (CK) to teachers in Ireland, subject groupings from the United States of America (Social Studies,

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8 Schmidt's (2009) original TPACK assessment instrument was made available for use by other researchers provided they obtained Schmidt's prior permission; enabling Schmidt to keep a database of usage and track any localisation and translations of the instrument. To obtain permission, the researcher was requested to submit a description of the intended study, including research questions, population, locations, etc., to Schmidt for review. Dr Denise Schmidt reviewed the localisation and without further amendment granted her permission to use the adapted instrument on 7th March 2014.

Science, Maths & Literacy) were localised by replacing them with subject groupings from Ireland's National Council for Curriculum and Assessment (Languages, Sciences (inc. Maths), Business Studies, Applied Sciences and Social Studies). A further simplification was carried out by asking participants to indicate their subject once throughout the questionnaire which allowed the original 51 statements to be reduced by 23 to 28. This localisation also required certain statements to be changed, for example: *'I have sufficient knowledge about literacy'* was changed to *'I have sufficient knowledge about my subject area'* and *'I can use a literary way of thinking'* to *'I can apply my subject to my way of thinking'*. Several minor terminology changes were made to improve the readability of the questionnaire by teachers in the Irish education system.

Prior Views of Teaching and Learning. Based on Nolan and Francis' (2002, p. 44) work on stating teachers' prior views of teaching and learning, participants were asked to indicate their level of agreement with 14 statements on a 5-point Likert scale. This reflective section sought to gather a summary of the beliefs that teachers held about their philosophy of education and the learning theories that were employed in their practice. Views of some of the significant and widely known learning theories; behaviourism, cognitivism and constructivism, were examined. Again, these data were collected to allow for comparison between participant's beliefs and practice, or between participants.

Pilot. The draft questionnaire was piloted with a deputy principal (a teacher) who was not participating directly in the study to assess its suitability as a research instrument. Piloting is often used to "get the bugs out of the instrument so that the subjects in your main study will experience no difficulties in completing it" (Murray, 1999) and in this case sought to evaluate some of the following characteristics of the instrument:

- Time taken to complete the questionnaire.

- Were the instructions easy to follow?

- Were the questions easy to answer and clear?

- Testing for personal or inappropriate questions.

- Any other comments.

The intention to pilot an instrument raised a methodological flag for the researcher as it can be seen as conflicting with the general approach of grounded theory, however, based on the following three reasons I concluded that no conflict existed. Firstly, the purpose of the pilot was to test the process of completing it rather than the data generated by it as can be seen by the questions above, second, the teacher who piloted it was separate from the study and so would not have been impacted by the process. Finally, the questionnaire was designed to capture background and demographic evidence only, further negating any methodological concerns.

There was positive feedback, see Appendix 3C, and the pilot was successful in its aim of testing the questionnaire; feedback from the pilot teacher allowed for minor revisions to the questionnaire. Following the incorporation of revisions from the pilot process, the final questionnaire was administered electronically to the teachers using SurveyMonkey (an online survey tool) in September 2014, see Appendix 3B. All 7 participant teachers completed the survey, giving a 100% response rate.

Ethics and confidentiality. Ethics will be discussed in Section 3.6, but as SurveyMonkey was the only online tool used, it is useful to state the ethical and privacy safeguards here in the context of use. Participants were asked to complete the questionnaire online at their convenience and unsupervised. At the time of administration, SurveyMonkey complied with Data Protection legislation in the European Union by voluntarily adopting the policies

of the United States of America's Safe Harbor Programme[9]. The questionnaire requested the participants' names and was therefore not anonymous. At the end of the data analysis phase, the data were anonymised by removing the identities of teachers from the data without retaining a key to allow identification at a future date.

School Evaluations & Policies

Within the Irish education system, evaluation of schools takes place largely through two processes; an external inspection entitled *whole school evaluation - management, leadership and learning* (WSE-MLL) by the Department of Education & Skills Inspectorate (DES), or internally, through schools' self-evaluation, a DES initiative (2012). Participating schools were asked to supply the most recent evaluations and any other documents or policies relevant to their mobile device initiatives, (see Appendix 3D). Written documents were considered as data in this study as they serve not only as records, but they 'explain, justify, and/or foretell actions' (p. 46), and are often overlooked as a source in grounded theory studies. The request revealed three potentially relevant documents (see Table 3.6), two were *Whole School Evaluations* from the Inspectorate, although they were quite dated. Seafront School also had a vision statement from the principal which addressed the rationale for their mobile learning programme. Following a discussion with the school principals, the whole school evaluation documents were deemed too dated to be relevant and thus were excluded from analysis. The remaining document was incorporated into the data and subject to initial coding and the subsequent processes of grounded theory analysis.

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9 The European Commission's Directive on Data Protection went into effect in October of 1998, and would prohibit the transfer of personal data to non-European Union countries that do not meet the European Union (EU) "adequacy" standard for privacy protection. The U.S.-EU Safe Harbor Framework, which was approved by the EU in 2000, is an important way for U.S. organisations to provides "adequate" privacy protection, as defined by the Directive. http://export.gov/safeharbor/

Table 3.6

Table showing the reports reviewed, sorted by school and type.

School	Description	Author	Year	Status
Hillview School	Whole School Evaluation - Management Leadership and Learning	Dept. of Education Inspectorate	2007	Excluded
Seafront School	Whole School Evaluation - Management Leadership and Learning	Dept. of Education Inspectorate	2008	Excluded
Seafront School	School's Vision Statement for Mobile Learning Programme	Principal of Seafront School	2013	Included

Observing Educational Environments

As a highly structured environment, a classroom will have a variety of educational practices, tasks or activities in action at any observable moment. Most of these practices can be considered as standard or even desirable in such settings and would be regarded by practitioners as signs of good practice. As I was not a classroom teacher, and therefore an outsider to some of these practices, it was necessary to have a framework to understand the 'normal' activities in a class. While preparing for fieldwork, I accompanied a Maynooth University Department of Education teaching practice supervisor on his visits to the classrooms of student teachers. That process allowed me to become familiar with the routines of the classroom and also to develop some skill in observing and noting classroom practices. The process also allowed me to add a new dimension to my professional experience as an education technologist by showing the intersection of the 'ideal' uses of technology and the reality of classroom practice. By being a neutral observer in their classes, I could witness the challenges and opportunity for teachers as they experimented with or implemented technology-enhanced approaches for teaching and learning. Aside from the academic output of the research process, that experience provided me new ways

to relate to teachers in professional settings, and to relate to them and their practice in more meaningful ways. All student teachers were evaluated using the Maynooth University *Teacher Competence Appraisal Guide*[10] (see Appendix 3E), which examined: (a) planning and preparation, (b) teaching, learning and assessment, (c) classroom environment, and (d) professional responsibilities. In keeping with the use of grounded theory, the appraisal guide was not used as a lens to analyse the data, but it did allow me to place many of the observed practices within the range of generally accepted or expected classroom or educational practices. In answering this study's research questions concerning *changes* in the role of the teacher or the relationships of learning, the guide sensitised me to the range of educational practices from which changes could be observed and subsequently analysed.

Observations Of Physical Classes

Three observations of classes, which were also video recorded, were undertaken with each of the seven participating teachers between October 2014 and January 2015. A total of 27 observations were completed. Information on the classes, relevant to the physical and virtual classroom observations (see next section), is presented below in Table 3.7.

Table 3.7

Table showing the classes observed, including information for the physical and virtual observations.

Teacher	Subject	Class level	Year	Virtual Classroom	Teacher Website
Hillview School					
Tanya	Music	Mixed	1st year	Edmodo	-

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10 The Maynooth University *Teacher Competence Appraisal Guide* was developed by the university's Education Department by collating information from international and national education bodies, including the Organisation for Economic Cooperation and Development (OECD), Teaching Council of Ireland, Professional Development Service for Teachers (Ireland) and from research and teaching expertise within the Education Department.

Teacher	Subject	Class level	Year	Virtual Classroom	Teacher Website
Amy	Business Studies	Higher	3rd year	Edmodo	-
Martin	History	Mixed	3rd year	Edmodo	Weebly
Olive	Maths	Ordinary	3rd year	Edmodo	-
Seafront School					
Dan	Geography	Mixed	3rd year	Schoology	-
Martha	Geography	Mixed	2nd year	Schoology	-
Beverly	History	Mixed	3rd year	Schoology	-

The purpose of the physical observations was to record and examine the class activities and the interactions between students and teachers. As the researcher, I played a passive role in the proceedings of the class. During each observation, I recorded field notes which recorded points of interest and identified areas to focus on in future observations and during the focus groups. Following each observation, there was a de-brief with the participating teacher to answer brief followup questions (<3 minutes) based on my field notes. I wrote (or audio recorded) an initial memo, aided by early codes from the field notes and observation de-brief. In each observation, video footage was captured with two cameras; a rear camera on a tripod facing forward towards the teacher/projector screen and a discreet camera at the front of the classroom facing the students, and a standalone microphone. In some cases, two cameras could not capture all activity where there was no single focal point of activity in a class. A technical process followed each observation where the raw video footage from the video and audio sources were edited to provide videos for later coding and analysis. The video processing included adding starting titles,

timestamps and audio filtering to remove background noise. Two high-definition video files were created for each observed class[11].

Observation Of Teachers' Virtual Classrooms

Teachers' and students' use of virtual classrooms (learning environments) for teaching and learning were observed and recorded to allow coding and analysis. The intention was to examine the nature of online interaction between and amongst students and their teachers as well as the interface between the physical and virtual classroom spaces. Participating teachers granted me access to their online learning environments which used two popular products/platforms, Schoology and Edmodo, see Table 3.7 above; one teacher also maintained a website of course materials. I captured all activity on those environments for the entire 2014/15 academic year, with the exception of Tanya's platform as she went on leave mid-way through the field-work. The data gathered from each platform were quite different, to the point of not being directly comparable due to differing product designs and functionality. Edmodo is structured around a feed of activity, where posts from students and teachers containing text, images, videos, attached documents, assignment or polls appear in chronological order. Students also have the ability to comment on and 'like' posts in a way that would be familiar to any user of Facebook. Schoology is structured into a 'course' per class with a focus on the area for 'materials', or course content, in a way that would be familiar to a user of Moodle or Blackboard. There is an area for 'updates' similar to Edmodo, but it is a secondary feature, with materials being the default view. These are simplifications of the features of both platforms and Chapter 4 will expand on them. The data gathered were coded and analysed using a

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11 Due to technical difficulties 5 out of 21 of the observations had only one camera in operation.

grounded theory approach; challenges emerged in coding the activities observed and will be discussed in Chapter 4.

Interviews

Interviews are the most common, or *traditional*, data collection method used in grounded theory studies; the process allows a researcher ask questions of their participants which may account for their beliefs, actions or thought processes (Charmaz, 2014). I conducted interviews with principals in both schools, with seven participating teachers and held 'whole-class' interviews with each of the seven observed class groups; the research timetable in Appendix 3A details the timeline of interviews.

The use of guides in interviews is a subject of debate in grounded theory, with Glaser cautioning against using: "interview guides, units for data collection, samples, received codes, following diagrams, rules for proper memoing, and so forth" (Glaser, 1998, p. 94). Glaser's argument is that to use them is to preconceive the data, and therefore the analysis, before you begin. Charmaz draws a distinction between an open-ended interview guide and imposing received codes on your data. She argues that a guide is a reasonable way for a researcher (particularly those early in their careers) to avoid making mistakes during interviews and recommends that new researchers "develop a detailed interview guide to think through the kinds of questions that can help them fulfil their research objectives" (Charmaz, 2014, p. 62). I developed a semi-structured interview guide with nine key questions for use during interviewers. As data collection and coding was taking place simultaneously, I was able to modify the interview guide to respond to data

collected during the online observations and classroom observations in keeping with a grounded theory approach.

Teachers. I interviewed each teacher at the end of their series of classroom observations, and supplement those interviews with any post-interview questions; this approach allowed me the opportunity to explore the issues under investigation in-depth. Each interview took 40 minutes and was professionally transcribed for coding and analysis. The interview guide, see Appendix 3F, covered several initial themes, which included:

- Introduction
- Physical and virtual classrooms
- Role of the teacher
- Tensions (specific examples)
- Learning activities
- Homework
- Mobile learning
- Gender
- The Staff Room and ICT

In keeping with a grounded theory approach, the interview guide was supplemented with specific questions which dealt with incidents or scenarios that were observed and documented in the field notes, initial coding and memos.

Students. Each of the seven class groups of the participating teachers were 'interviewed' by me without the presence of their teacher. The term 'interview' is not usually used for a large group of up to 25 students; however I felt that selecting individual students or small groups for interview or focus groups would add unnecessary complexity to the field work as the issue of sampling would arise. Moreover, the method of 'interview' as a class group mirrored my observation of the class where my presence and the format would be familiar

to the students. My interview skills enabled me to elicit a broad range of responses from all students. Again, the interviews were professionally transcribed for coding and analysis, and where possible students were differentiated in the transcript by number, although in some cases that was not possible due to audio quality and the acoustics of the classroom where the interview took place. The interview guide, see Appendix 3G, covered several initial themes, which included:

- Introduction
- Student research / work
- Connections
- Support
- Role of the teacher
- Creative exploration of learning

Similar to the interview with teachers, the interview guide was supplemented with specific questions that dealt with incidents or scenarios that were previously observed and documented.

Principals. Memoing and theoretical sampling revealed the need to gather whole-school perspectives, therefore each school principal was interviewed following the completion of student and teacher interviews and their interviews marked the completion of the scheduled fieldwork (although the option to return to any participant was retained). The interviews were conducted using a semi-structured approach, the interview guide provided a breadth of topics to cover, however the participant was free to lead the conversation or to provide depth in any area. The interview guide, see Appendix 3H, covered several themes, which included:

- Introduction
- Mobile learning initiative

- Role of the teacher
- Student learning
- Teachers in this study
- Conclusion

The interviews with the principals responded to the data and was an opportunity to discuss the wider educational culture in the school, established practices, and policy aims and objectives.

As leaders of their schools, principals are expected to advocate and be champions for them. It is not unreasonable therefore to consider their motivations and how they may shape their answers during interviews. The potential exists for them to overemphasise the successes and achievements of their school or to underplay challenges or setbacks they may have faced. It may also be possible that certain facts, which may reflect badly on a school or principal personally, may be omitted. I employed several strategies to attempt to triangulate and verify the data from principals:

- In some cases, teachers or students referred to events that the principals reported on, allowing triangulation and verification of the events and the interpretation of the significance of them (an example is discussed in Section 6.4 exploring initial tensions of teachers' virtual classrooms).
- In other cases, events or routines that were described by principals were triangulated from observations of teachers' virtual classrooms or physical classrooms (an example being the management of absent classes discussed in Section 6.3).
- Where principals described their schools and communities, I introduced additional data from national and other statistics to illustrate those discussions (an example being the addition of higher education progression statistics in Section 5.2 for the discussions on school context).

These strategies respect and anticipate that principals would have their own perspectives on any situations (similar to any other research participant), and through triangulation those perspectives can be reconciled with other data. Indeed it would also be the case that principals would report on their knowledge of an event or situation, but that knowledge may be incomplete. Triangulation allows those perspectives to become grounded with the addition of more data.

It is also the case that data from principals was at times forthright in admitting errors or events that could reflect poorly on the principal or school. I believe this reflects not only the level of trust between the school, the principal and me as researcher, but that the principals gave informed consent and were fully aware of the use of the data for academic research. While I ultimately felt that principals gave accurate accounts in their interviews, reasonable steps were taken to control for the risks in this class of data.

3.6 Ethical Considerations

As a research study on humans, specifically involving students, teachers and their schools, ethical approval was sought from the Maynooth University Social Research Ethics Sub-committee and granted after a review process. The principle of informed consent guided my interactions with all participants, whether schools, teachers, or students. Compliance with all current ethical guidelines in force in Maynooth University and current Ethical Guidelines for Educational Research guidelines from the British Education Research Association (BERA, 2011) were followed throughout this study. Background research for the study involved gathering background demographic

information on teachers and policy and performance information from schools. Schools were asked to have approval for the research from their Boards of Management (as appropriate). Fieldwork for data collection was the primary research phase. Individual teachers selected for study were asked to give their consent. Students under direct observation in the classes of participating teachers were asked to grant explicit permission, were also granted an opt-out. In all cases, statements of informed consent and plain language statements explaining the research were provided to participants with a period of review provided. In the case of students, those materials were age-appropriate and were also be issued to parents/guardians for approval.

Ethical approval was granted by the Maynooth University Social Research Ethics Sub-committee. Risks to the participants were highlighted as an area of interest but without the need for major changes. Some of the questions of this research were: (a) to identify the changes (if any) in relationships of learning between students and teachers, (b) to determine if these changes were brought about solely by the use of mlearning and adoption of mobile devices or if other factors caused or contributed to the changes, (c) establish whether the mlearning practice paradigm raises students' expectations of teachers to adapt their teaching practice and any resulting tensions from those expectations. The research was not intervention-based, and did not intend to initiate or cause those changes in relationships of learning or practice to occur, but it acknowledges the role that the researcher's professional engagement with each school and their teachers may have brought about some of those changes. As discussed, precautions were designed and implemented to isolate the researcher's influence in the time before the study commenced

as well as the final data analysis; part of the anticipated process of reflexivity was excluding the researcher from contact with teachers for a time beforehand.

Cooperation with this study was optional for schools, teachers, and students. The researcher ensured that there was no expectation of reward for participation or penalty for non-participation in the commercial relationship between each school and the researcher's previous employer. In particular, teachers were made aware that there was to be no impact on their professional development programme by opting out; students were also made aware that there would be no academic penalties for non-participation. Individual teachers were given a token gratuity to acknowledge their participation in the study; this was determined in accordance with ethical guidelines and given with explicit permission of each school Principal.

The privacy of the research population and confidentiality of data was a consideration throughout the research study, and those concerns were addressed in the design phase. In gathering research data, questionnaires and focus groups were designed with minimal intrusion in mind. Teachers who took part in interviews and questionnaires were informed of the ethical standards of the research, the policy on data retention and their right to withdraw from the research before any data was collected or published. Anonymity was preserved for the questionnaire and focus group participants by anonymising the results and transcripts. All reasonable precautions were taken to protect the integrity and security of the data collected, whether in physical or digital form. Specific and appropriate safeguards, including secure physical storage or digital encryption, were put in place at the design stage of each instrument.

Risks To The Participants

As an observational study that did not collect sensitive data (relating to personal or 'taboo' issues), the risks were assessed as ranging from negligible to minimal and will be expanded upon below.

School. Risks of physical, emotional or psychological harm to the school or wider school community were judged to be negligible. There was minimal risk of disruption to the smooth daily running of the school and certain classes during the data collection phase. This was mitigated by careful planning with the school, and my data collection timetable conformed to the availably of the participants as determined by the school.

Teachers. The risk of physical harm was judged to be negligible. The risk of emotional or psychological harm to teachers arose during observations of classes with the potential for teachers to feel anxious or become uncomfortable with an event that may have taken place in the classroom. Teachers may have felt that their general level of competence was under scrutiny. This risk was mitigated by having pre-observation briefings to discuss the observation protocol and what type of activity was being measured. There were post-observation de-briefings to share the observation notes and discuss any issues that arose. As a result of these precautions, the risk level of emotional or psychological harm was minimal.

While designing the ethical safeguards for the study, the risk of emotional or psychological harm to teachers arising during observations of classes was acknowledged. The safeguards recognised the potential for teachers to feel anxious or become uncomfortable with an event that may have taken place in their classroom, or that teachers may have felt that their

general level of competence was under observation. In some cases, teachers may not have been observed since their initial teacher education (ITE) and during observation may recall some of the stresses of that period. I took three steps to mitigate these risks: (a) a pre-observation briefing was held to discuss the observation protocol and what type of activity was being examined, (b) teachers were offered a 'dry run' before any observations took place, and (c) each teacher had the opportunity to require the removal of any portion or all of the observation footage. While the use of a pilot observation may be seen by some as a methodological contradiction in a grounded theory study, the ethical considerations were judged to outweigh such concerns. Ultimately, no participant teacher availed of the 'dry run' or recalling the recording.

Students. The risk of physical harm was judged to be negligible. The risk of emotional or psychological harm to students arose during observations of classes and in the focus groups afterwards. In particular, having video footage of classes where a critical incident took place may have become an issue. I agreed a protocol with each school and teacher that an observation could be terminated (while in progress or retrospectively) or postponed if the teacher or students reported any incidents that caused distress. No such incidents occurred or were reported to the researcher. Discussions during interviews with students presented another opportunity for incidents causing emotional or psychological harm to students; an example might be where a student gave an answer that was regarded as 'silly' by peers in a peer group discussion. Skilful facilitation of the focus group was required to manage any incidents arising. As a result of these planned precautions the risk level of emotional or psychological harm was minimal.

3.7 Chapter Summary

This chapter has set out the research question of the study and provided justification for the use of a grounded theory approach as an appropriate means to answer that questions. The role of the researcher was examined, with particular emphasis on controlling for bias during the study, while also ensuring the highest ethical standards were observed. While describing the research methods, there were signposts to some of the challenges that would emerge during data collection and coding, which will be explored in Chapter 4 *The Coding Process*.

Chapter 4: The Coding Process

The purpose of this chapter is to discuss the coding process and how it was conducted with the data in this study. I describe the approach to the concurrent stages of initial coding, focused coding, and theory generation; in each section I describe the approach taken and a discussion of any issues which arose. Initial coding of diverse types, including text, video and online data required some innovation which will be discussed. The chapter concludes with the final set of categories and sub-categories, which sets the scene for the following chapters to analyse and discuss the grounded theories.

The process of collecting and coding data in grounded theory is not a strictly linear one, which challenges the researcher when attempting to describe the process in any form of chronological account. The process was further complicated by the methods of data collection employed, which took place in two phases: a preparatory phase and a field-work phase. While the experience for each participating teacher would have been of an ordered linear sequence of data collection, the field-work as a whole was conducted in a less linear way, (see research timetable in Appendix 3A), allowing for simultaneous data collection and coding, constant comparison, and for the process to respond to the data in a manner consistent with grounded theory. This approach balanced the need to minimise disruption and confusion for participating schools, teachers and students, while allowing me to remain open to new insights as the data were collected and coded. Those insights influenced how, and from whom, I collected subsequent data to better ensure theoretical saturation.

The field-work phase consisted of four data collection methods, as described in the previous chapter: (1) three contemporaneous observations of classes with each participating teacher, (2) video recordings of those observed classes, (3) online observations of teachers' virtual classrooms, which were based on the Edmodo or Schoology platforms, and (4) interviews with teachers, students and principals. The variety of methods employed produced diverse types of data, presenting an obvious challenge to me when coding data that were not like-for-like. It will be evident in this chapter and in the subsequent discussion, that these diverse types of data did indeed illuminate the processes at work in the complex educational contexts under study.

In keeping with the process of grounded theory, early insights gained during data collection and coding allowed me adapt my methods; interviews in particular were changed, with new questions added as well as including the schools' principals as interviewees. The methods employed provided a rich insight into these environments and allowed further probing: classroom observations prompted questions to teachers while online observations prompted new questions to students. Two further examples exemplify how the process responded to the data. Firstly, while coding the observations of teachers' virtual classrooms, I noted the absence of identifiable independent student learning. As a result, the coding revealed only the 'procedural' actions which did take place. My expectation of being able to observe independent student learning in the teachers' virtual classrooms (and the lack of it) revealed a bias or preconception on my part, which possibly formed from my reading of academic literature or practitioner blogs[12]. Two challenges

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12 An example of a practitioner blog comes from Brandon (2008) who describes how the introduction of internet access, and web 2.0 services in particular, provided new opportunities to students and teachers. Those opportunities included access to information and the ability to collaborate and engage in knowledge construction.

emerged from this: firstly, I questioned my ability to be reflexive and aware of the biases I brought into the study, and secondly that those biases were bound up in my research questions. The revelation of the challenge to my reflexivity and bias provides a further defence of grounded theory as an appropriate methodology, as I added questions to subsequent interviews with students to explore their use of online spaces. In those interviews, students described the creation of their own networks and the purposes of them. A second example is the content of teacher interviews, where early questions asked about technical affordances (or abilities/features) of the devices and which Apps the teachers used. These questions produced limited answers and were replaced with questions which asked what further potential teachers felt existed for students' independent learning and research. My adherence to the grounded theory process, the passage of time since writing the research questions, and a willingness to identify and challenge my biases, allowed me to analyse my collected data in a way that minimised the impact of my preconceptions and biases.

One of the advantages of grounded theory is how the analysis and cycling of data makes initial flaws more obvious through coding while also allowing the questions to change to combat the starting imperfections. The resulting process was in keeping with grounded theory, as it adapted in response to the data, while adhering to the rigour of the coding process. Coding moved through three phases, starting with initial coding, then focused coding and leading to theoretical coding, as explained in the following sections.

4.1 Initial Coding

The initial coding phase began after the first classroom observation was complete; subsequent coding and memoing were undertaken following each collection of new data, including interviews, observations, and video recordings. The schedule of fieldwork is shown in Appendix 3A.

Interviews With Students, Teachers And Principals

Each interview was professionally transcribed prior to initial coding and as discussed in Chapter 3, were coded using a line-by-line approach. An initial attempt to code the transcripts digitally using MaxQDA was significantly slower than coding the transcripts by hand. With a care for my time, and mindful of Charmaz's (2014) admonition to 'keep close to the data' and 'move quickly through the data', I decided to undertake all initial coding by hand and coded in the margins. Challenges quickly emerged in coding some student interviews as shown in Table 4.1. Some students' answers to certain questions were short (usually affirmative or negative) and lacked specific examples to justify or explain their answers. To overcome this in future interviews, I occasionally prompted them with popular answers from previous interviews; their answers to the prompts were quite often negative, and in some cases, students instead responded with specific examples from their contexts. In other cases, students spoke over each other, although some of the most telling codes emerged when the conversations became more flowing. When students spoke as a class, their answers were usually unanimous and should read that way when presented in subsequent chapters. Where there were dissenting or contradictory voices, I will present them and take the opportunity to discuss them. When students talked about their teachers' actions or beliefs, they were themselves making

inferences (with or without supporting evidence), which resulted in portions of the

students' interviews being coded in the third person.

Table 4.1

Table with examples of coding challenges; students giving short answers and students talking over each other.

Challenge	Example from the transcribed text
Short answers	INTERVIEWER: Do you have another space that you made yourselves? STUDENT 5: iMessage. ... INTERVIEWER: So, what I'm trying to find out is do you have your own networks that you use after school to sort the stuff out, whatever stuff is? STUDENT 5: Yeah. STUDENT 4: Yeah. STUDENT 5: Yeah. STUDENT 4: Yeah. STUDENT 3: Yeah. INTERVIEWER: Okay. So, iMessage. Anything else, Facebook? STUDENT 5: Facebook. STUDENT 3: Facebook. INTERVIEWER: Facebook. Okay. Is Snapchat in there too? ALL: Yeah.

Source: Hillview School, Martin, Students' 'whole-class' interview.

Short answers	INTERVIEWER: Okay. How else would you contact each other? STUDENT: Email. STUDENT: By email. STUDENT: WhatsApp. STUDENT: WhatsApp. INTERVIEWER: WhatsApp. Someone said iMessage and email. And would that be about homework, schoolwork, etc.? STUDENT: Yeah. INTERVIEWER: And all sort of things? ALL: Yeah. INTERVIEWER: Okay. Any other ways? Do you use iMessage groups? ALL: No.

Source: Seafront School, Beverly, Students' 'whole-class' interview.

Students talking over each other	INTERVIEWER: Okay. Hang on now, let's, I want to get this one right. So, come on. STUDENT 1: Ah, no, like girls use it more for social media and all that and – INTERVIEWER: You first. STUDENT 7: And boys use it to play Minecraft and, like – STUDENT 2: Games. STUDENT 4: Minecraft? Minecraft? STUDENT 5: Really, is that what you think of us? STUDENT 1: [Inaudible] Minecraft. STUDENT 7: It [inaudible] – STUDENT 6: Yeah.

Source: Hillview School, Olive, Students' 'whole-class' interview.

Coding in the 3rd person	STUDENT: Some teachers, like they find it like a bit offending because I think they feel that they should be able to use them and sometimes they're like, 'Oh here, I'll do it. Sit down.'

Challenge	Example from the transcribed text	

Source: Seafront School, Dan, Students' 'whole-class' interview.

Unanimity / Dissenting voices	INTERVIEWER:	Does she have a plan B or does she just think on her feet?
	STUDENT:	Think on her feet.
	ALL:	Yeah.
	STUDENT:	She does.
	STUDENT 3:	Oh lads, you're making her sound bad.

Source: Seafront School, Beverly, Students' 'whole-class' interview.

Line-by-line coding revealed the implicit actions and beliefs of the participants, but occasionally their own language was so evocative as to warrant an *in-vivo* code[13], where in most other cases codes were constructed with gerunds. Examples of initial codes are presented in Table 4.2, showing the utterances and how they were coded.

Table 4.2

Examples of initial codes and utterances

Source	Code(s)	Utterance
Amy, Hillview School	Classroom implications unexamined	And I hadn't really thought about it because I was at home and I had the iPad at home and I thought, 'I know how the iPad works and this is grand'.
Martin, Hillview School	Felt an obligation to teach 'It's just so doable'	... and I guess having your iPhone there in hospital and knowing, okay, you've got a class today. It's just so doable.
Martin's Students, Hillview School	Irritated by breadth of content	STUDENT: Well, it's a bit annoying there's so much information there on Wikipedia.
Olive's Students, Hillview School	Willing to assist the teacher	STUDENT: Well, if it's something we know that she doesn't we can
Principal, Hillview School	Addressing a deficit Students disempowered to succeed	And the other interesting fact is that so many students drop out of third level and they weren't able, they didn't know how to learn for themselves.
Dan, Seafront School	Expects students to be able to search effectively	So, yes, I would give hints but I suppose, look, they all know how to do a search. I would hope and expect.
Beverly, Seafront School	Challenged by possibilities Feels teaching is inadequate	Recently, we had [an outside speaker] in here talking about it, you know, and like, 'Oh my God, you should be doing this and you can do that' and I'm going, 'But I'm not doing that'.

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13 *In vivo* codes are adopted directly from the data, such as telling statements discovered in interviews, documents, and the everyday language used in studied sites.

Source	Code(s)	Utterance
Dan's Students, Seafront School	Supplements content with independent research	STUDENT: Able to research stuff online if you're stuck for any answers that you need to get.
Martha's Students, Seafront School	Challenges their right to inspect	STUDENT: Just because we got them from the school doesn't give, like, them the right to look at our iPads
Beverly's Students, Seafront School	Infers teacher's belief in subject knowledge Doubts teacher's expertise Distinguishes from current teacher	STUDENT: Depends what teacher, like we've a [subject] teacher. Thinks she's, think she knows everything, but I'm not sure if she does and like Teacher 07 is the sort of end of the spectrum.
Principal, Seafront School	Defines school characteristic In competition to deliver results	And we're an academic school, we're competing with other academic schools.

As codes were emerging, so too were analytic insights which I recorded in a series of memos and entered in MaxQDA. Early memos provided summaries and descriptions, but later ones became more advanced and offered comparisons between the data and began to ask further questions of it (see example memos in Appendix 4C). As the memoing process continued, initial codes clustered together, allowing associations to become visible. I undertook a clustering exercise with the memos to map out the similarities, contrasts and relationships and to allow them to reveal further insights into the data, see Figure 4.1 below.

Figure 4.1. Graphical display of clustering exercise on memoing of initial codes

Teachers' Virtual Classrooms

To enable my observation of the teachers' virtual classrooms and code their activities, I was admitted to each online space as an observer (who did not interact with the class). While there were a variety of popular platforms for teachers to choose from, each school had decided to adopt and standardise on one in the previous academic year. My

observations, therefore, took place during the first full year of whole-school use. Hillview School chose Edmodo, while Seafront School chose Schoology, each of which offered different features and abilities: Edmodo being designed around a chronological feed of activity and interactions, whereas Schoology's design focused on course materials. Collection and initial coding of the data took place throughout the fieldwork phase in the case of Edmodo (capturing the chronological feed), and at the end for Schoology (capturing the final set of content/materials). The differences in design, features and abilities of each platform were mirrored by strongly contrasting patterns of usage in each school. I will summarise the design and function of Edmodo and Schoology in this section, and in Chapter 6 will add in-depth analysis when I discuss teachers' virtual classrooms and the grounded theories which emerged.

Edmodo in Hillview School. Edmodo is structured around a feed of activity, where posts from students and teachers containing text, images, videos, attached documents, assignments, or polls appear in chronological order. Teachers establish a group per class and invite their students to join it, they may also issue an invitation to parents/guardians who have a restricted view which focuses solely on the activity of their child. Students also have the ability to comment on and 'like' posts in a way that would be familiar to any user of Facebook, although they do not have the ability to send messages to each other. Edmodo also provides folders for storing course materials for reference and retrieval. Examples of two posts are given in Figures 4.2 & 4.3, which show a student asking what homework was set and then receiving an answer from a fellow student, and the teacher setting homework for the class.
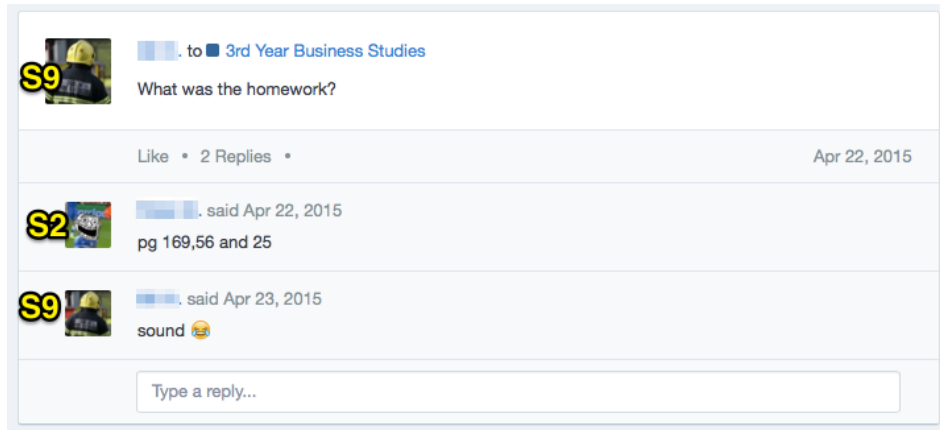
Figure 4.2. An example post from a student in Amy's class, coded as student-initiated and student-responded.
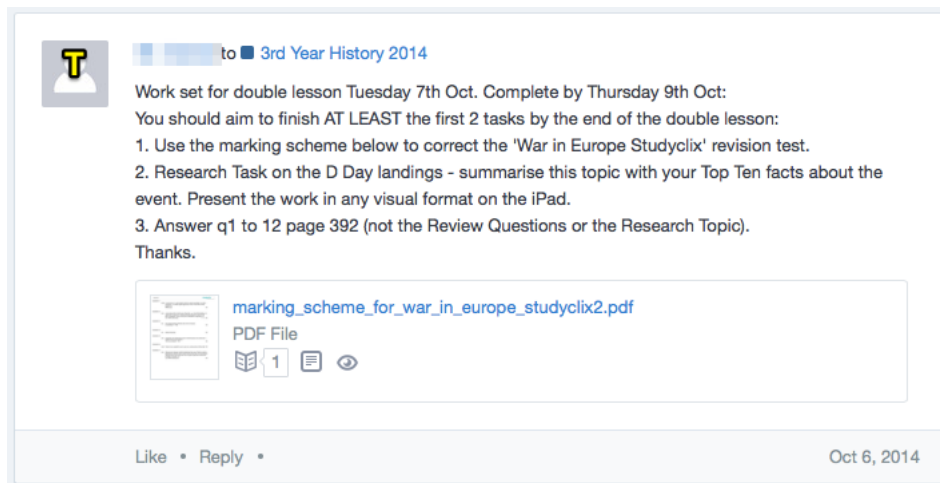
Figure 4.3. An example post from Martin's class, coded as setting homework.

Edmodo was selected by the teachers of Hillview School as the standard platform they would use for interacting with students. Interestingly, its use extended beyond formal classes to include extra-curricular activities, Figure 4.4 shows a sign that was placed on the outside of the staff room inviting players to join an Edmodo group for the Badminton Club.
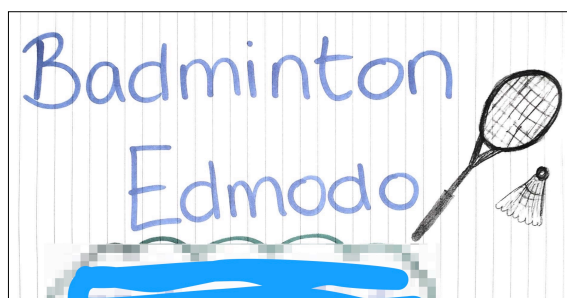
Figure 4.4. An invitation for team members to participate in the Badminton Club's Edmodo group.

My analysis of all the activity revealed two broad classifications of use: first for student-initiated requests (see Table 4.3), and secondly, as a way of posting notifications, announcements, or examples of work (see Table 4.4).

Table 4.3

Initial coding of interactions on Amy's Edmodo group, showing student-initiated requests

	Responded to by:	
Student-initiated requests	Students	Teacher
- Requesting course content	0	2
- Querying if or what homework has been set	7	1
- Requesting assistance with work	0	0

Notes: The period of observation was September 1st 2014 to June 19th 2015.

Table 4.4

Initial coding of interactions on Amy's Edmodo group, showing notifications and announcements

	Initiated by:	
Notifications and announcements	Students	Teacher
- Setting (or stating) homework	0	16
- Distributing course content	0	3
- Notification of absence	0	0
- Relating to extra-curricular activities	0	0
- Sharing examples of class or homework	0	0

Notes: The period of observation was September 1st 2014 to June 19th 2015.

Aggregate statistics for all teachers in Hillview School were also generated using the same classifications; student-initiated requests are presented in Table 4.5 and notifications, announcements, or examples of work are presented in Table 4.6). Appendix 4A contains the individual analysis for all teachers.

Table 4.5

Initial coding of interactions for all teachers' Edmodo groups in Hillview School, showing student-initiated requests.

	Responded to by:	
Student-initiated requests	Students	Teacher
- Requesting course content	0	3
- Querying if or what homework has been set	21	2
- Requesting assistance with work	6	4

Table 4.6

Initial coding of interactions for all teachers' Edmodo groups in Hillview School, showing notifications and announcements.

	Initiated by:	
Notifications and announcements	Students	Teacher
- Setting (or stating) homework	7	93
- Distributing course content	0	43
- Notification of absence	4	11
- Relating to extra-curricular activities	1	5
- Sharing examples of class or homework	147	3

The majority of requests initiated by students were requests for clarification of homework, with occasional requests for assistance with work, or for course content. Most requests were responded to by students themselves. In the case of notifications and announcement, teachers used Edmodo extensively to set homework (often with an accompanying resource, refer back to Figure 4.3 above), distribute course content, and invite students to

share examples of their work (see Figure 4.5). One teacher, Martin, continued to teach his class from hospital after a minor injury; Edmodo allowed him set work, homework and provide feedback, while a substitute teacher supervised his classroom. Two of the four teachers, Martin and Olive, used Edmodo as a sharing space for student work, with various resources being created in Maths and History classes.
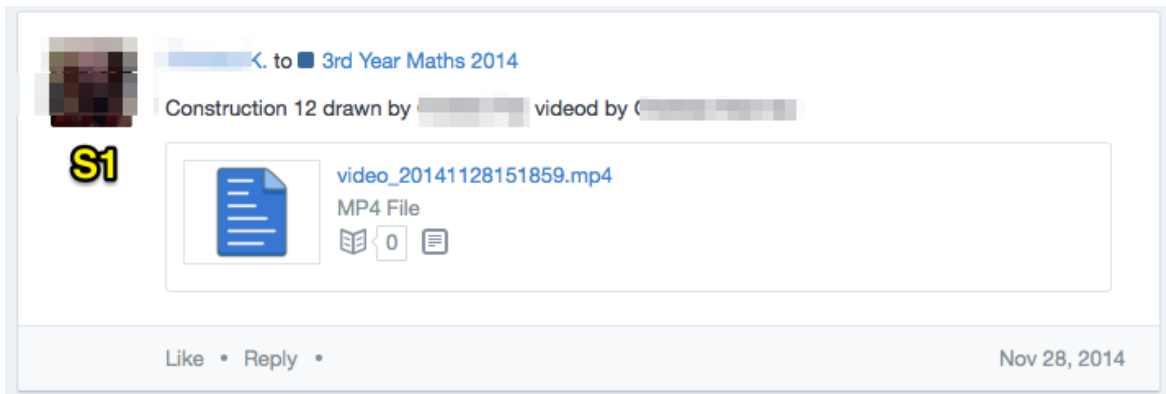
Figure 4.5. A sample post from a student in Olive's class, showing a narrated video from a Maths activity. This post was coded as a 'student-initiated' 'sharing of examples of class or homework'.

Schoology in Seafront School. Schoology is structured into a 'course' per class with a focus on the area for 'materials', or course content, in a way that would be familiar to a user of Moodle or Blackboard. There is an area for 'updates' similar to Edmodo, but it is a secondary feature, with materials being the default view. Teachers are encouraged to upload and organise content for their students, and may make use of built-in assignments, quizzes and discussions, while they may upload documents (including PDF and Word), presentation slides (usually PowerPoints) and links to other information sources / resources on the internet. An example of structured content in a Schoology course is shown in Figure 4.6.
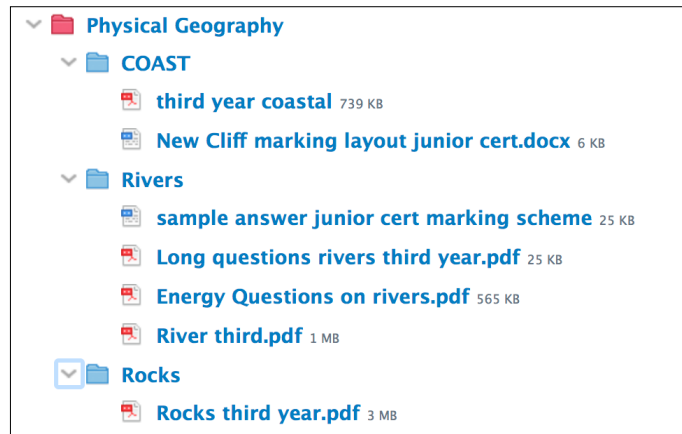
Figure 4.6. An example of a selection of materials uploaded and structured for students by Martha.

Updates are also possible, again in a style similar to Facebook, but this feature was largely neglected, an example of an update can be seen in Figure 4.7 below, and similar to Edmodo, direct messaging between students was not possible.
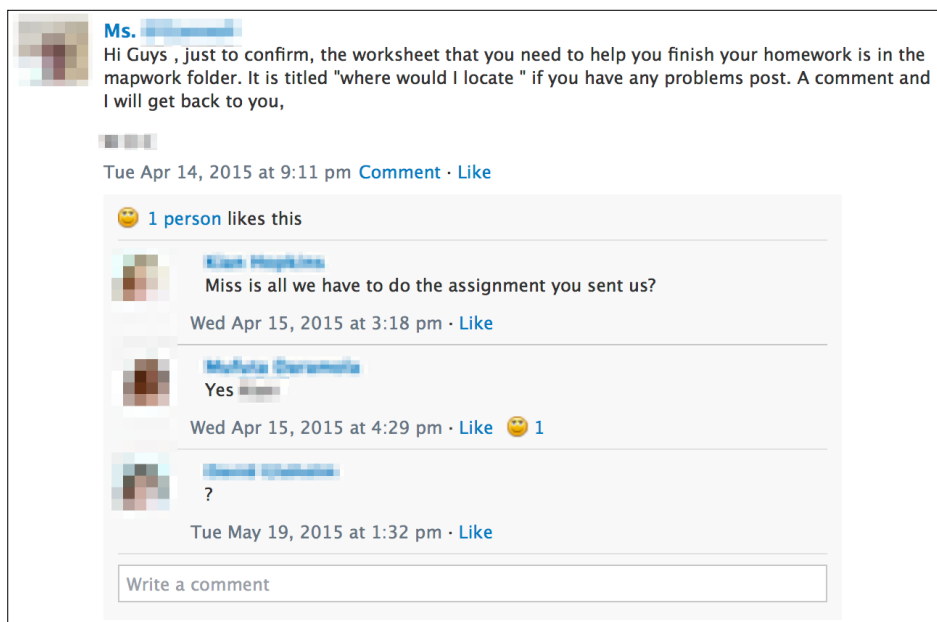
Figure 4.7. A sample of an update from Martha reminding students about homework. This post was coded as a 'homework reminder'.

My analysis of the Schoology courses, starting with initial coding, was quite different from the Edmodo ones. With interaction between students and teachers largely absent, and the focus on resources, it is arguable if this would qualify as *initial coding* in a strict

application of grounded theory, rather a classification exercise. Nevertheless, the classification of resources and updates shown in Table 4.7 does add some useful insights into the use of this online space by teachers, and it did inform interview questions in keeping with a grounded theory approach.

Table 4.7

Initial coding of materials and updates on all Schoology courses in Seafront School.

	Dan	Martha	Beverly
Materials			
– Assignments	8	25	10
– Documents (Word and PDF)	-	28	10
– PowerPoints	49	3	1
– Internet Links	-	7	13
– Quizzes	-	-	5
– Discussions	-	-	4
Updates			
– Homework reminders	-	2	-
– Questions from students	-	-	2

Notes: Analysis of the materials and updates in the Schoology courses tool place on June 19th 2015, and generally amounted to one year's worth of course content (coinciding with the adoption of Schoology).

While Schoology was used predominantly to distribute content from teachers to students, variations in the patterns can be observed. In particular, Martha is seen to be giving PowerPoints with course content and she set some activities (issued homework), whereas in contrast, Beverly uses more links to internet sources for her students. Beverly's activities also more interactivity in the online space, in particular with quizzes and discussions. The sources of course content, and the degree to which students find their own or rely on the teachers' was examined in interviews and will be discussed in depth later.

By the end of the field-work phase, which included initial coding, it became clear to me that some of my expectations of what activities would be observed in these online spaces were preconceptions, which I will address further in Chapter 6. The observed activities were largely procedural: setting of homework and making announcements, distribution of course content, activities and feedback, and occasionally as spaces for students to upload work or assignments. The coding process and data challenged elements of my research questions, in particular my ideas about students' use of online spaces. I was then able to modify later data collection in response, in particular with teachers in Seafront School to examine their use of online spaces and motivations, and with all students to ask about their own online networks. Chapter 6 will return to the teachers' virtual classrooms, where data from students and teachers will be incorporated to present a fuller and more sophisticated analysis.

Video Recordings And Classroom Observations

This section describes the process of initial coding of the video recordings and physical observations of classes. It describes the challenges faced while trying to apply typical grounded theory coding approaches and the development of a novel approach to initial coding. That approach integrated the diverse types of data in this study and enabled focused coding and constant comparison across all the data. The section will conclude with a discussion about the validity of the new approach to coding and some of the insights which emerged from it.

My initial attempt to code these data used approaches typical to grounded theory, specifically line-by-line or sentence-by-sentence coding. These approaches yielded a large

volume of codes, which predominately showed direct instruction (or teaching), the minutiae of classroom management, and routine interactions between students and teachers. During some observations, where students were directed to work in groups, coding in this way was simply not possible as the breadth of concurrent activity could not be captured on video (or directly observed physically). These two challenges required me to re-think my approach to initial coding and to devise a coding strategy which would accurately reveal the processes at work in the observed classes. A strength of grounded theory is the ability use insights gained during data collection and coding to ask new questions of the data or to see it in new ways; this strength afforded me some flexibility and allowed for some innovation in the coding.

Charmaz defines coding in grounded theory as "an initial phase involving naming each word, line or segment of data" (2014, p. 113). My redesigned approach moved away from coding lines or sentences and instead coded segments of data which were discrete educational tasks (or activities) to become 'task-by-task' coding. This approach recognises that the classroom is a highly-structured and formal environment with established routines and educational practices. Individual lessons are a series of planned activities, drawn from a teacher's repertoire of strategies for teaching or classroom management. Each of these activities and strategies would have a rationale and defined aim underpinning their usage; the process of lesson planning is a manifestation of a teacher's experience and professional practice.

The task-by-task approach to initial coding resulted in a few outcomes, the first of which was to reverse-engineer an 'implied lesson plan' from the observation field notes and

video recording of the class. While it would have been beneficial to code the actual lesson plan for an observed class, teachers in Ireland are not required to document their plans with the same level of formality as elsewhere (Dolan, 2009). In these cases, there were no written lesson plans to code, and as I did not intend to prompt a change in practice, I did not request them. A further outcome was the integration of the field notes and the video observations which allowed them to be coded together. The field notes were points of interest or significance which I observed during the classes and recorded in short hand with a time index. The field notes ultimately performed two functions. First, they aided in delineating the observed tasks and second, they allowed me to return to those points of interest to code and analyse them thoroughly.

The process of initial coding was an iterative one, which was shaped by constant comparison with the rest of the data. The codes evolved, looking deeper within the identified tasks for greater insights, which in turn shaped interview questions. At the completion of initial coding, each observation was coded by task, with added dimensions to show the use of ICTs by students and teachers and the links to online learning spaces in the lessons. The importance of looking at the use of ICTs emerged during the interview with Martha in Seafront School when she described how Schoology was now deliberately and 'inextricably' linked to her lesson planning process:

```
INTERVIEWER:    Sure.  And if you were looking at your lesson plan,
                even if it's just in your head is, is the Schoology
                portion of the class an extension of the physical
                part of the class?
MARTHA:         Extension of…?  I don't understand where –
INTERVIEWER:    The two linked together are, are the two parts of
                the, the  whole lesson plan?
MARTHA:         Yeah they're inextricably linked now ... I've made
                them inextricably linked.
```

                                                    (Martha, Seafront School)

An early memo suggested that there were links between teachers' subject beliefs and their use of ICT, for example, when focusing on exam preparation, technology was often used to distribute revision notes more efficiently. This tentative idea, supported by interview data, suggested that the coding of the video observations should look in this direction, and indeed it provided fruitful data which I will discuss in Chapters 6 & 7. The coding of teachers' virtual classrooms, discussed earlier, revealed little in the way of independent student learning. Martha's comments, echoed by other teachers, together with observations in my field notes, prompted another look at the virtual classrooms. Points of crossover, where the physical class and the online space intersected, revealed that the spaces demonstrated other valuable uses by teachers which this coding approach helped to reveal and will be discussed later. An example of an observation from Olive's Maths class in Hillview School is presented with completed initial codes in Table 4.8 below. A glossary of Apps and features can be found in Appendix 4D below, with a short discussion on it. The full set of coded observations is attached in Appendix 4B.

Table 4.8

Initial coding of video observations of classes for Olive in Hillview School; coded by educational task with examination of technology use.

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Observation 1: 3rd year Maths - teaching class on the topic *Geometry* (31 minutes)			
Apps & tools: Edmodo and Camera (for video)			
Introduced the topic *Geometry: triangles and rectangles* *Whole-class activity* (6 minutes)	Projected instructions for practice activities	Viewed class activity notes/handout on Edmodo	Class activity notes/ handout uploaded to Edmodo

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Practiced *construction of triangles* *Paired activity* (7 minutes)	Projected instructions for practice activities Projected a demonstration of the construction of a triangle with a video animation	Followed instructions downloaded from Edmodo Practiced their triangles on paper	Class activity notes/ handout uploaded to Edmodo
Created recording of students narrating the construction process for the first type of triangle *Paired activity* (10 minutes)	Directed students to work in pairs, one constructing the triangle while the other makes a video recording	Recorded and narrated the construction of a triangle using an iPad Swapped roles and repeated	Posted samples of each type of triangle construction to Edmodo for peer review and as a revision resource
Created recording of students narrating the construction process for the second type of triangle *Paired activity* (6 minutes)	Directed students to work in pairs, one constructing the triangle while the other makes a video recording	Recorded and narrated the construction of a triangle using an iPad Swapped roles and repeated	Uploaded samples of each type of triangle construction to Edmodo for peer feedback and as a revision resources
Set homework *Whole-class activity* (<1 minute)	Directed students to complete homework section of class notes/ handout	Followed instructions downloaded from Edmodo	Notes for class included homework task and resources

As I have put forward a novel approach to initial coding for some of the data, I must ensure that is both an appropriate extension of the methodology and that the treatment and analysis of the data are valid. Firstly, to justify the extension of the methodology I have demonstrated that task-by-task coding allows the actions and directions in a lesson to be clearly identified; an approach in keeping with Charmaz's belief that initial coding should "explicate how people enact or respond to events, what meanings they hold, and how and why these actions and meaning evolved" (2014, p. 113). Furthermore, there is a close parallel to line-by-line coding with gerunds; in both cases, the codes "define implicit meaning and actions, gives researchers directions to explore, spurs

making comparisons between data, and suggests emergent links" (Charmaz, 2014, p. 121). An example is Martha's quote above which pointed to her choice to redesign her lessons around Schoology, which prompted me to look for those links in the coding of observations. By reverse-engineering the lesson plan from the observed actions/directions, the beliefs of the teachers (and potentially students) are exposed for further analysis through focused coding and constant comparison, and indeed they prompted further questions in interviews. An example from Olive provides support for this approach as I was able to triangulate the coded lesson plan with an interview with Olive, and also her students. In that particular example (see Appendix 4B, Table 4, Observation 1), Olive's intentions when teaching coordinate geometry of the line were accurately deduced and confirmed by her when interviewed. I will revisit this example in Chapter 6 for further analysis with teachers' virtual classrooms.

As I found myself outside the methodological literature that was guiding my research, I decided to return to the literature and widen my search. I consulted the most recent edition of The SAGE Handbook of Current Developments in Grounded Theory (Bryant & Charmaz, 2019), while there was a discussion on developments in using visual still images, there was nothing written on video analysis. I then attempted to explore how researchers may have responded to similar methodological challenges, first in educational contexts and then looking beyond into different fields and contexts. My search revealed little in the area of video analysis using grounded theory in formal classroom settings, however Griffiths (2013) presents a study which used video analysis of interactions between teachers and students with profound intellectual disabilities. Griffiths' (2013) analysis included the coding of 'micro-incidents', where a gesture or expression conveyed

some meaning between the participants and could be coded and analysed. In this case, where a participant was non-verbal, traditional coding of a transcript was impossible, yet the grounded theory approach was flexible enough to allow a coding method which was both rigorous and appropriate for the context. There is a similarity between the coding of micro-incidents used by Griffiths (2013) and my coding of tasks, as each takes a discreet event (of varying durations) and codes it. I continued to widen my search to include key words and terms 'grounded theory' and 'video' or 'video observation'. The search revealed only a handful of articles, the most relevant being a video analysis of leadership in action in trauma resuscitation in hospitals (Xiao, Seagull, Mackenzie, & Klein, 2004). That study coded the interactions, both verbal and non-verbal cues, between clinicians to show a dynamic and constantly shifting leadership role dependent on expertise and immediate medical need. The relevance comes from Xiao's (2004) analysis of discrete events which occur in a formal / professional setting, where there are defined relationships and an established hierarchy. I must also acknowledge that while this study follows a constructivist grounded theory approach, this treatment of the video observation data, echoes Glaser's (Glaser, 2001) belief that grounded theory is collection method neutral and that it can conceptualise any form of data.

To consider my treatment of the data I return to the discussion in Chapter 3, where I acknowledged my outsider status as I was not a classroom teacher. As an outsider, I was therefore unfamiliar with some of the tasks and practices at work in the classroom during lessons. Mindful of this, I performed a verification check at the end of the initial coding by returning to my preparation for classroom observations where I accompanied a teaching practice supervisor (since re-titled to 'school placement tutor') on visits to student

teachers' classrooms. I used the *Teacher Competence Appraisal Guide* (see Appendix 3E) as a lens to examine whether my initial coding captured the types of activities expected (or potentially absent) from the lessons. I performed a further check with my supervisor (a teacher educator, school placement tutor and former science teacher) asking if the coding accurately reflected the expected conduct of a class. These verification checks were carried out separately from the coding process to ensure fidelity to the methodology; where the codes should emerge from the data. The checks confirmed that the codes accurately reflected the content of the observed lessons, so no changes were required. I am therefore confident that the coding is both in keeping with grounded theory and a valid account of the activities observed.

During data collection I noted the Apps and iPad features being employed in my field notes and during initial coding of the video recordings those points were expanded on to give greater depth to the tasks being observed. To aide in the understanding of coded activities shown in Table 4.8 and Appendix 4B, I assembled a glossary of Apps, which is shown in Appendix 4D. While in some cases Apps are self-explanatory, for example digital textbook Apps, in other cases features like AirPlay (the ability to wirelessly project from an iPad to a projector screen) need an explanation. The glossary provided an insight into how and for what purpose some Apps and features were being used by teachers and it allowed me to ask further questions during interviews to determine a teacher's beliefs and intentions, it therefore provided some insight into the observed tasks and had an impact on coding and further data collection. Given the limited nature of how the data were collected, no generalised findings can be drawn; therefore it is appropriate at this point that it fulfils

its original purpose and informs the reader of the purposes of the Apps and features observed.

4.2 Focused Coding

Focused coding is the second major phase of coding; it seeks to make sense of the data by identifying the most frequent or most significant of the initial codes. Focused codes allowed me to 'sift, sort, synthesise and analyse' large volumes of data, enabling its categorisation; which was the ultimate aim of this phase (Charmaz, 2014). Interestingly, some in vivo initial codes showed strong significance and were elevated to focused codes. Focused coding was initially undertaken with paper and pencil, after which 278 focused codes were entered into MaxQDA giving the ability to search, sort and enquire within the sets of documents, memos and codes. This ability was vital to the analytic process, allowing for comparison of data and testing of codes. The code set was given a summary review to resolve duplicates, which were inevitable with 170 pages of transcribed interviews. Only obvious duplicates were combined, for example *'developing students' independence'* and *'developing independence'* were verified as duplicates, and more easily *'evolving pedagogical practices'* appeared twice. Following de-duplication, 263 focused codes remained for analysis. Throughout the process of focused coding and categorisation, codes were checked and in some cases re-coded as they were compared with other codes and data. At the conclusion of data analysis, when the codes and categories had stabilised there were 296 focused codes in five categories.

The memoing process had already prompted tentative categories that could encompass the codes. A guiding statement from the study's research question and further questions from the memoing process helped narrow the possibilities:

- This is a study of mobile learning and the impact on relationships of learning.
- Were the codes the right codes?
- Were the codes concise enough?
- How do these codes contribute to the study of mobile learning and its impact on the role of the teacher?

The first statement prompted an ongoing examination of the data, testing the alignment of the codes, categories and interrelationships to the study of mobile learning. It did so by asking if emergent codes contributed to that understanding, and whether they discerned from other established or expected educational practices, other initiatives that may be ongoing, or other phenomena outside the scope of the study. A caveat to the guiding statement and questions must be acknowledged here. Later in the coding and analysis, I distinguish between mobile learning and a mobile device initiative, a distinction that I have foreshadowed when describing my expectations not being evident and will discuss again in detail in Chapter 5. The impact of this distinction will be that particular sub-categories, for example describing how the school *operates within a national education system* emerged as being highly relevant to the analysis.

The second and third questions prompt an examination of the validity of the codes and can be taken together. Ensuring brevity and accuracy in the codes, so that they illuminated the concepts, required that their 'fit' within tentative categories be continuously re-examined until appropriate codes emerged. An example of this process uses these two focused codes:

- *'traditional classroom orientation'*, where the teacher organised their classroom in rows, with students facing forward towards the teacher.
- *'designing the learning space'*, where the teacher was describing how they had re-oriented their classroom to support group-work, and remove themselves as the sole focal point.

Both of these focused codes related to the design of classrooms, encompassing the place of students, the arrangement of furniture, the purposes and expected benefits (or consequences) of such designs. In this case, both focused codes were combined to become 'designing the physical learning environment', thus re-coding the data. Their test for relevance, in line with the first guiding statement, showed a contrast between a teacher who was using mobile devices to facilitate group-work (arranging the learning space accordingly), and a teacher who was not (acknowledging a deliberately traditional layout). This provided a point of contrast for later analysis. Table 4.9 gives examples of focused codes, their definitions and examples from the transcribed interview texts.

Table 4.9

Examples of focused codes, their definitions and examples from the transcribed interview texts.

#	Focused Code	Definition	Example from the transcribed text	
1	Students taking responsibility	Students accept that they have responsibility for completing homework if they were absent from a class.	MODERATOR:	Okay. But if you're at home, what makes you want to FaceTime someone else to chat about homework?
			STUDENT 9:	Boredom.
			MODERATOR:	Boredom?
			STUDENT 4:	It depends if you're not in or not.
			MODERATOR:	If you haven't been in, yeah?
			FEMALE VOICE:	Yeah.
			STUDENT 9:	Or if you forget the homework.
			MODERATOR:	If you forget the homework?
			STUDENT 1:	If you had to get out of the class for something or if you had to leave home, get home early.
			MODERATOR:	Okay. So if you-
			FEMALE VOICE:	Because like when we do music, it's on the last class.
			MODERATOR:	So if you had some activity on?
			FEMALE VOICE:	Yeah.
			FEMALE VOICE:	Yeah.

#	Focused Code	Definition	Example from the transcribed text

#	Focused Code	Definition	Example from the transcribed text
2	*Drawing a line'*	Amy chooses not to respond to day-to-day or procedural queries from students. She does this to draw a line between work and home.	Amy: If it was something specific, if I read it and I thought it was urgent, I would reply to it, but I don't make a habit of it. I don't think – I don't think it's necessary. Edmodo is great and email and – like email and things like that outside of the classroom with different hobbies for project work, is great but just day-to-day [bits and pieces?], queries, I don't deal with them, I don't reply to them all the time because the kids are on it the whole time and they do it themselves anyway. So I think you have to draw a line somewhere.

#	Focused Code	Definition	Example from the transcribed text
3	Configured for group-work	The teacher describes how their classroom is physically laid out to enable and support group-work.	Martin: Well, you know, you've been there. You've got the seating plan. I don't think it's a completely different seating plan to many other classrooms, but it's very much orientated towards group work, my classroom is.

#	Focused Code	Definition	Example from the transcribed text
4	Teacher 'controlled' space	Students identify Edmodo as a teacher-controlled space and take personal conversations elsewhere.	MODERATOR: Yeah. So your teacher is on your Edmodo group. Do you ever find that you want to chat in some other way so that she can't see what you're saying? FEMALE VOICE: Well, you can't really do that on Edmodo because it's more open. FEMALE VOICE: No. STUDENT 1: That's not really what Edmodo is for though. If you wanted to just talk to each other, you should just check, start email instead of just using Edmodo.

#	Focused Code	Definition	Example from the transcribed text
5	Critiquing real-world problems	Students discuss and critique the use of real-world examples in mathematics, stating that they can make scenarios more challenging to understand and solve.	INTERVIEWER: Is it not meant to be like real world problems? STUDENT 1: Well, it's meant to be but that just gets you off-topic, like. It's like the other night mentioned a celebrity in a question and then straight away you'd be like, oh, I know that celebrity, you know? STUDENT 4: Like, when will we ever have to figure out if Rory McIlroy, how far he can hit a ball or anything? STUDENT 2: Angle of elevation. STUDENT 6: Exactly. INTERVIEWER: Do you not think that helps you understand maths and relate it to everyday life? STUDENT 2: No, it makes it harder. STUDENT 1: No. STUDENT 4: No, it makes it you don't know what the question they're asking you to do. STUDENT 2: Harder to do it.

#	Focused Code	Definition	Example from the transcribed text	
6	Challenging gender stereotypes	A female student challenges a male peer on their stereotyping of girls' use of social media.	INTERVIEWER:	That's, actually some people say that boys and girls use technology differently, do you think that's true, looking at each other?
			STUDENT 1:	Yeah.
			STUDENT 6:	Yeah.
			INTERVIEWER:	Okay. Hang on now, let's, I want to get this one right. So, come on.
			STUDENT 1:	Ah, no, like girls use it more for social media and all that and –
			INTERVIEWER:	You first.
			STUDENT 7:	And boys use it to play Minecraft and, like –
			STUDENT 2:	Games.
			STUDENT 4:	Minecraft? Minecraft?
			STUDENT 5:	Really, is that what you think of us?
			STUDENT 1:	[Inaudible] Minecraft.
			STUDENT 6:	Yeah.

Source: Hillview School, Olive, Students' 'whole-class' interview.

#	Focused Code	Definition	Example from the transcribed text	
7	Supporting the teacher	Students indicate a willingness to offer and provide technical support to their teacher(s).	INTERVIEWER:	Okay. Grand. And would you ever help Teacher 05?
			ALL:	Yeah.
			INTERVIEWER:	Would he ask or would you offer?
			STUDENT:	Ask.
			STUDENT:	Ask.
			STUDENT:	A bit of both.
			INTERVIEWER:	He'll ask?
			STUDENT:	Yeah, he'd ask.
			STUDENT:	He'll just say, 'Does anyone know how to fix this or work that?'
			INTERVIEWER:	Okay. How do you think he feels about that?
			STUDENT:	Fine.
			STUDENT:	Grand.

Source: Hillview School, Dan, Students' 'whole-class' interview.

Finally, examining the relevance of codes to the study of mobile learning was vital to this study, and impacted on coding decisions. An example comes from the interview with the Principal of Hillview School, where *"defining a vision for teaching and learning"* is the first focused code. In this example, the principal is describing the school's vision for teaching and learning and talks about some of its history of initiatives in service of this aim. The mobile device initiative was only mentioned in the third paragraph, where she describes the school's choice of *"prioritising the ICT initiative"*, over becoming a pilot school for an upcoming curriculum reform. Throughout focused coding, many more codes emerged which were related to established school practices, plans, or aspirations and it

became apparent that it would not be possible to isolate mobile learning from the overall context of the school.

As discussed, early memos were written in tandem with initial coding and a clustering exercise with the memo titles suggested some tentative categories, shown in Table 4.10. As focused coding proceeded, it became apparent that these tentative categories did not neatly contain, or accurately reflect, all the codes that emerged; nor did they place mobile learning in the context of the school, which emerged strongly in focused coding.

Table 4.10

Tentative coding categories at the end of initial coding and memoing.

Categories
Internet, network and backchannels
Students and information / knowledge
On teaching and learning
Role, authority and control

An example of the limit of the tentative categories was *teachers' and students' initial reactions to the introduction of mobile devices*, which was not prominent in the memoing process, but emerged clearly and consistently in the coding. Several focused codes (see Table 4.11) clustered around this tentative new category, and while the details of the responses differed in the various cases, the frequency of the codes justified the category '*responding to the introduction of mobile devices*', with constituent sub-categories.

Table 4.11

Tentative category: responding to the introduction of mobile devices.

Category	Sub-category	Focused code(s)
Responding to the introduction of mobile devices	Students' responses	*Swept-up in the excitement* *'Didn't have a clue'*

Category	Sub-category	Focused code(s)
	Teachers' responses	*Amazed by the pace of change*
		Willingness replaced by frustration
		Talking a 'leap of faith'
	Classroom implications unexamined	*Classroom implications unexamined*
	Evaluating performance and planning expansion	*Reflecting on progress to-date*
		Linking with Dept. of Education initiatives
		Devolving responsibility for the vision
		Planning for whole school 1:1

Similarly, it became evident that the tentative categories would not neatly and accurately contain all the focused codes that were emerging. I reached an impasse when I had several groups of focused codes loosely categorised at a low level; examples included *the role of the teacher*, *subject beliefs*, *examinations*, *responsibility for learning*, and *textbooks*. While in grounded theory, one must not preconceive the data, it is important to be sensitised to the body of knowledge. I decided, therefore, to refer to Hogan (2009), as his set of relationships of learning, including a teacher's relationship with their subject, and their relationships with the students, offered suggestions for categorisation. Interestingly, Hillview School was one of the research sites for TL21[14], which informed Hogan's work. and may also have sensitised the school and participating teachers to some aspects of those relationships. These additions to the emergent categories brought the data together in a way that acknowledged the complex interconnections between codes and the context from which they were constructed.

Analysing the focused codes necessitated constant comparison of the data, codes were tested against the data and in some cases required the redefinition of the codes or re-coding

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14 Hogan's work on relationships of learning was linked to the TL21 initiative, which included Hillview School. The TL21 initiative is a workshop-based Continuing Professional Development programme for teachers and school leaders that promotes innovative practice and professional learning communities in post-primary schools. More information can be found here: https://www.maynoothuniversity.ie/tl21

of the data. This process resulted in the codes constantly evolving, although the degree of

evolution decreased towards completion. Some codes naturally coalesced, and again, a

clustering exercise was used to detect other patterns and relationships. At the conclusion of

the process, the following categories and sub-categories had emerged.

Table 4.12

Categories at the conclusion of focused coding

Category	Sub-category
The school as an institution	Possessing a self-identity
	Engaging with its community
	Operating within a national education system
	Subject to broader economic influences and agendas
Responding to the introduction of mobile devices.	Planning to introduce mobile devices
	Students' responses
	Teachers' responses
	Classroom implications unexamined
	Evaluating performance and planning expansion
Getting online and communicating (students)	Getting online (focused code only)
	Creating informal networks
Teacher's virtual classrooms (TVCs)	Purpose & Implementation
	Teacher/student communications
	Functions of the TVCs
	Embedding in school life
The teacher's relationship with their subject	External Influences
	Intrinsic Beliefs
	Fosters students' interest & engagement
	Accepting challenges to subject knowledge
The teacher's relationship with their subject	Creates a rapport with students
	Differentiating to meet learners' needs
	Reconceptualising role
	Students as agents of change
Concerning methodology	

One small category formed around codes relating to the methodology of the study, including selection of participants and the impact of the researcher. This category would be excluded for further data analysis after some data were incorporated into the methodology chapter. The coding process concluded with 6 categories and 296 focused codes.

As the degree of evolution in the coding and categorisation was decreasing, the theoretical understanding of the concepts and relationships between them was increasing. This manifested in seeing links and relationships between categories and sub-categories, in seeing questions to pose to the data to test the fit of codes and categories, and approaching the point of saturation. As coding drew to a conclusion, tentative theories began to emerge which could then be analysed in the next phase.

4.3 Constant Comparison, Theoretical Sampling And Theory Generation

The processes of grounded theory did not stop with the conclusion of focused coding; they continued concurrently with the analysis of the data. Evidence of the processes of constant comparison, theoretical sampling and theory generation will be presented in each of the following discussion chapters, usually beginning with a table presenting a category or sub-category of data that is to be analysed and discussed, and from which grounded theories will emerge.

4.4 Chapter Summary

At the conclusion of the coding process, all interview, classroom observations, and online observation were coded. Traditional grounded theory coding methods were

augmented with a novel approach to coding video data from classrooms. The coding process, therefore, gives a complete picture of the data in the study. Rigorous use of memoing and constant comparison, throughout the process, has enabled coding and categorisation of the data, while also revealing inter-relationships. In the following chapters, which focus on analysis and present the data, codes, categories and memos will enable grounded theories to emerge.

Given the novelty of my approach, which blended traditional grounded theory interviews with video and observational data, I would like to step out of the analysis for a moment and offer a short reflection on that process for the benefit of future grounded theorists. My range of data collection methods provided a very rich set of data, which then posed an analytical challenge. Of particular concern was how to align the coding strategies for data from interviews, online observations, and videos so as to enable constant comparison across them. For the video data, the tension largely resulted from me not being a classroom teacher and having to understand the routine classroom processes which dominated the recordings. An analogy could be seen in the ratio of signal to noise in a radio transmission, where the challenge is to filter out extraneous data. Reflexivity and positionality are key here; as an education technologist I was attuned to see certain pieces of data that a classroom teacher would not, like moments of crossover into online spaces. Indeed, the same would be true in reverse, where a classroom teacher would immediately see other patterns, for example which students initiate disruptions. To extract the 'signal' from these videos, I focused on the tasks that teachers had planned and enacted which represented a set of embodied beliefs. Their actions and beliefs were then coded and provided data for constant comparison.

Chapter 5: Participants In Context

5.1 Introduction

The purpose of this chapter is to orient the reader with the context of the research by providing a snapshot of the participating schools, teachers, and students. This snapshot will allow a degree of comparison between schools and teachers at the point they began their mobile device initiatives, it will also allow some comparison and analysis along the three year timespan until data collection. While this chapter could simply state and describe those contexts, the coding process revealed the importance of the contextual information as two categories emerged which warrant analysis. Those categories are the *school as an institution* and *responding to the introduction of mobile devices*, and when analysed with their sub-categories and codes (see Table 5.1), provide significant data to support the emergence of grounded theories, while also helping orient the reader with the contexts under investigation, and will be discussed in order in this chapter.

Table 5.1

Categories relating to school context.

Category	Sub-categories
The school as an institution	Possessing a self-identity
	Engaging with its community
	Operating within a national education system
	Subject to broader economic influences and agendas
Responding to the introduction of mobile devices.	Planning to introduce mobile devices
	Students' responses
	Teachers' responses
	Classroom implications unexamined
	Evaluating performance and planning expansion

The structure of this chapter departs from the linear order of the categories and sub-categories by presenting the context in three parts, beginning with the context for each school and their teachers. Information on schools will include structure, location, and demographics; while the information on teachers will draw on the *teachers' initial questionnaire* to include educational background, subjects taught and ICT competence. This part will also explore and analyse the category the *school as an institution* by looking at their self-identities, engagement with their communities, operation in a national education system and how they are subject to external influences and agendas. The second part will begin to explore the schools' planning for their mobile device initiatives, including what was articulated as a vision for teaching and learning and how they engaged with teaching staff and the wider community. The final part will explore the category *responding to the introduction of mobile devices*, and it is through the analysis of those reactions that we more clearly distinguish between an initiative which aimed to introduce mobile learning (mlearning) as a practice and one which introduced mobile devices. The finalisation of this distinction marks the change in focus of the study, which is reflected in the upcoming data analysis chapters. This part will conclude by establishing the grounded theory that the classroom implications were largely unexamined in the planning and introductory phases; this theory will directly address one of the research questions.

5.2 Context

This section will discuss the participating schools, teachers, and categories that formed from the data. It will illuminate the context for the reader by providing a timeline of key events in the schools' mobile device initiatives, the research process, and for policies within the education system. The timeline is presented in Table 5.2, below.

Table 5.2

Timeline of schools' mobile device programmes, research activity, and national policy initiatives.

Academic Year	Hillview School activity	Seafront School activity	Research activity	Education activity (policies & responses)
2011 / 12	Mobile device initiative for 1st year, with students having an Apple iPad 2 (Wi-Fi)	Mobile device initiative for 1st year, with students having an Apple iPad 2 (Wi-Fi)	-	Nov. 2011: NCCA proposes Junior Cycle reform, including the *potential* for formal assessment of work presented digitally
2012 / 13	Mobile device initiative for 1st & 2nd year	Mobile device initiative for 1st & 2nd year	-	Nov. 2012: School Self-Evaluation Guidelines published
2013 / 14	Mobile device initiative for 1st, 2nd, & 3rd year Experimentation with Edmodo	Mobile device initiative for 1st, 2nd, & 3rd year Pilot of Schoology	Recruitment of schools Recruitment of teachers Ethical approval	Apr. 2014: Unions take industrial action to protest against June Cycle reform.
2014 / 15	Mobile device initiative for 1st, 2nd, & 3rd year Mobile device initiative extended to 4th year Mainstream use of Edmodo	Mobile device initiative for 1st, 2nd, & 3rd year Mainstream use of Schoology	Data collection and field work.	Sep. 2014: Revised Junior Cycle English course officially introduced.
2015 / 16	Mobile device initiative for 1st, 2nd, & 3rd year Mobile device initiative for 4th & 5th year Mainstream use of Edmodo	Mobile device initiative for 1st, 2nd, & 3rd year Mainstream use of Schoology	Data analysis	Oct. 2015: Digital Strategy for Schools (2015-2020) launched. Sep. 2015: Revised Junior Cycle Science course officially introduced. Apr. 2016 First classroom-based assessment administered in English.

Note: For Education activity (policies and responses), only policies referenced in this thesis and relevant to the study have been listed. The timeline of the Junior Cycle was created from official publications (referenced in this chapter), or public launch dates, and the Irish Times (2015b). Sources: (Department of Education and Skills, 2012; 2015b) (Department of Education and Skills, 2015)

The timeline, shown in Table 5.2 above, outlines the progression of the mobile device initiates throughout the Junior Cycle in the participating schools, and that it extended into the Senior Cycle in one school. It also signposts the relevance of national policies, or their

absence. It is interesting to call out that the schools were pioneers in their plans for educational technology; they launched their initiatives in 2011/12, anticipating the imminent introduction of the revised Junior Cycle, which was ultimately delayed by several years. They were also years ahead of a new Digital Strategy which was published in 2015. These topics will be discussed in detail in the subsequent sections.

Participating Schools

As described in Chapter 3, two schools continued to the field work phase of this study. A summary of the schools is provided in Table 5.3 and discussed further below. The types of the community each school is part of, including demographics and social class will be introduced here and discussed subsequently. Hillview School serves a rural community, with a strong base of farmers and working-class residents. Seafront School is located in a wealthy suburban town near Dublin, which has a primarily middle-class community.

Table 5.3

Participating schools, showing sector and patronage, location profile and enrollment.

School	Sector	Patron	Location	Enrollment
Hillview School	Education and Training Board	An Education and Training Board (formerly Vocational Educational Committee)	Rural small town	800 - 900
Seafront School	Community and Comprehensive	Association of Community and Comprehensive Schools	Suburban Dublin	>1,000

Note: Both schools are co-educational. School enrolment numbers are shown in ranges to ensure anonymity.

Participating Teachers

Within the two schools, seven teachers participated; all of whom were experienced teachers and all had at least a decade of teaching experience, see Table 5.4 below. Many of

them reported being active in the wider life of the school and led extra-curricular activities. Four of the seven reported having engaged in some CPD over the previous year. Interestingly, none of the teachers reported using Twitter, or other networks, to have an online professional learning network.

Table 5.4

Background, demographics and educational information on participating teachers.

Name	Age range	Teaching experience	Educational Qualifications	Content areas	Extra-curricular activities	Recent CPD
Hillview School						
Tanya	36-45	22 years	- Undergraduate Degree - H.Dip. Education	- Music - History	Yes	TL21
Amy	36-45	11 years	- Undergraduate Degree - H.Dip. Education	- Business - Maths - LCVP	Yes	Project Maths
Martin	26-35	11 years	- Undergraduate Degree - H.Dip. Education	- Geography - History - P.E.	Yes	Not stated
Olive	36-45	17 years	- Undergraduate Degree - H.Dip. Education - Postgraduate in ICT in Education	- Irish - Maths - Computers	Yes	Irish subject methodologies (6 hours)
Seafront School						
Dan	36-45	15 years	- Undergraduate Degree - H.Dip. Education	- Geography - English	Yes	Not stated
Martha	46-55	25 years	- Undergraduate Degree - H.Dip. Education	- Geography - History	Yes	In-house ICT
Beverly	36-45	17 years	- Undergraduate Degree - H.Dip. Education - Postgraduate in Educational Leadership	- History - Business - Economics	No	Not stated

Note: Names are pseudonyms and teachers are listed in a random order.

Introductions to each teacher are presented below, including some demographic and contextual information.

Tanya. Tanya is a teacher of Music and History for over 20 years, and led the introduction of music as a subject to be taught in the school a decade ago. She is active in the extra-curricular life of the school, leading the school choir and directing the annual school musical. Tanya reported that she felt competent to perform a wide range of technological tasks.

Amy. Amy is a teacher of Business and Maths and has been teaching for just over a decade. She coaches a sports team in the school. Amy reported that she felt competent to perform a range of technological tasks, but was unsure about her abilities to use multimedia.

Martin. Martin is a teacher of Geography, History and Physical Education for over a decade and he trained to teach in the United Kingdom. He coaches a sports team in the school. Martin reported that he felt competent to perform a wide range of technological tasks, and also that he kept up with current technological developments.

Olive. Olive is a teacher of Maths, Irish and Computer Studies. She was active in the extra-curricular life of the school before she started her family, but she still mentors the school's Mathletics team. Olive has a postgraduate qualification in ICT in Education. Olive reported that she felt competent to perform a range of technological tasks, although she felt unsure about her abilities to guide students to create portfolios.

Dan. Dan is a teacher of Geography and English, with 15 years experience. He is active in the extra-curricular life of the school as director of the annual school musical. Dan reported that he felt competent to perform a range of technological tasks, but was unsure about the use of multimedia.

Martha. Martha is a teacher of Geography and History with over 25 years experience of teaching. She previously coached a school sports team. Martha reported that she felt competent to perform a basic technological tasks, and self-identified as a technological 'dinosaur'.

Beverly. Beverly is a teacher of History, Business and Economics with 17 years of experience. She founded the school's teaching and learning club, a voluntary groups for teachers interested in enhancing their pedagogical practices. Olive has a postgraduate qualification in Education Leadership. Beverly reported that she felt competent to perform a set of basic technological tasks, and expressed further doubts about her ability to create educational content.

In the *teachers' initial questionnaire,* teachers were asked to rate their ICT skills based on a series of statements of ability, ranging from basic information retrieval to advanced multimedia creation or curation of resources. These statements are presented in Table 5.5.

Table 5.5

ICT Skills: teachers' reported ability to complete certain tasks.

Name	Hillview School				Seafront School		
	Tanya	Amy	Martin	Olive	Dan	Martha	Beverly
I can use the internet, email and write documents	Yes	Yes	Yes	Yes	Yes	Yes	Yes
I can develop materials such as handouts and worksheets, I can capture and edit images, and make PowerPoint presentations	Yes	Yes	Yes	Yes	Yes	Yes	Yes
I can create edited video and audio files	Yes	No	Yes	Yes	Unsure	No	Yes
I can combine different different types of digital resources that I have created	Yes	Unsure	Yes	Yes	Yes	Unsure	Unsure

	Hillview School				Seafront School		
Name	Tanya	Amy	Martin	Olive	Dan	Martha	Beverly
I can create interactive materials using iBooks author or similar authoring tools.	Yes	Yes	Yes	Yes	Yes	No	Unsure
I can curate subject materials using iTunes U Course Manager or similar tools	Yes	Yes	No	Unsure	Unsure	Unsure	No
I can guide students to create a digital portfolio of their work (on any type of web service)	Yes	Yes	Yes	Unsure	Yes	No	Unsure

The teachers' initial questionnaire shows a group of teachers with a strong set of basic skills. Some teachers, particularly those in Hillview School have intermediate to advanced skills, while those in Seafront School show more uncertainty. Further data from teachers emerged during interviews and were coded and categorised appropriately and will introduced as supporting evidence for the grounded theories presented in Chapters 6 and 7.

Schools As Institutions

A significant number of codes emerged which described or discussed the schools' self-identities, roles in their communities and interactions with national policies and initiatives. These codes formed the category *the school as an institution*, see Table 5.6, and together with sub-categories, will be analysed below.

Table 5.6

The category 'the school as an institution' with sub-categories and focused codes.

Category	Sub-category	Focused codes
The school as an institution	Possessing a self-identity	*Expectations of an 'academic' school*
		Leading a 'progressive' school
		Ability to innovate restricted
	Engaging with its community	*Accessible to the community*
		Embedded in the community
		Provides services to the community

Category	Sub-category	Focused codes
	Operating within a national education system	*Overcoming apathy*
		Working in a 'vacuum'
		Engaging with other schools
		Teacher professionalism
	Subject to broader economic influences and agendas	*Aspiring to be a modern teacher*
		Expectations of teachers shaped by outside influences
		Looking to the future
		Beliefs about the importance of ICT
		Disappointed by the 'sales pitch'

Possessing a self-identity. Each principals describe their school's their self-identity, an identity or set of beliefs that informs and guides their educational practices as follows; Hillview identifies as a 'progressive school' and Seafront as an 'academic school.' They further elaborate on how this self-identity is tempered by each school's place in its community and on the choices parents make when choosing a school for their children. Where relevant, additional data will be used to triangulate the principal's interview data.

Hillview School is described by the principal as being a 'progressive' one, characterising it as one which welcomes innovations and new educational approaches. She feels that while the school is humble and slow to self-praise, that is has a well-earned respect and trust within its community and would be seen as a good school. The school takes its role in the community seriously, recognising that as the only school in a small rural town, it has the ability and responsibility to act for the good of the community. In its work with pupils, the school measures its success as high academic performance and progression to further and higher education, while also catering for a variety of needs, abilities, and interests.

Seafront School is described as an academic school, and given its suburban location, exists in some competition with nearby schools with similarly strong academic reputations. The school prides itself on promoting a caring environment, especially for students with SENs and the principal is concerned with the engagement of second-year boys in light of the ESRI's findings on disengagement (Smyth, 2006). While the school attracts students from a wide area, it prioritises those from the local community and is further engaged in it through the sharing of sports facilities and offering a range of adult education courses.

Both principals describe their schools as being 'good schools' and invoke academic performance as one measure of quality. They do acknowledge measures other than academic performance, which may include a more holistic approach to education or as a school that enhances career prospects with its level of progression to further and higher education. The principal of Seafront School elaborates on academic performance as a measure and its value to parents:

```
PRINCIPAL:        And we're an academic school, we're competing with
                  other academic schools. If we've dropped down to
                  eight subjects and start all these fancy little
                  short courses, as the way parents might view it, and
                  the school five minutes away from us doesn't, stays
                  with their academic thing then how will that work?
```

(Principal, Seafront School)

This quote shows the high level of importance parents place on academic performance, and interestingly, has a higher relative importance than reported by the principal of Hillview School. Three question arise from these descriptions by the principals:

(a) what is a 'good school' and how is that measured?
(b) is parental trust in each school conditional?
(c) is innovation enabled or constrained in each school by their academic record?

A challenge to knowing what a 'good school' is and how to measure it exists in the lack of national statistics on performance or outcomes in schools[15]. The Education Act (1998) Section 53 placed limits on the ability to gather such statistics, the Act empowered the Minister (for Education) to:

> refuse access to any information which would enable the compilation of information (that is not otherwise available to the general public) in relation to the comparative performance of schools in respect of the academic achievement of students enrolled therein (Education Act 1998, S.53)

This section is designed to prevent the compilation of league tables or similar instruments which may have had unintended consequences as seen in other jurisdictions. The Act also created the Department of Education Inspectorate to have a care and responsibility for the "quality and effectiveness of the education provided in those schools". Despite the inspection programme run by Inspectorate and the process of school self-evaluation, there is little information available for parents that would allow them to judge academic performance apart from what information a school shares with them, their personal experiences of the school, and word-of-mouth reporting. As a result, the quality of information available to parents is often subjective and anecdotal. A different measure of a school's academic success and contributor to its reputation may be the level of progression to further and higher education. The principal in Seafront School describes parents' expectations of their children's progression to further and higher education (and also how she recognised further education for providing additional pathways aligned with her more holistic vision of education):

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15 Results for the Junior Certificate and Leaving Certificate examinations, administered by the State Examinations Commission (SEC), are presented nationally, with analysis by subject level and gender, but not by school.

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PRINCIPAL:        parents expect their kids to go on to further
                  education of some sort and 95% of ours go on.  Now,
                  that includes PLCs which I think are very valuable.
                  So, it's that we have an ethos of expecting high
                  academic standards.
```

<div align="right">(Principal, Seafront School)</div>

As a direct result of the Education Act, limited statistics are available for progression to further and higher education in Ireland, except those nationally reported to international bodies. The *Irish Times Feeder Schools* report which is published annually (The Irish Times, 2017) provides a set of privately-collected data, although the private nature of data collection and that only universities and institutes of technology (as higher education institutions) are counted for progression limits the usefulness of the data for national comparisons. Post-leaving Certificate (PLC) courses in further education institutions are not counted, and indeed there are no statistics available to track those students aside from what an individual school may gather to track its alumni. A further limit to these statistics is that they are unable to track students who may take an alternative pathway to higher education via further education. The progression rates for the schools in this study are shown in Table 5.7 and show that both have high progression rates; indeed they are well above Ireland's 50%+ performance for progression to tertiary education (The Irish Times, 2017) – a discussion about these statistics in their local contexts will follow later.

Table 5.7

Sample schools, showing progression to higher education and university reported by the Irish Times

School	Progression to	2014	2015	2016	Average
Hillview School	All Higher Education Institutions	88%	84%	87%	86%
	Universities only	34%	40%	42%	39%
Seafront School	All Higher Education Institutions	86%	94%	93%	91%
	Universities only	41%	54%	45%	47%

Note: Progression rates are shown for the year of fieldwork (2015), with one year before and after. Progression rates for further education (FE) and post-leaving certificate (PLC) courses are unavailable.

Returning to the question of parents' trust in their schools and the schools' ability to innovate, a simple answer is that while both schools achieve academically, one may have a greater capacity to innovate than the other. Some triangulation is possible by examining each principal's assertions followed by an analysis of their freedom of action. It is evident from the data discussed and further coded data that both schools achieve well across a range of measures, including inspection reports, self-reported data, informal nationwide statistics, and crucially, each school's reputation in its community. What is striking is though is the different levels of freedom each principal feels in their ability to innovate. Hillview School's principal reportedly enjoys great freedom, to the point that she can rely on parents' trust and support and is more concerned with wayward or reluctant teachers:

```
PRINCIPAL:      there would be a few subjects [teachers] that we'd
                be sort of looking at and saying, you know, come on,
                come on,  trust it ... when you look at the results
                of the teachers who are actually allowing the
                students to learn themselves, they speak for
                themselves and we'll continue to work on that.
```

(Principal, Hillview School)

The principal of Seafront School's previous comment on being an academic school indicates that some recent educational innovations, particularly short courses in the revised

Junior Cycle, are seen as less academically rigorous and viewed sceptically by parents. She describes a recent tension with parents who sought a renewed focus on academic performance: "I've been under a bit of attack lately, we're trying to push the academics more," although she continues to believe in the value of a more holistic education that supports all pupils.

To fully understand the schools' freedom of action, and mindful of the link to parents established above, it is helpful to examine the local context of each school. Hillview School is the only school in a small rural town and is, therefore, the 'local' school which the community sees as the natural progression from primary education for their children. The school has a well-established academic record, and the principal and teachers are well known and approachable in the community. It may be the case that the deep and personal connections that exist in a close-knit rural community are a sustaining factor for the school's reputation. Furthermore, the logistics of sending a child to another school – in another town – would require a very active effort on the part of parents. Of course, other factors beyond the scope of this study may be at work but those identified suggest both a strong level of trust in the school and a high threshold before parents would consider other schools. Overall, Hillview School appears to have significant latitude to innovate with its educational practices. In contrast, Seafront School is in an affluent urban area and exists in a competitive environment with other schools. The principal feels a constraint in the limits of educational innovation, which she attributes to parents' expectations of the school and the type of education it provides. She fears that any dip in performance may be met with the ultimate threat by parents, to 'vote with their feet' and place their children in other nearby 'competing' schools, and in this regard, parents would be unlikely to experience the

same circumstances as in Hillview School. This discussion has demonstrated that while each school has a desire to maintain and advance progressive educational practices, the ability to implement them is tempered by each school's reputation, their level of trust from the community, and ultimately the parents' willingness to embrace those innovations. Interestingly, both principals expressed enthusiastic support for the revised Junior Cycle, which will be discussed shortly. Their support was not only for the programme's educationally progressive elements, but they felt that by moving all schools along such a progressive path, some of the competitive threats (which have restrained innovation in Seafront School) would be negated.

Engaging with their communities. Both schools speak proudly of their engagement with their local communities, beyond just the service they provide to them. When thinking about a school's community, it is important to remember there will be a diversity of constituents, which may each have different expectations of a school. Those constituent groups may include past-pupils (some of whom are prospective parents), new prospective parents, and those in the wider community. Both schools make their facilities available to the community; the principals feel that the range of services and supports they provide, including sports and adult education classes, places them at the heart of the community and enrich the life of it.

> PRINCIPAL:　　Well, the school has a huge impact in the community. It's only in the mornings and the evenings when they're coming and going to school, 870 students and small town, rural town Ireland. They stop the traffic, it's just, everybody knows about the school and yes, it's held in high regard.
>
> (Principal, Hillview School)

As the principal of a rural school, she feels that she is known and accessible throughout the locale. As an urban school, Seafront may not have the same scale of impact described above, but the school's reputation leaves it oversubscribed and attracting students from outside its catchment area. Despite these pressures, the principal feels they still look after their local students and are "fulfilling our commitment to the community". It is evident that both schools feel they support and are supported by their respective communities.

Ireland's (2016) census, see Table 5.8, reveals two very different communities in which the schools are based. Seafront School's local area is predominantly middle class, with professional and managerial jobs substantially above the national average at 63% (the national average is 36%), and other lesser skilled workers below average. In contract, Hillview School's local area is mainly working and agricultural class, with manual, skilled, and semi-skilled job around the national average and managerial jobs below average.

Table 5.8

Population by Social Class and Socio-Economic Group.

Social Class	Seafront School (locale)	Hillview School (locale)	Ireland
Professional workers	15%	6%	8%
Managerial and technical	48%	16%	28%
Non-manual	16%	17%	18%
Skilled manual	8%	16%	14%
Semi-skilled	4%	16%	11%
Unskilled	1%	6%	4%
All others gainfully occupied and unknown	9%	24%	18%

Source: Census of Ireland 2016, SAPMAP areas for electoral divisions and settlements.

These data show that the schools work within very different communities, which may have different economic and social needs, their expectations of the education system to provide options for further and higher education are reflected in the discussion of each school's self-identity.

Returning to the Irish Times Feeder Schools(The Irish Times, 2017) data, the three-year average for progression to higher education in Hillview School is 86% and in Seafront School it is 90%. Looking at the three-year average for progression to universities only, Hillview School is 39% and Seafront School is 47%. Strikingly, there are significant variations in the social class for the catchment areas of each school; Hillview School's is predominantly working/agricultural class, while Seafront School's is more middle-class. It is interesting to note that despite the differences in social class, both schools' performance for progression to higher education is high. Indeed it is well above Ireland's general progression rate to third level[16] which is c.50% (The Irish Times, 2017).

To ensure validity in these claims, I performed a comparison of the progression rates of each school with two others in similar contexts, see Table 5.9. In the case of Hillview School, I selected two from the same region of Ireland, who were co-educational, the sole school in their town/village, had a similar enrolment, and a similar profile of social class. In the case of Seafront School, I selected two from equivalent suburban areas surrounding Dublin, who were co-educational, in 'competition' with other schools, had a similar enrolment, and a similar profile of social class.

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16 Ireland publishes national-level statistics for international comparison.

Table 5.9

Progression to higher education and university in sample schools, with comparison schools.

School	Progression to	2014	2015	2016	Average
Hillview School	All Higher Education Institutions	88%	84%	87%	86%
	Universities only	34%	40%	42%	39%
Hillview Comparison School #1	All Higher Education Institutions	58%	61%	66%	62%
	Universities only	24%	20%	18%	21%
Hillview Comparison School #2	All Higher Education Institutions	85%	59%	81%	75%
	Universities only	16%	19%	26%	20%
Seafront School	All Higher Education Institutions	86%	94%	93%	91%
	Universities only	41%	54%	45%	47%
Seafront Comparison School #1	All Higher Education Institutions	83%	96%	85%	88%
	Universities only	45%	39%	37%	40%
Seafront Comparison School #2	All Higher Education Institutions	75%	87%	90%	84%
	Universities only	30%	34%	47%	37%
National averages are unavailable					

Note: Progression rates are shown for the year of fieldwork (2015), with one year before and after. Progression rates for further education (FE) and post-leaving certificate (PLC) courses are unavailable.

I also compared the locale (town/village) of each school with that of the two comparison schools to ensure that the profile of social class was indeed comparable, see Table 5.10.

Table 5.10

Population by Social Class and Socio-Economic Group, with comparison schools' locales.

Social Class	Seafront School (locale)	Seafront comparison locale #1	Seafront comparison locale #2	Hillview School (locale)	Hillview comparison locale #1	Hillview comparison locale #2	Ireland
Professional workers	15%	12%	13%	6%	5%	3%	8%
Managerial and technical	48%	43%	44%	16%	21%	14%	28%

Social Class	Seafront School (locale)	Seafront comparison locale #1	Seafront comparison locale #2	Hillview School (locale)	Hillview comparison locale #1	Hillview comparison locale #2	Ireland
Non-manual	16%	18%	20%	17%	16%	16%	18%
Skilled manual	8%	10%	9%	16%	20%	17%	14%
Semi-skilled	4%	6%	4%	16%	11%	16%	11%
Unskilled	1%	1%	1%	6%	6%	8%	4%
All others gainfully occupied and unknown	9%	11%	9%	24%	22%	26%	18%

Source: Census of Ireland 2016, SAPMAP areas for electoral divisions and settlements.

While acknowledging that progression to higher and further education is a crude statistic, I have demonstrated that it is one of the measures of a school's performance in Ireland and despite the schools having different profiles of social class in their communities, they achieve similar rates of progression. The comparison also revealed no significant difference between progression rates in Seafront School and its comparison schools, but Hillview School showed a significant difference in progression rates. This evidence demonstrates that Hillview School has achieved substantial success in raising its students' aspirations and abilities for progression to higher and further education. These data further support the conclusion that the principal had freedom to innovate based on a strong track record.

Operating within Ireland's education system. As the schools are operating in Ireland's education system, they are subject to national policies, pressures, and objectives. The structure of that system is peculiar to Ireland and the result of historical legacies which have created a complicated arrangement of school ownership, funding, employment status and protection of teachers and curriculum planning. A school, operating on its own

initiative, may encounter challenges with policies, funding, or balancing of local priorities with system-level initiatives. Coding revealed two such classes of challenges in the interactions between the schools and the system. Firstly, in the way that schools interact with the institutions governing the education system, in particular concerning financial decisions, funding provision, or policy initiatives (or lack of policy). Those interactions were: (a) the legacy of the economic crash, (b) the introduction of Junior Cycle reform, (c) school self-evaluation, and (d) the lack of a funded national digital strategy. The second class of interaction was teachers' perceptions on how they were viewed by the public, for example, frequent comments about long holidays. These interactions will be discussed below.

The legacy of Ireland's economic crash had a continuing impact on the education system at the time of the study. Salary cuts and increased working hours[17] had been imposed on teachers, while new entrants to the profession were on lower salaries and had precarious contracts. In many schools these factors combined to create an atmosphere of apathy (or worse):

> PRINCIPAL: But the cuts as well, there's an uncertainty about jobs and CID arrangements and all of that and that leaves everybody a little bit of a sour taste and can lead then to, 'we're not going to bother. Why should we bother?'
>
> (Principal, Hillview School)

While the schools in this study managed to proceed with new initiatives, it was only through deliberate strategies employed by the principals to create positive environments. The principal of Hillview School described how such an environment was nurtured:

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17 The so-called 33 'Croke Park' hours.

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PRINCIPAL:        So you constantly have to be reaffirming teachers
                  and thanking them for what they're doing and, you
                  know, my line is, 'The bus is going to pass by
                  shortly and you need to be ready to get on that bus
                  so don't throw out everything and so "oh, well, I'm
                  not doing that"'.  You know, you might be cutting
                  off your nose to spite your face.
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<div align="right">(Principal, Hillview School)</div>

In 2011, following consultations with stakeholders, Ireland's National Council for

Curriculum and Assessment proposed a major reform of the Junior Cycle which aimed to

address concerns over the heavy emphasis on 'teaching to the test' in secondary schools.

For a variety of reasons that are beyond the scope of this study, the implementation of the

revised Junior Cycle became conflated with the industrial relations dispute that stemmed

from the financial measures which responded to Ireland's 2008 financial crisis. Following

protracted negotiations, implementation began in 2015 with the intention of being fully in

place by 2022 (Department of Education and Skills, 2015b). The new Junior Cycle

envisaged the parallel development of students' subject knowledge and eight 'key skills'.

A new Junior Cycle Profile of Achievement (JCPA) would be awarded to students for most

subject areas and would combine two new classroom-based assessments for 40% with a

written examination for 60%. The focus on the eight keys skills also introduced elements

of ICT usage into the curriculum in a formal way, for example, the key skill

communicating had an objective to develop students' capacities in *using digital technology*

to communicate. A significant outcome of the negotiations between the teaching unions

and the Department of Education was that a new support service for teachers would be

established (Department of Education and Skills, 2015b) and that substantial continuing

professional development (CPD) would be provided to teachers – addressing a concern

that we will explore shortly. One element which changed was short courses, which would

have allowed schools or other providers design units of study of 100 hours (compared to

200/240 for traditional subjects) and replace some traditional subjects. Initially, schools were to undertake two short courses, but that requirement was revised to one. As the principal of Seafront School remarked, parents could see those as less academically rigorous as a traditional subject, and choosing which traditional subject to stop teaching would be problematic amongst staff. In both schools, there was an alignment of aims between their visions for teaching and learning, the revised Junior Cycle, and their mobile device initiatives, and the warm welcome afforded to the proposals from both principals has already been discussed. I must acknowledge that the delay in the introduction had an impact on this study, and potentially limits its findings. The teachers were not following the new programme, which was envisaged to have substantial pedagogical innovations. Ertmer's (2012) study found alignment between increased technology integration and curriculum reform aimed at introducing more progressive practices or 21st-century skills. The impetus for similar changes, whether as a result of the availability of technology or a latent desire by teachers will be examined in Chapters 6 and 7 respectively. Despite this limitation, the junior cycle reforms did have a significant impact on the schools in deciding *why*, *how*, and *when* to introduce mobile devices.

School self-evaluation (SSE) was an initiative of the Department of Education and Skills (2012) designed to develop schools' capacity to measure and critique their performance in consultation with students, teachers, and parents for the purpose of developing plans to improve their educational practices. While the aim was to avoid a top-down approach to new initiatives, the implementation phase began with literacy and numeracy as two nationally-specified areas. The relevance of self-evaluation can be seen in hindsight from the time of data collection, at which point schools were free to select

their focus areas. In Seafront School, the principal and teaching staff collectively selected ICT and technology enhanced learning, thus allowing them to devote time, energy and resources to the examination of their current practices, in consultation with students, parents, and teachers. In Hillview School, the SSE process was oriented towards other areas of schools life, and does not play a part in the mobile device initiative. Returning to the beginning of the mobile device initiatives, one can appreciate the competing demands on teachers' time and energy, SSE being one of them.

At the time the schools started their initiatives, the previous digital strategy (Department of Education and Skills, 2009) had expired. Aside from the continuing Schools' Broadband Programme, there was little support from the education system in planning and launching these initiatives, whether through policy advice for school leaders, pedagogical guidance for teachers, or financial grants. The absence of policy guidance left the schools operating in a 'vacuum', although it did encourage a collaborative approach amongst these early-adopters who relied on engagement with like-minded schools to support their staff in taking 'leaps of faith.' Both schools felt a subsequent obligation to share their experiences with other schools intending to follow in their footsteps by stepping in to provide guidance in the absence of a national strategy (which was published in 2015: (Department of Education and Skills, 2015a)). As early-adopters, both schools showed a willingness to host open days for other schools who were considering mobile device initiatives, which they felt provided the schools, teachers and students and opportunity to share their experiences but also, importantly, to reflect on their achievements in choosing what elements of their practice to share.

The public perception of teachers was discussed by Dan, a teacher in Seafront School, who stated his belief that teachers were unfairly stereotyped as having short working hours and long holidays. He pointed out that only counting contact hours would ignore a significant amount of work that teachers do and he expressed disappointment at what he perceived as a decreased level of trust in teachers. He reflected on the idea of teaching as a vocation but would prefer to define teachers as professionals, being part of a profession which warrants greater autonomy and trust. Some of these comments are echoed by Martha and Beverly, as they describe changes in their teaching role and the limits of their current skills. While these are small points in the data, they do highlight that the system and teachers are increasingly subject to broader economic forces and agendas.

Subject to external influences and agendas. All participants discussed how the education system was subject to external influences and agendas. While the term 'agenda' may have negative connotations elsewhere, here it refers to both the positive and negative impacts on the system (and teachers) as a result of these external influences. The themes which emerged during coding were: (a) the inevitability of technological progress and resulting changes in our economies and societies, (b) new or changed external expectations of teachers and education systems, and (c) disappointment in the 'sales pitch' from global technology companies. The latter two points emerged strongly from one teacher, therefore limiting the findings that can be made, but may have greater resonance in the wider profession.

Students showed a remarkable awareness of the impact of technology on their lives, whether at present or predicting the future. One fifteen-year-old girl in Olive's class

described how she had taken on technological tasks for her father: "like, Daddy with the farm, everything is online. I have to do it all the time for him, even tagging calves [registering in the national database] and everything has to be done online now". Another student, in a prescient comment speaking beyond the scope of this study, showed an understanding of the current and predicted automation of jobs: "they're going to replace people's jobs now because they're already doing that." There was a universal acknowledgement, indeed a sense of inevitability, that ICT will be an important part of students' lives and careers, although there were some expressions of disapproval. Returning to the example of the farm, a career not traditionally associated with technology, there is an expectation that "everyone will be doing it now, like, all the young farmers" (student in Olive's class, Hillview School). The principal in Seafront School sees the impact on learning and careers:

PRINCIPAL: I'm very much aware of what the future holds and
               where the jobs are, and I was a career guidance
               counsellor, and I was looking at the way my own
               children were learning and I just felt that this is
               the way of the future as a tool.

(Principal, Seafront School)

Beverly in Seafront School describes an anxiety she came to feel as a result of her perception of changed expectations of teachers and the pressure she felt under to teach in different ways and be able to perform different technological tasks. She is clear that it is not a complaint about workload, but rather a very real tension in her practice, where she feels that her current skills are insufficient and she's "letting the students down." She questions her level of training as she feels being a teacher of content knowledge is no longer enough, that she must now be able to create content and resources. She has a desire and intention "to move forward and become a modern teacher," which she sees as guiding student research and bringing them along on a learning journey. Her desire prompts the

questions of "what is a modern teacher?" and where are these ideas coming from? She

answers these by describing the impact on her of a recent presentation which was given to

the teaching staff of Seafront School by a visiting teacher sent by Apple:

> BEVERLY: Recently, we had [teacher's name] in here talking
> about it, you know, and like, 'Oh my God, you should
> be doing this and you can do that' and I'm going,
> 'But I'm not doing that'.

<div align="right">(Beverly, Seafront School)</div>

She sees this teacher as an example of:

> BEVERLY: ... modern people on the cutting edge of educational
> technology telling me what I can do but I'm not able
> to do that, you see? So I feel that there's this
> chasm that's widening about what I'm expected to be
> able to do.

<div align="right">(Beverly, Seafront School)</div>

She felt challenged, behind the times, and that her teaching was inadequate. She questions

the validity of these outside influences, tentatively suggesting that Apple (or other global

technology companies) are advancing a vision of education that she finds daunting and

challenging. There is an obvious tension between her forward-looking aspirations and

commitment to her students and advancing the cause of quality teaching and learning,

while casting a critical eye on external pressures which appear.

She further developed her critique of the narrative of modern teaching by questioning if

her students were getting the best out of their iPads. She sees a link to Ireland's curriculum

reform, where she observes textbooks being de-emphasised (at a policy level, if not in

practice) and teachers encouraged to create their content, and even textbook replacements,

which she sees as a 'nightmare'! She concludes this comment by acknowledging she is

engaged in a wider discourse on the role of technology in education, one that is potentially

shaped by those forces outside the education system. She was 'promised' independent

learning and Apps that had teaching content amongst the many possibilities, but then "I realised no, none of that is actually there, I have to create that", this revelation brings her back to her aspiration to be a modern teacher, but where she feels unskilled in what is now expected. Beverly knows that despite bring faced with such pressures, she could turn inward and revert to older, established practices but she does not. She is painting a forward-looking and open picture of education, even if that view scares her. She is also concerned that her students are suffering, that teachers are failing their students and that students are left disempowered by teachers.

The presentation Beverly attended was in the school's first year of their mobile device initiative and pre-dated the introduction of teachers' virtual classrooms. Beverly's reaction was a candid one, although I must acknowledge it as an outlier in the study. Beyond the study, teachers may have mixed reactions to a similar stimulus; some may draw inspiration from the un-tapped potential revealed to them rather than feel confusion, while others may feel a degree of confusion and a sense of being behind, and may be afraid to share their vulnerability with colleagues. The concern that teachers are "nervous and feeling lacking in confidence" (Beverly, Seafront School) is, therefore, an important one, with a general impact, but for most teachers in this study, it was not an issue. It is, however, a concern for future research or policy considerations.

5.3 Planning For The Introduction Of Mobile Devices

This section draws on the sub-category *planning to introduce mobile devices* shown in Table 5.11 below, and several early memos which deal with the planning phases in each

school. While the steps each school followed in the planning phase were similar, the details of the steps provide points of contrast. Their planning processes were underpinned by a vision for teaching and learning, and they articulated how it could be enhanced with mobile devices. Both principals appreciated that there was a finite capacity for change in their schools which guided many decisions and timelines. The principals then engaged with their teaching staffs and the wider community. This section will conclude with a description of the technical solution adopted in the schools.

Table 5.11

Sub-category 'Planning to introduce mobile devices'

Category	Sub-category	Focused codes
Responding to the introduction of mobile devices.	Planning to introduce mobile devices	*Articulating a vision to enhance T&L with mobile devices*
		Engaging staff
		Engaging the community

Vision for Teaching and Learning

In both Hillview and Seafront Schools, the principals articulated a vision for teaching and learning that underpinned their mobile device initiatives. In articulating how technology can enhance teaching and learning, they both drew heavily on their schools' self-identities and both align with the intentions and aspirations of the revised Junior Cycle programme:

```
PRINCIPAL:     that's the basis of the new Junior Cycle, you know:
               students' self-directed learning and also the five
               [later revised to eight] key skills that, the
               development technology in learning and encouraging
               students to take on the learning themselves. That's
               what the new junior curriculum is all about.
```

(Principal, Hillview School)

There is a warm embrace for the new programme shared by both principals, and indeed the principal of Seafront School states that it aligns with a long-standing educational aspiration for her: "25 years I've been thinking this way. So, you just have to be patient". The warm embrace of curriculum reform is echoed in Hillview School, where the principal links the aims of the revised programme to the school's shared vision for teaching and learning, which is:

```
PRINCIPAL:     to get students to be more responsible for their own
               learning and to evaluate how we were teaching our
               students, whether we were spoon-feeding them or
               whether they were able to learn on their own,
               whether they were producing the goods themselves or
               whether they were relying on notes or whether they
               were just learning off and regurgitating again.
```

<div align="right">(Principal, Hillview School)</div>

As the teaching unions were opposing the Junior Cycle reform at the time of field work, it was not possible to arrive a generalised view of the Junior Cycle from each school.

Both schools were able to articulate a vision for the use of educational technology which is largely student-centred, with teaching taking a more facilitative role. Although they still recognise the importance of quality teaching: "It (the technology) won't replace good teaching, it won't replace good teachers" (Principal, Seafront School). The aim is to give students ownership and responsibility for their learning processes by developing their ability to learn, collaborate, or work autonomously. The principal in Hillview School emphasises that these were not buzzwords being 'thrown around,' but there was a meaningful engagement with the process and rationale for it. Both principals acknowledge the importance of a more holistic education, with students developing an awareness of self and environment.

The vision for the use of mobile devices expressed by the Principals of both schools was evidently an educational one, and the next paragraph will give examples of activities to corroborate the principal's assertions. The language they used emphasised new possibilities for teaching and learning, in particular with access to diverse, current and relevant sources of information, while also seeking to develop a sense of responsibility for learning on the part of students. With an ambitious vision guiding them, both schools recognised that constraints in time and focus/energy[18], and their unwillingness to compromise on current standards, would result in having a finite capacity to change, which they must carefully manage. Later in this chapter, and again in Chapter 6, I will draw a distinction between the high level vision expressed here and the classroom-level practicalities that emerged in the data.

The term 'capacity to change' was defined in an early memo and encompassed remarks from both principals about new curriculum initiatives, availability of time, teachers' technological skills, teachers' desire to change their practices, and a limit to how much disruption of current practices can take place before quality suffers. The principal of Hillview School recognised that undertaking two significant initiatives was not possible: "we felt we couldn't be a network school [to pilot the revised Junior Cycle] and introduce a device, that we would do the technology first and then we would come online with the new junior curriculum at that stage" (Principal, Hillview School). The principal also reported a high capacity to change due to the school's involvement in the TL21 programme and a recent staff visit to New Zealand, which gave teachers the outlook and inspiration for a renewal of their educational practices. In the year before this study, two

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18 By focus I mean the ability to focus on the implementation of an initiative.

teachers went on an educational research trip to New Zealand to explore approaches taken in a similar system. Their visit inspired the teachers and staff as a whole to adopt a theme for the year: *less teaching, more learning*, which became a focus for CPD; and for some teachers, it guided their use of mobile devices by students. In Seafront School, the principal describes the school's focus on pedagogy in anticipation of the revised Junior Cycle, although acknowledging the delays, she says: "we've been working ahead on pedagogy, right, we've been doing a lot of work there so whatever comes down the line I think we'll be ready for it." The preparation was embraced by some staff who formed a voluntary teaching and learning club, led by Beverly (Teacher in Seafront School), as a space for teachers to share experiences and reflections on their practice. Given that the principals intended mobile devices to support the aims of the revised Junior Cycle, they felt it logical to have a linked and sequential introduction of both initiatives. The schools both introduced mobile devices a year ahead of the anticipated mainstream start of the new Junior Cycle, intending to have the technology 'bedded down'. With the industrial relations difficulties resulting from Ireland's financial crisis, 'things changed dramatically since that, there was a lot of stalling on the new junior curriculum." (Principal, Hillview School). Despite the delays, the strong rationale and vision allowed the mobile device initiatives to proceed, and the principal of Hillview School indicated that it was the right choice: "But we've forged ahead with our IT and things and I'm really, really glad that we took that road."

Engaging Staff

For both principals, engaging with their teaching staff to secure their 'buy-in' and consent was the next step in the process of introducing mobile devices. There was a

recognition of both the opportunity that would be given to teachers to embrace new approaches to teaching and learning, but also the challenges to enhance their skills and develop their teaching methodologies - all while maintaining standards.

In Hillview School, the principal and deputy principal began to lay the groundwork by consulting with their 'TL21 team' and some of their more technically-able staff. Their background work also included investigating the technical and financial matters in advance of presenting their proposal at a staff meeting, which the principal approached with some trepidation. She recalls the meeting "I can remember thinking we'll never get this over the line", and after a period of discussion time at the meeting, "felt like we should pull up; this is going nowhere", but was reassured by the deputy principal "we're getting there, just keep going now". By the end of the meeting the principal describes the positive outcome and the next steps:

> PRINCIPAL: … pretty much everybody got on board and said they'd
>   like to buy it in partnership in school.
>
> PRINCIPAL: So there was that sense of ownership from day 1 and
>   it just moved from there to the parents and to the
>   students.
>
> <div align="right">(Principal, Hillview School)</div>

The engagement with staff in Seafront School took place over a short timeframe as a result of the appointment of a new school leadership team including the principal and two deputy principals in March 2011. On reflection, she feels the implementation was rushed:

```
PRINCIPAL:        I only took over in March and I wanted this to go
                  ahead in September. I felt we just needed to go with
                  it, mainly because, the reason I rushed it was
                  because the new junior cycle seemed to be around the
                  corner where people [were] making their own
                  resources and we would be looking at these short
                  courses and I felt we needed to get the iPad
                  in and somewhat embedded so that people wouldn't be,
                  it wouldn't be coming in at the same time as the new
                  courses and then everyone being overwhelmed.
```

<div align="right">(Principal, Seafront School)</div>

The school also adopted a different financial model where it bought the devices outright for the staff as it had a recent financial windfall. In hindsight, with the Junior Cycle delayed, the principal acknowledged "I suppose we didn't prepare them [the teachers] very well, we bribed them, let's be honest" and "I did rush it." The principal acknowledged that the approach taken could cause difficulties initially: "initially it would be a struggle but as people became more accepting of it and as its usefulness grew then people would learn more", indeed the approach also had a limited ambition for how the devices would be used which we will explore.

Engaging The Community

In both schools, the consultation with staff was followed by a general meeting with parents where the initiative was presented to the parents of incoming first-year students. While sounding uncomplicated, the invitation to parents to participate relies on their trust in the schools and willingness to accept and value the proposed innovation. The invitation to participate, or 'pitch', to parents was reported to highlight what new advantages would be offered to students and their educational experience in line with both schools' visions, and also some immediate benefits like lighter school bags. They also highlighted what would not change, like the quality of educational experience and attainment. Crucially, neither school was willing to sacrifice their reputation as a 'good

school,' although as already noted, Hillview School felt it had a wider latitude than Seafront School. In both cases, the parents overwhelmingly opted in with over 95% uptake. When considering the financial cost was between €550 and €700 per student and the differences in demographics and social class between schools, the uptake shows substantial trust in the schools. Conscious of the potential for the financial cost of the purchasing a device causing some students to miss out, the schools put in place supports for families with financial difficulties: "I think there were three [out of 157] that couldn't afford it and we worked out something and they all had the iPads" (Principal, Hillview School).

The Technological Solution.

Both schools introduced their mobile device initiatives to students at the start of the 2012/2013 school year, with devices being deployed to students in June 2012 in Hillview School and August 2012 in Seafront School. The schools were among the very first in Ireland to begin mobile device initiatives, and as early-adopter schools, they could not learn from other reference sites or schools. As a result, both schools engaged the services of an educational technology consultancy firm to advise them and assist developing the required infrastructure, which can be summarised as:

- A tablet computer for all students and teachers, in this case an Apple iPad.
- Internet access and Wi-Fi connectivity in schools
- Cloud services, in the form of accounts with Google's G-Suite for Education, or Microsoft's Office 365 for Education
- Digital content in the form of digital textbooks from Irish education publishers.

Both schools had similar levels of technology provision at the outset of their initiatives. All classrooms were equipped with digital projectors and Windows-based PCs for the teachers. The schools did have computer rooms, but access was limited to the point that no teachers in this study reported using them. For their mobile device initiatives, both schools selected Apple iPads as the devices for students and teachers. The model was typically an iPad 2, (the first to have a camera), with 16GB of storage and running iOS 6 at the time of deployment. Often, when trying to recall the state of technology in the past, we may not accurately remember so it may be useful to remind the reader of the features present, and indeed absent, from the iPad at this time. There was very limited mobile device management (MDM) in place, meaning that remote management of Apps, monitoring usage and setting policies for forbidden activities ranged from limited to impossible at this time. Some later Apps, which have become 'hero' apps amongst education technology evangelists also did not exist, for example, Edmodo or Book Creator. Recent features like peer-to-peer sharing with AirDrop were still years away.

Each school was part of Ireland's broadband for schools programme and had recently been connected to the education backbone with 100m/bit connections. Each school has invested in an 'enterprise-grade' Wi-Fi solution. It must be noted that while the government programme brought connectivity to the schools, there was no direct funding and little advice at the time for providing the in-school Wi-Fi connectivity, causing schools to rely on third parties for advice – with mixed results as will be seen in a later discussion.

Digital versions of students' existing textbooks formed an essential part of the initiatives; for parents and students there was the promise of lighter school bags, and for teachers, continuity with the books and content they were already familiar with:

```
BEVERLY:        they kind of wanted to ease us into it so it was
                very much just an eBook substitute at that point of
                just getting use to using, you know, the tools on
                the eBook, so that's how it started.
```

<div align="right">(Beverly, Seafront School)</div>

As a result of Ireland's small size, the educational textbook publishers are mostly Irish-based companies rather than larger international publishers. In response to trends in educational technology and the adoption of e-reading, Irish publishers began to digitise their content and transition their business model from print purchases to digital subscriptions. In contrast with some other education systems, student textbooks are purchased by parents for each child, rather than by schools or districts. This model has been long criticised for the expense it imposes on parents and has been subject to efforts to change it, with a recent Irish Times (2018) article reporting on the 80 year debate on school book costs. Each publisher released a cross-platform ebook app linked to their proprietary content management systems, which allowed students access relevant titles for the duration of their subscription. The content was typically a digital facsimile of the printed book (often PDF or equivalent format). Additional content; including multimedia, PowerPoints, etc., is presented separately rather than in-line. If one were to compare a digital book shown by Apple as an exemplar of new forms of digital content like E.O Wilson's (2012) *Life on Earth*, the Irish publishers' digital textbooks would be substantially less sophisticated.

The following section will examine the responses to the introduction of mobile devices. While reading, it will be important to bear in mind the state of technologies and the novelty of the solution in the Irish context at this point in 2012. In particular, the absence of Edmodo and Schoology in the initial year is noteworthy and will be discussed in further detail.

5.4 Responding To The Introduction Of Mobile Devices

This section draws on the remainder of the category *responding to the introduction of mobile devices,* see Table 5.12. The category emerged during the coding process as it became apparent that those reactions were prominent in the data. After examining the responses of teachers and students, the analysis will turn to the classroom implications of having mobile devices. I will establish a distinction between mlearning as a practice envisaged in Chapter 2 and the research questions, and the mobile device initiatives observed in the data.

Table 5.12

Categories relating to school context.

Category	Sub-category	Focused codes
Responding to the introduction of mobile devices.	Planning to introduce mobile devices	*Articulating a vision to enhance T&L with mobile devices*
		Engaging staff
		Engaging the community
	Teachers' responses	*Amazed by the pace of change*
		Willingness replaced by frustration
		Talking a leap of faith
	Students' responses	*Swept-up in the excitement*
		'Didn't have a clue'
	Classroom implications unexamined	-

Category	Sub-category	Focused codes
	Evaluating performance and planning expansion	*Reflecting on progress to-date*
		Linking with Dept. of Education initiatives
		Devolving responsibility for the vision
		Planning for whole school 1:1

Note: The sub-category p*lanning to introduce mobile devices* was discussed in Section 5.1, but the full category is presented to show the full context.

Teachers' Responses

Coding of teachers' interviews revealed 'anticipation' and 'frustration' at the outset of the initiatives, although there was a strong divergence in the level of enthusiasm and the immediate reactions between both schools. In Hillview School, a teacher described it as "a leap of faith" and commended his colleagues for their bravery:

```
MARTIN:          They're brave enough. They're very much, it's very
                 much a leap of faith in terms of the staff here to
                 take this on board. They did so without many
                 problems as far as I'm concerned.
```

(Martin, Hillview School)

Three of the school's four participating teachers reported the enthusiastic use of their iPads, with Olive having piloted a teacher-only device for the previous year and being eager to extend the experience to all her first-year students. Amy was on maternity leave for the September to December term and offers a unique view of the pace of change during her three-month absence:

```
AMY:             Well, I'll tell you, the first year that iPads were
                 here, I was actually on maternity leave up until
                 Christmas. So I had been here up until the summer
                 when we kind of got our iPads and I thought I was
                 familiar with the iPad then by the time the summer
                 had gone by and whatever.  Then I came back to
                 school and it was like a different world; it was
                 amazing. Because I came in at Christmas and they
                 seemed to do - everything just had completely
                 changed, everything.
```

(Amy, Hillview School)

As a temporary outsider she described some of the differences she observed, including how apps had been embraced, homework was recorded, notes were now photographed with the camera, and how printed books had been replaced with digital versions. Moreover, the pace of change surprised her: "it seemed like such a short period of time, I wasn't missing for a year. It was just three months there from September up until Christmas and everything had completely changed" (Amy, Hillview School).

Initial experiences in Seafront School contrasted strongly with Hillview School. The sample group of teachers and a similarly-minded cohort engaged with the initiative and were eager to tap into the students' enthusiasm and motivation. Not all teachers however shared that disposition as Dan felt that "certainly, I wouldn't say every teacher in the school embraced it but, a good few of us did." Martha however, was even more equivocal:

```
MARTHA:          … did I embrace them immediately when they came?  I
                 would say that I, they were brought in as a book,
                 okay, as a replacement for books so I was using them
                 as a replacement for books and when they came in
                 initially I didn't find them that brilliant because
                 there were technical issues with it.
```

(Martha, Seafront School)

Those technical issues were reported by all of Seafront School's participating teachers with Beverly bluntly stating the impact of them: "… but it's only because I got so frustrated with the Wi-Fi before, it kind of stopped me". Taken together, these comments indicate that despite modest ambitions, the initiative suffered serious technical challenges at the outset, resulting in teachers' willingness to engage with the initiative being replaced by frustration.

Both students and teachers in Seafront School address the issue that some teachers ignored the technology: "some teachers just use the book and they don't really, and some teachers don't at all use it. I haven't gone on my iPad in [subject redacted] ever this year" and Dan addresses his frustration with his colleagues "there are people who've been given iPads and the iPad has never even been turned on so like that annoys me." Martha's story may explain some teacher's lack of engagement; she was one who was initially frustrated in her attempts to use the digital textbooks and therefore stopped using them, although once a compelling reason to re-engage emerged, she did, as was reported by one of her students "The fact that she found Schoology definitely changed. She's kind of like obsessed with it now and everything goes on Schoology now." It is evident that Martha was re-engaged by what she felt was a real purpose for the technology, rather than the implementation of a top-down decision.

The evidence suggests that the teachers' responses could be categorised in two ways, first, those who attempted to use iPads and ebooks but were frustrated by Wi-Fi, and those who did not try at all. In both cases, teachers also had the option to continue using printed textbooks. I am prompted to ask if teachers saw enough value (pedagogical or otherwise) to experiment with the iPads and ebooks, to persevere through technical challenges? It seems that for many the answer was 'no' and a perspective from the literature may help understand their position. Ertmer (1999; 2012) described two types of barriers which impacted on teachers' use of technology in the classroom. She defined first-order barriers as those external to the teacher and included resources, training, and support. Second-order barriers were internal to the teacher and included their confidence, beliefs about students' learning, and the perceived value of technology in the teaching and learning process. To

begin to apply that theory to this study, we must look at the 'weight' given to each barrier by teachers. Ertmer (2012), quoting her (1999) research, notes:

> the more significant difference between high- and low-level users related not to the barriers themselves, but to the "relative weight that teachers assigned to first-order barriers" (p. 52). Thus, even if access and resources were low, teachers might assign these barriers little weight due to strong beliefs about the role technology should play in the classroom. (Ertmer et al., 2012, p. 433)

In this case, the first order barriers were high, and teachers' view of the perceived value of the benefits of using the iPads and ebooks were low. The teachers' responses to the introduction of mobile devices in Seafront School are therefore unsurprising when looked at through the lens of Ertmer's research, where first-order barrier can act as a considerable impediment to use.

The experiences of both schools are echoed in the literature, Bebel & Kay (2010) note that even where there are positive changes in teachers' attitudes and practices, there can be a steep learning curve, particularly in the first year, and that larger changes can take years. These findings begin to touch on teachers' practices and beliefs, which will be examined in Chapters 6 and 7 respectively.

Students' Responses

Students' reactions were similar in both schools, where their apparent joy at having mobile devices resulted in chaotic exuberance. Olive described it as "chaos. chaos, it was", while Amy described students' enthusiasm to advance new ways of doing things:

<pre>
AMY: I mean I was writing things on the board saying,
                        'Now, let's take this down quickly before the bell
                        goes?' 'Miss, can we get a photo of that?' And I was
                        like what, no, no, write it down, write it down.
</pre>

<div align="right">(Amy, Hillview School)</div>

While the students were advancing new ideas, they may not have considered why their teacher was resisting them; it may have been that she had not yet considered these new approaches and resisted out of reflex, or that she placed a pedagogical value on the physical act of transcription. A further question emerges in whether the students were advancing new educational practices or convenient shortcuts for them––later interviews suggest that convenience is a strong motivator. Students in Martha's class agreed with the sentiments of initial chaos: "… because the first year we were, like, oh my God, iPads …", however, that it was an initial reaction and "we've kinda copped on" and now feel more trust from their teachers. Students did cast a more critical tone though then they reported feeling experimented on "… it's just because we're kind of like the testers on them because we were the first year to use them", another student felt the same, but that there were improvements since those early days:

<pre>
STUDENT: Like, we have our sister coming next year and they
                        show off the, they're showing them all the iPad the
                        progress they made with the school and everything
                        and it's supposed to be a lot better.
</pre>

<div align="right">(Student in Olive's, Hillview School)</div>

Some of the early excitement was however directed towards their subjects and the convenience that new technical possibilities afforded them in class. The students' reactions were not merely seeking the convenience of photographing the board but were based on educational possibilities. Olive's reports that students in her maths class "... were so excited, they couldn't believe that you could actually do this with maths" and they found a new voice for their work: "even different apps that were being used, different ways of

presenting their work." Students found new ways to collaborate, for example "at the other side of the room was the only person to get it right, they can all take a picture and have their work."

Students raised an interesting point about their lack of skills while reflecting on their first year experiences: "we didn't have a clue because we were the first year to get iPads, they [their teachers] didn't have a clue how it was used or anything." The points challenge the widespread (and contested) assumption that students are naturally talented with technology (Calvani, Fini, Ranieri, & Picci, 2012), and by extension, should be able to use it for education purposes automatically. The reality in this study appears to be that students are familiar with technology but lack training and direction on pedagogical uses, a finding that is unsurprising given recent research by Calvani (2012). Teachers would also have a familiarity but in different contexts and would approach technology in a more utilitarian way. In Hillview School, the principal and Olive added to these points when discussing how the programme expanded to transition year and their observation of weak technical skills:

```
PRINCIPAL:      And it was amazing to see how weak they were, the
                transition years, even though they've done their
                ECDL and their, all of those, they're just not as
                quick and adept as the others.
```

<div align="right">(Principal, Hillview School)</div>

```
OLIVE:          And there are some students in the class who would
                have an iPad at home and they have yet to say oh
                look, I'll do this, you know, I can do this. They
                don't associate using their iPad with school.
```

<div align="right">(Olive, Hillview School)</div>

Therefore despite substantial exposure to technology in the schools (as the pre-device years), students' skills were at a lower level, and their conception of ICT as a learning tool

was lacking. This finding suggests a potential tension for teachers as they will have to develop students' pedagogical use of technology, a process that was seemingly absent in the first years of the programmes.

Notwithstanding students' questionable skills and outlook on ICT, students did have expectations of a 'technology school' and an awareness that peers in other schools have fewer opportunities "they're always complaining because they don't have iPads." In Seafront School, in particular, the principal and Beverly keenly felt that students may be disappointed:

BEVERLY: I think, yeah, in first year because it's new to them using iPads and they're expecting more use of technology. They're coming in here going, 'Oh, my God, this is a technology school. This is going to be so exciting', and then they soon find out that besides the eBook which they're highlighting with their fingers and getting frustrated turning pages and not being able to get full views and all that, they realise, oh, right.

(Beverly, Seafront School)

The digital textbooks proved to be a particular disappointment for most students (across all classes) because of a combination of technical troubles and a preference for printed books which students regarded as more user-friendly:

```
INTERVIEWER:    So for all of you who are saying you don't like it,
                is it the books that you don't like or the iPads?
ALL:            iPads.
STUDENT 6:      Like the books on the iPad.
STUDENT 4:      There's always problems with the books and when you
                just have normal books, there's no problems with
                anything. And on the iPads, there's just so many
                problems, you're getting logged out and breaking and
                stuff.
STUDENT 1:      Just all the things that can go wrong with the iPad
                that can't go wrong with a book.
INTERVIEWER:    And are they all related to books?
STUDENT:        Yeah.
STUDENT:        Like I don't mind the book in class, but I hate
                studying off the iPad book for some subjects, like
                Irish and stuff, because the teacher like would be
                talking and something you can't write notes quick
                enough for your iPad. There is highlighting and all,
                but they just really annoy me. I would prefer to
                have a copy.
STUDENT 4:      And if you lose a book, it's not that bad, but if
                you break or lose your iPad, you know.
```

(Students in Dan's class, Seafront School)

The methods by which the initiatives were introduced in both schools were in sharp contrast, including the engagement with teachers, the community, and how each school articulated a vision for how teaching and learning would be enhanced with mobile devices. The technical infrastructure provided a particular point of frustration in Seafront School. These factors combined explain the initial reactions of teachers and students to mobile devices.

5.5 Grounded Theories And Chapter Summary

This section will continue to discuss and analyse the categories presented in this chapter, and it will elevate tentative theories into established grounded theories.

Classroom Implications Unexamined

An emergent theory in the data is that at the outset of the mobile device initiatives, teachers had not examined the implications of having devices in their classrooms. Amy from Hillview School exemplified this theory when she remarked:

AMY: And I hadn't really thought about it because I was
           at home and I had the iPad at home and I thought, 'I
           know how the iPad works and this is grand'. Hadn't
           put a lot of thought really into it as to how it was
           going to affect day in and day out.

<div align="right">(Amy, Hillview School)</div>

Amy's assumption that she knew how an iPad worked was problematic and led her to leave the classroom implications unexamined, in particular, the impact on pedagogical strategies or classroom routines. She was on maternity leave for the first term of the school year, affording her a unique perspective and allowing a before and after comparison that other teachers could not:

AMY: But when they came in, those first years after
           Christmas, everything, from the way they recorded
           homework and took down notes and books, everything
           was completely different, so I was bamboozled.

<div align="right">(Amy, Hillview School)</div>

Amy's remarks prompted further questions of the data and examination of other teachers' initial experiences. Comments from those teachers indicated that they were 'willing to try' or 'taking a leap of faith', suggesting that they also did not examine the classroom implications of having mobile devices. It is evident that teachers were figuring things out as they went along, suggesting that while the schools felt mobile devices would be beneficial in general, no specific practice was envisaged for their use; a point I will return to shortly. In this section, I will explore this emergent theory in two ways. I will begin by posing two followup questions, and then I will re-visit one of the study's research questions.

The data revealed that the classroom implications could be understood in two ways, first as classroom management strategies/routines (classroom management for short) and then the pedagogical implications, with some potential for overlap between the two. While classroom management was present in the data, it was not problematic (except Amy's initial experience) as teachers reported being able to adapt very quickly. Initial examples of classroom management included keeping students from being distracted by their iPads or how students 'recorded homework and took down notes'. My two followup questions, therefore, focus on the unexamined pedagogical implications:

- Were the current pedagogical practices 'good' enough that teachers didn't perceive a need to change them?
- If new practices were to be employed, what could they be?

It is evident that Seafront School's teachers have a view of good teaching which is linked to the school's self-identity, and as Chapter 7 will discuss, they are motivated to prepare students for the state exams, consistent with the school's self-identity. Returning to that self-identity for a moment, we can see strong links between what constitutes 'good teaching' and parents' expectations that the school delivers strong academic results, especially in the state exams. The principal was also mindful of parents' ability to 'vote with their feet', which can be seen as a feedback loop where the belief that the school provides effective teaching and a high-quality education would leave teachers reluctant to change 'effective' practices. In Hillview School, the definition of good teaching is more loosely defined and largely implicit in the school's self-identity as a progressive one. Teachers are free, and indeed encouraged, to innovate in their practices as evidenced by the school's participation in the TL21 programme. There is an emphasis on the students'

experiences and that they should develop responsibility for learning. In both schools, there is substantial evidence that at the outset of their mobile device initiatives they believed their current approaches constituted good and effective teaching, suggesting there was not an immediate impetus to examine new pedagogical approaches as a result of introducing mobile devices. The initiatives were mostly framed as preparing for upcoming curricular reforms, not addressing a current deficit. There are of course some exceptions, the principal of Seafront School sought to address the disengagement of boys in second year, and Olive in Hillview School had trialled a mobile device in the previous year and was eager to use its potential with her students for Maths.

At this point in the analysis of the data, I began to touch on the area of teachers' beliefs about education and their subjects. This topic will be approached again in Chapter 7, so I will limit discussion here to only what is necessary to establish this theory. I will also make two observations which should prevent this section being read as a criticism of the schools. First, these data are from a point in time, they are teachers' recollections of their experiences at the beginning of the initiatives, and secondly, that the schools' own expectations were limited as they were in uncharted waters. They have described the 'leap of faith', which it was, as they were among the very first schools in Ireland and did not have the benefit of a template to follow. Chapter 6 will show that over the course of the initiatives, the schools developed their usage past these initial experiences as teachers' abilities and the state of the technology improved.

To think of how a change of practice can be envisaged, it may be useful to consider the flipped classroom which was mentioned by the principal of Hillview School as one

potential pedagogical innovation. The tentative grounded theory *classroom implications were unexamined* implies the absence of a process (or a negative space), invoking the flipped classroom allows a consideration of planned pedagogical changes (a positive space). While the grounded theory will not rely on this discussion, it is a useful prompt for future initiatives to consider the implications of technology actively. As discussed in the literature review, the flipped classroom reverses 'traditional' instruction and is often seen as a complementary practice for mobile device initiatives. A characteristic of the flipped classroom is that students use a device and internet connectivity to watch pre-recorded direct instruction outside of their classroom, an approach which requires a conscious decision to avail of the particular features of mobile devices and use them to support educational activities. While looking at the flipped classroom may provide an example of what it would be to examine the classroom implications from a pedagogical perspective (and how the technology supports that), there is evidence that the schools foresaw some of those potentials. The principal and teachers in Hillview School had a sense that some new capabilities (the ability to communicate in particular) could be discovered or existing practices could become easier or more efficient; examples of these current approaches include group work and peer learning. Stating that the classroom implications were unexamined should not be read as a critique of the schools or diminish their vision or intentions for their use of mobile devices. Indeed, these examples potentially show the delineation between the schools' broad vision for enhancing teaching and learning, or what the school would like to achieve; and teachers foreseeing and examining the operation of their classrooms in detail, by asking how to achieve that.

Mobile Learning As A Practice

As I state that the *classroom implications were unexamined* as a grounded theory, I will return to one of the study's research questions which sought to 'establish which theoretical framework(s) underpins the mlearning practice paradigm in the subject schools'. In Chapter 2, the literature review established a definition and set of characteristics of *mobile learning as a practice* with a synthesis from the literature. The characteristics of that practice were identified as a mobile device, internet connectivity, socially-connected learning spaces, a change in the role of the teacher, and the use of constructivist pedagogies (with students). I can answer the research question by stating that the practice of mobile learning, as described in the literature review, was not evident in the schools in this study.

I am prompted by that statement to ask if I have conflated mobile *learning* initiatives and mobile *device* initiatives in my research question? The distinction between them can be seen in the literature review as the absence of the educational/pedagogical characteristics 'a change in the role of the teacher' or 'constructivist pedagogies'. The absence of these characteristics was also evident in the data, which I can demonstrate with the following points:

- The previous section concluded that the classroom implications were unexamined and that the potential for new pedagogical strategies was not considered by teachers before mobile devices were introduced.
- The example of the flipped classroom was a useful comparator, showing what an initiative that envisaged changed pedagogical practices *could* look like.

- There was evidence that the devices were introduced in both schools in advance of anticipated pedagogical innovations that would come with curriculum reform. The principals and teachers saw the devices as supporting later innovations (with some exceptions discussed already), but crucially, they were not the driving force.

- Chapter 6, in its examination of teachers virtual classroom will conclude, amongst other things, that most teachers took the opportunity to extend current practices using technology and so the change was in the scale or the degree to which those activities were happening rather than developing new practices.

Having established that *mobile learning as a pedagogical practice was not present*, I can ask why and what is the impact on this study? In an early memo, I asked if I was conflating the two types of initiatives when analysing the data. I now believe that I did indeed conflate the two, and that it happened at the design stage of the study rather that in the analysis. A strength of grounded theory as a methodology is that by privileging the data, one can reveal and appropriately manage hypothesis, assumptions, and biases brought into the study. So while I must acknowledge the limitation of not being able to answer that research question, I have arrived at a more accurate understanding of the initiatives as they unfolded in the schools and classrooms. In Chapter 8, I will return to the grounded theories and research questions, and through an integrated discussion, comprehensively treated and reconcile them.

The data presented in this chapter is based on participants' reflections on various point in time, which, in this chapter, have coalesced into two distinct phases: the periods before and immediately after the introduction of mobile devices. Indeed, these phases

naturally overlap with the subcategory *planning to introduce mobile devices* and category *responding to the introduction of mobile devices*. When looking at the period immediately after the introduction of mobile devices, it is important to ask if these are 'one-time' or transient reactions? The importance of asking is to draw a line between a phase that appears to be naturally chaotic, where teething problems are expected, and the subsequent phase where the day-to-day focus is on teaching and learning rather than technical issues. Two arguments support the finding that these were one-time effects. Firstly, students themselves acknowledged that they 'didn't have a clue' yet also state that the experience for those in younger years has improved: "they're showing them all the progress they made with the iPad in schools and everything and it's supposed to be a lot better" (Student in Olive's Class, Hillview School). Students also demonstrated an ability to judge their teachers' skills and attitudes with ICT, giving them a perspective and degree of authority in judging the quality of the programmes over time. The second factor, which only affected Seafront School, was the impact of poor Wi-Fi. If one were to control for the effects of poor Wi-Fi, it should be easy to imagine a more favourable initial reaction from teachers than 'frustration'. Although the differences in each school's initial rationale would lead them in different directions, Seafront School would almost certainly have had a better experience with robust Wi-Fi from the outset. The impact of poor Wi-Fi and the frustration it caused to staff will be an impetus for the adoption of teachers' virtual classrooms.

Chapter Summary

This chapter has provided a contextualised view of the participating schools and teachers, situating them as institutions and professionals, but also as actors in a broader education system which comes under varying degrees of pressure from parents as well as

political and economic forces. The nature of parents' expectations and their level of trust in the schools has been seen to have a significant impact on the innovations a school can implement. This chapter also set out the schools' vision for their mobile device initiatives, which were primarily focused on preparing for progressive curricular reforms. The process of designing the technical solution, and engaging with staff and communities was discussed. The initial reactions of teachers and students were analysed and led to a tentative theory on classroom implications. The addition of new data and reference to the research questions allowed the theory that the *classroom implications were unexamined* be established, as well as the finding that mobile learning as a practice was absent in the schools.

With a view of the schools, teachers and technology from the initial phase of these initiatives, I can now further examine the data and theories which emerged. Chapter 6 will explore teachers' virtual classrooms, which were notably absent of the start of the initiatives. Teacher's virtual classrooms will be shown to provide an opportunity for the schools to 'reboot' and recover from early challenges, or build on initial successes, by providing new abilities to schools, teachers, and students.

Chapter 6: Informal And Formal Communications

6.1 Introduction

This chapter introduces the categories *getting online and communicating* and *teachers' virtual classrooms,* shown in Table 6.1 with their sub-categories and focused codes. The analysis presented in this chapter focuses on students' informal communications and formal communications between teachers and students using teachers' virtual classrooms. The discussion of how teachers' virtual classrooms were used for other functions will be developed in the following chapter.

Table 6.1

The categories 'getting online and communicating' and 'teacher's virtual classrooms' with sub-categories and focused codes.

Category	Sub-category	Focused codes
Getting Online and Communicating	Internet Access	*Getting online*
	Informal communications & networks	*Backchannels*
Teachers' Virtual Classrooms	Purpose & Implementation	*Defining its purpose*
		Redefining practices
		Defining as teacher 'controlled' space
		Place is irrelevant
		Maintaining professional communications
	Functions of the TVCs	*Extending the activities of the class*
		Storing and distributing content
		Dynamic Lesson Planning
		Intentions for future use (growth)
	Teacher/student communications	*Initial tensions*
		Maintaining professional communications
		Experiences & expectations
		'Drawing a line'
	Embedding in school life	*Providing a focal point for dissent*
		Embedded in school practices
		School-wide approach
		Enhancing school practices

The analysis of these categories provided significant data to support the emergence of grounded theories. I will present a view of the participating students as an internet savvy and connected group, availing of technology and connectivity to maintain near-ubiquitous communications with their peers. I will explore how their networks form backchannels for classes, and how those backchannels can be both helpful and problematic. I will begin to discuss teachers' virtual classrooms, including the rationale for introducing them, and their purposes and implementation. I will then engage in a detailed examination of the sub-category *teacher/student communications*, enabling the introduction of the grounded theory that teachers' virtual classrooms functioned firstly *as a space for communications*. I will also draw on the study's research questions to explore the tensions and practical implications for teachers, and where appropriate, I bring in perspectives from the literature to enhance the discussion. The chapter will conclude by discussing and summarising the grounded theories which emerged, while signposting the discussion of further functions of teachers' virtual classrooms in Chapter 7.

6.2 Getting Online And Communicating

Getting Online

The students in this study reported a concern with getting online and maintaining connectivity throughout the day, whether 'at home', 'in school', or 'everywhere'. In both urban and rural schools, coding and constant comparison revealed no difference in the desire and ability to remain connected. Students reported an ability to move seamlessly from one internet connection to another as they moved through the school day, citing their commute to school on a bus or train, using school internet and Wi-Fi, and on to public

places or home after school. Students in Olive's class succinctly demonstrate the point when asked where they connect to the internet from:

```
INTERVIEWER:    So where do you guys connect to the Internet from?
                Where do you get Internet access?
STUDENT:        Home.
STUDENT:        School.
STUDENT:        Home.
STUDENT:        Everywhere.
```

<div align="right">(Students in Olive's class, Hillview School)</div>

Three of the places cited by students were noteworthy: school, home, and other public places. Coding revealed further insights into their experiences of getting online in each of these which I will now examine in turn. I will then discuss how students used that internet access to communicate.

When examining internet access in school (notwithstanding Seafront School's issues with Wi-Fi), students reported that the school internet filter caused them little inconvenience, nor held them back in any way. All schools in Ireland have a standard internet filter provided by the Department of Education and Skills; it limited students' access to inappropriate content but did not restrict messaging platforms. As will shortly be discussed, students made extensive use of messaging platforms and their continued ability to use them was a likely explanation for why students were not discommoded by the internet filter. Curiously, but tangentially, the designers of the internet filter were either unaware of the students' actual use of internet connectivity or felt that messaging services were unproblematic.

Despite widespread availability of broadband internet access in Ireland, see Table 6.2, a minority of households across the country remained unconnected.

Table 6.2

Table showing % of households with internet access in 2011 and 2016 from the Census of Ireland.

Teachers	2011	2016
Seafront School (local area)	87.62%	92.29%
Hillview school (local area)	58.31%	66.36%
Ireland	71.84%	78.45%

Notes: Sourced from the 2011 and 2016 Census of Ireland: http://census.cso.ie/sapmap_2011/

Hillview School's local area has a lower than average rate of connectivity compared to Ireland as a whole, and students in Martin's class gave an account of dealing with that challenge by using a cellular/mobile internet dongle:

```
STUDENT:          I live in an area where … we can't exactly get on to
                  the Internet so I, we had to go off the mobile
                  broadband but it keeps running out [of pre-pay
                  credit] so it makes group work a bit more difficult
                  because you can't communicate with anybody, you're,
                  kind of, blocked off …
```

<div align="right">(Student in Martin's class, Hillview School)</div>

While the challenge is more significant in rural areas like Hillview School's, some students in both schools were unable to get access at home[19]. Lack of internet access was not a personal issue for teachers, but an organisational one; they reported dealing with the challenge by making reasonable accommodations for those students by encouraging them to download resources in advance or being flexible with deadlines. In the case of Olive in Hillview School, she developed a new routine for students to manage the challenge:

```
OLIVE:            if they have an assignment for homework they would
                  download the file from Edmodo and just in case, there
                  might be a possibility that their Internet might not
                  work or something, they take a screenshot of it.
```

<div align="right">(Olive, Hillview School)</div>

---

19 In both Hillview and Seafront Schools, Principals indicated that in some cases, parents may have made a conscientious choice not to have internet access at home.

Students were highly attuned to the availability of Wi-Fi in public or commercial places, either of its availability by knowing in advance or spotting the Wi-Fi sign. They were aware of the process of getting online and indicated they had little hesitation in going or sending someone to ask for the Wi-Fi password if needed. A few students from Martha's class even suggested that Wi-Fi will inform choices they make about where to visit: "I mean if there's, if you're picking between two cafés or two restaurants or whatever and there's free WiFi in one you're going to go for the one with free WiFi".

Students strongly and consistently emphasised the importance of maintaining internet connectivity throughout the day, and based on their reports and other corroborating data; they substantially succeeded in this aim. While students have displayed a certain level of 'savviness' as discussed earlier, the technical skills required have not been beyond the reach of any student. Therefore, it is not possible to make any further claim about ICT skills or competency at this time. The connectivity and networks that were enabled by such access will be examined next.

Informal Communications And Networks

Having established that students maintain internet connectivity throughout the day, I can turn to the uses for that connectivity, in particular, their communications with peers. At this point, I must make a distinction between informal and formal communications, where informal relates to the private conversations of the students, and formal relates to the school and teachers as the distinction will be helpful in showing how traditional lines have become blurred. With that distinction made, this section will discuss the technical foundations of students' networks, their purpose in enabling various types of

communications, and how some of those related to the classes. I will present an emergent

grounded theory and begin to discuss the implications of it.

The technical foundations of students' informal networks were near-ubiquitous

internet access (as discussed), a mobile device (school iPad or personal smartphone), and a

range of messaging apps/services. Students reported consistent use of messaging services,

including iMessage, Facebook Messenger, WhatsApp (on their smartphones), and even

email. In most cases they emphasised ease-of-use as a dominant factor in which app/

service to use, resulting in very little technical skill being required to initiate or participate

in these social interactions. Students availed of the built-in features of their iPads and

reported using iMessage extensively and FaceTime (video chat) occasionally, valuing their

ease of use and versatility:

```
STUDENT:          I usually [use] iMessage because I'd say it's more
                  simplistic than emailing and Edmodo so I can, if
                  you're on Edmodo, you might send to more people than
                  you really wanted to and on emails, you need to type
                  in the address and then iMessage, it's just simpler
                  and you can put in a photo easier.
```

<div align="right">(Student in Tanya's class, Hillview School)</div>

A different student in Tanya's class reported using FaceTime to speak with her peers and

put forward some additional considerations for use; there was an ease of communication

with video which helped overcome auto-correct errors "if you were texting because it does

autocorrect and … it went on to something else". There was also a sense of authenticity

and trust which may be absent in a text-based chat or group conversation "… so it's like

easier to FaceTime so you know it's actually coming like from the person …".

Informal communications by students can broadly be categorised in two ways. The primary use reported by all students was for social interaction, which a student in Martin's class nonchalantly described as "just texting". There was some variation across the class interviews on the patterns of interaction, with a mix of one-to-one and group-based chat (although there was no discernible pattern based on school, age, or gender). The second use, also universally reported, was in the discussion of school life and their academic work. The use of students' informal networks was not unexpected given the availability of communications tools, but in light of the coding of the teachers' virtual classrooms, this usage took on a new significance. Interviews with students indicated that they saw Edmodo and Schoology as teacher-controlled spaces and not somewhere for them to communicate. As a result, when students wished to discuss schoolwork or homework they moved those conversations into their informal networks; a student in Tanya's class in Hillview School said: "That's not really what Edmodo is for though. If you wanted to just talk to each other, you should just check, start email instead of just using Edmodo". Students' conceptualisation of having separate spaces from their teachers is interesting; I will return to it later when I bring in more data to establish this theory. A limitation of this study and an opportunity for subsequent research is to understand if or to what degree, students' informal communications strengthen their friendships and relationship and provide academically beneficial support.

Prompted by my experience of initial coding of online observations, which exposed a preconception on my part (the expectation of visible online learning, discussed in Chapter 4), I was keen to understand if the teachers shared the view that little observable

learning was happening in the teachers' virtual classrooms. When I asked Olive "do you see any learning happening there?", she replied:

```
OLIVE:          It's hard to know at the minute because sometimes
                they will - they won't answer one another back on it,
                so you can see a lot of what's happening. Whereas
                they will iMessage one another, some of them FaceTime
                one another if they didn't have - if they couldn't do
                the questions, so I wouldn't see that but I'd hear
                them saying that.  So it's kind of hard to know like
                that.
```

<div align="right">(Olive, Hillview School)</div>

Olive talks about not knowing if a question had been answered on Edmodo as a discussion may have taken place between students directly. Her answer also implicitly rejects the premise of the question, instead it reflects actual experiences, where she had set an expectation about her speed of response and had encouraged students to respond to each other. While addressing the same topic, students in Olive's class indicate that while she is aware of their networks, she does not pry into them and she is happy that students support each other. There is evidence of the same phenomenon in Seafront School where students in Martha's class believe that Schoology is "a way of just the teacher giving us the homework, and when we don't understand the homework we just ask each other, like over iMessage or Facebook". Again there is an alignment between the students' use of those spaces and their teachers' expectations, where Martha would encourage students to help each other and had explicitly set that expectation with students. Of course, it must be acknowledged that some students would use the opportunity to take shortcuts with homework, and while the desire to copy is not new, the ease with which it can be done is now much more significant:

```
INTERVIEWER:    iMessage as well.  What type of files would they be?
                Do you share homework?
STUDENT:        No, not like –
STUDENT:        Yeah.
STUDENT:        Yeah, at home say you didn't do your homework and you
                just want someone else's answers kind of thing.
```

The final comment raises the question of teachers' intentions while designing tasks and whether their focus is the product or process? This question will be subsumed into a larger analysis of the impact of the examination system in Chapter 7. Students also indicate, somewhat pragmatically, that it is not only their prerogative to communicate in this way, but that there are practical limits to their teachers' abilities to supervise them.

At this point, it is possible to establish an emergent grounded theory. The responses above from Olive and Martha, and separately from their classes, provide triangulation and corroboration for the conclusion that *students are taking school-related conversations out of the teacher-controlled space and are using their networks as backchannels for class*. The theory will be further strengthened later in this chapter after I discuss teachers' virtual classrooms, and I will bring in a perspective from the literature to help understand the issues of power, ownership, and control. The emergent theory provides opportunities for discussion of the implications of this theory, although with a methodological caveat.

A practical implication of this grounded theory emerged during interviews with students, which was that some of the messaging groups (iMessage/WhatsApp) that were established did not include the entire class. Examples included a 'girls-only' group which was established in Martha's class, or in Beverly's class where a Facebook group *necessarily* excluded students without a Facebook account:

```
INTERVIEWER:    Right.  So, you've a Facebook group for the class?
STUDENT 1:      Yeah.
STUDENT 3:      Yeah.
STUDENT:        Yeah, it's [inaudible].
STUDENT 10:     It doesn't even have 12 people in.
```

(Students in Martha's class, Seafront School)

A later conversation with Beverly's students further elaborated the potential for exclusion. A student rejected the premise of the question, stating instead that their intention was not to purposely exclude, but that they were unaware that the excluded student(s) was actually on Facebook. While the answer may be genuine, it is problematic as it moved the burden of detecting and avoiding exclusion to the excluded party. In practice, this would require a student to know they were excluded and then seek to be added to the conversation(s), which may present a difficulty for a shy or less popular student.

```
INTERVIEWER:    Okay.  So, let me ask you a question.  If you're
                asking each other about homework would you ever think
                that the whole class might be interested in the
                answer to the question?
STUDENT 8:      That's why we make it group chat.
INTERVIEWER:    Does that group chat include everyone in the class?
STUDENT 10:     No.
STUDENT 4:      No.
```

<div align="right">(Students in Beverly's class, Seafront School)</div>

The implication is that a tension in a teacher's practice is now evident, which speaks to one of the research questions for this study. At face value, it may not be seen as a teacher's job to police, moderate, or have any role in students' informal networks where the risks include the potential for accidental exclusion or overt bullying (although none was reported in this study). As the students themselves indicated, these networks exist and will continue to exist regardless of teachers' or schools' views on them. Therefore an understanding of them by teachers may allow for some guidance on usage. There is also the question of pastoral responsibility and if the same standard of care should apply in the digital world as in the physical one, for example, does a teacher foster inclusion and collaboration in class through the careful use of a seating plan? Answering that question is beyond the scope of this study, but posing the question may prompt deliberation on a tension that teachers may have to resolve.

The methodological caveat relates to the research questions and my reflexivity. As I discussed in Chapter 4, 'it became clear to me that some of my expectations of what activities would be observed in these online spaces [teachers' virtual classrooms] were preconceptions'. With the theory that students are having school-related conversations in backchannels, it is evident that an amount of students' learning has moved into these spaces and became unobservable. As I have acknowledged, this study is limited because of its inability to observe evidence of learning in these spaces. Later in this chapter, I describe an activity that Beverly undertook as an experiment, where she used her virtual classroom to host a historical discussion. The process of students engaging with the question and each other's comments made the evidence of learning visible in the formal space of Beverly's virtual classroom.

6.3 Teachers' Virtual Classrooms

This section will draw on the category *teachers' virtual classrooms*, see Table 6.1 at the start of the chapter, and will begin by clarifying the terminology used to describe these formal online spaces created by schools and teachers. I will explore the school-level rationale for their introduction, together with the views on the purposes they could serve for schools and classes. I will explore how they operated as a means of communications, including any initial tensions, students' experiences and expectations, and issues of ownership. As this chapter focuses on informal and formal communications, the examination of the sub-category *functions of teachers' virtual classrooms* will be signposted here but will take place in Chapter 7, where a single grounded theory will encompass three distinct functions including *as a space for communications* from this chapter.

The exploration of the teachers' virtual classrooms will take a path through their early phase of use, where a snapshot of the phenomenon, as reported by the participants in the early stages of the study, presents useful data for comparison. The end of section 6.4 will offer reflections from teachers looking at the entire process and considering their future intentions.

Defining And Implementing Virtual Classrooms

Before the discussion, I must settle on a consistent definition for these formal online spaces. Throughout this thesis (except the literature review where I respect the authors' terminology) I have used teachers' virtual classroom to describe these online spaces created and owned by teachers. The literature and wider community of practitioner blogs, Twitter-based personal learning networks, and other education-focused fora will have a series of terms, many of which are used interchangeably: VLE, online learning space, and, virtual classroom. Indeed, in this study the participants highlight different aspects of use in their definitions: "we use Edmodo as a network, a virtual learning arena" (Principal, Hillview School), and "it looks a little bit like Facebook" (Martin, Hillview School). Unsurprisingly, the terms used to describe the platforms themselves are different; Schoology as a learning management system, and Edmodo as a digital classroom, see Figures. 6.1 & 6.2.

Figure 6.1. Description of Schoology. From schoology.com website (2017). accessed 15th August 2017.

Figure 6.2. Description of Edmodo. From edmodo.com website (2017). accessed 15th August 2017.

For this study, I have chosen to standardise the terminology and use *teachers' virtual classroom*, which I define as an online space created and owned by teachers for the purpose of communicating or interacting with their students beyond the limits of the physical classroom or timetable of classes. This term emerged from the data and is a synthesis of the range of descriptions encountered during the study and reflects the main characteristics of usage. The term also foreshadows some early findings, that students identify these as teacher-controlled spaces, and that it encompasses the various ways teachers used their virtual classrooms to extend their physical ones. This definition does not limit our understanding of what the platforms are used for; indeed it is flexible enough to reflect a variety of uses by teachers. Within the remainder of this chapter, each of the elements of the definition will be expanded on: *teachers'*, as the space is controlled by

teachers; *virtual*, as the place is online and the physical space is irrelevant; and *classroom* in that it extends the class activities.

As discussed in Chapter 5, the state of technology was somewhat limited at the outset of the programmes. Virtual learning environments, such as Moodle and Blackboard, which were popular in higher education were not optimised for mobile devices or the patterns of use that would later develop. The teachers' virtual classrooms were not introduced at the beginning of the study in either school, which allows an exploration of the rationale for their use separately from each school's mobile device initiatives. In Hillview School, the use of Edmodo emerged from within the iPad initiative becoming an integral and indistinguishable part; in Seafront School, Schoology was a 'reboot' of the iPad initiative and was considered separate as I will now discuss.

Rationale For Introducing Teachers' Virtual Classrooms

Having established a definition of the teachers' virtual classrooms, which both emerged from the data and foreshadows some of the later discussion, I am now able to examine the rationale for their introduction in the schools. There were some variations between schools and teachers, and in each case, the process of choosing the teachers' virtual classroom emerged as highly relevant during coding.

In Hillview School, Edmodo was experimented with by a few adventurous teachers who had encountered it though professional development courses and practitioner conferences during the first year of the initiative. Based on the experience of these early adopters, the staff collectively agreed to standardise on it during the second year. The

school had previously experimented with Moodle but with little success. In contrast, Edmodo was discovered and adopted by the teachers from the ground up rather than being a directive from the principal or ICT coordinator. It was evident in the interviews that the features of Edmodo appealed to teachers, in particular the ability to communicate and their belief that the Facebook-like interface would appeal to students. There was also an emphasis in the principal's comments that she saw Edmodo as a network which enabled communication, indeed she recognised the ability to link students, teachers and parents as one of its most attractive features. Her belief is echoed by Martin when he describes the benefits of increased communications.

```
MARTIN:          To give them the work and to communicate with them.
                 And again, if you're very clear the communication and
                 what is expected and do that continuously, there's a
                 level of trust then with the students that they know,
                 okay, well, there's no such thing as a free lesson.
```

<div align="right">(Martin, Hillview School)</div>

He points to increased communications, development of trust, and ultimately students taking more responsibility for their work and the learning process. When Martin's students were asked, they concurred, and their responses demonstrate that the rationale expressed was happening in practice, and later discussions will explore this in more detail.

```
STUDENT 3:       He usually gives them, like if they've fallen behind
                 in some work he gives them as homework.
STUDENT 5:       And he always puts it up on Edmodo as well so –
STUDENT 4:       Yeah, you can't fall behind.
STUDENT 5:       Yeah.
STUDENT 3:       Yeah.
INTERVIEWER:     Actually that's a good one.  So, who do you think is
                 responsible –
STUDENT 4:       It's yourself.
INTERVIEWER:     - for your learning?
STUDENT 5:       Yourself.
STUDENT 4:       Yourself.
INTERVIEWER:     Yeah, okay.  Does everyone agree?
ALL:             Yeah.
```

<div align="right">(Students in Martin's class, Hillview School)</div>

In Seafront School, Schoology was introduced as a management-led pilot in the second year of their mobile device programme. It was brought into mainstream use in the third year (the year of fieldwork). As discussed in Chapter 5, Seafront School's introduction of mobile devices was hindered by technical (mainly Wi-Fi) issues, with many teachers becoming frustrated and disengaged from the project. The principal saw Schoology as an opportunity to reboot the project:

PRINCIPAL: the introduction of Schoology. I think people will start to see huge opportunities of using it in the classroom and for sharing resources and that's, I think, the future of it not necessarily the eBooks.

(Principal, Seafront School)

She saw an opportunity to engage (or re-engage) the middle ground of teachers, the ones who were not necessarily 'techies' or advocates for technology. In her interviews, she identified two purposes. First, there was an emphasis on storing and distributing educational content which she believed would resonate with the priorities of the teaching staff, which resulted in the second outcome of re-energising the staff and rebooting the project. The school engaged directly with a Schoology partner and planned a substantial and structured roll-out which included whole-staff, subject department, and even one-to-one training and professional development for teachers. Martha is one such teacher who was in the pilot project, availed of one-to-one training, and later became an advocate or champion for Schoology. A self-confessed 'dinosaur' who was sceptical of the benefits of the iPads and ebooks, she felt that Schoology:

MARTHA: allows me to explore different ways of teaching and different ways of them interacting with me and keeps them, keeping them more engaged and keeping them more interested.

(Martha, Seafront School)

Martha's comments indicated her intention to create an environment open to continued innovation, which she later discussed as being particularly challenging. She felt there was a mismatch between her disposition towards innovation on one side, and her prior training as a teacher, and the demands of an exam-led syllabus on the other. So for Martha, there was a tension between what she wanted to do and how much of that she felt able and confident doing, a concern echoed to a lesser degree by Dan and Beverly. All teachers in Seafront School discussed developing students' responsibility, and while it was not to the fore in the principal's interview, it was a shared intention to develop that aspect further.

There is an obvious contrast in the approaches taken in each school which should be viewed through two lenses, first by looking at each school's reaction to the introduction of mobile devices and teacher's virtual classrooms, and second by looking at each school's self-identity. Taking the first lens, Hillview School's introduction of Edmodo was a natural evolution of the project, embracing the discovery of a small group of teachers and sharing the potential with the entire school. In Seafront School, Schoology provided a new focal point to re-engage staff and functioned as a reboot of the project.

> PRINCIPAL: But I think we've got in a new group of people with
>   Schoology, people who before might have thought, oh,
>   yeah, the iPads, not too keen on those but when they
>   see how useful it is for managing their classes,
>   coming out of them a different angle I think they're
>   now saying, 'Oh, yeah', and they're now talking at
>   the staff meetings and they're getting more people on
>   board. So, it's just, you throw the pebble in the
>   water and the circles just go out and you just have
>   to be patient.

(Principal, Seafront School)

Looking through the second lens, of each school's self-identity (discussed in Chapter 5), it is evident that Hillview School was embracing the potential for increased communications to enhance students' responsibility. It is also possible to see that when innovative practices

were advanced by a few teachers, they were embraced by a wider audience of teachers and the school leadership. It lends credibility to the principal's description of the school in Chapter 5 and its attitude to educational innovation. In the case of Seafront School, it is too early to discuss until a greater examination of the functions of the teachers' virtual classrooms has taken place. A tentative explanation is that Schoology acted as a 'reboot' of the iPad initiative, where a set of product features (becoming its functions) appealed to teachers in a way that the iPads did not initially. This subtle distinction will become more pronounced in the next section, and will ultimately lead to prompting questions for the data in Chapter 7.

Changing Or Creating New Routines

Following the discussion of the rationale for teachers' virtual classrooms and how they were implemented, the ways that teachers were changing or creating new routines and setting expectations for students can be examined. At the simplest level, it is the process of changing 'how we do things', and there is evidence in both schools of the whole-school level of these changes, although with varying degrees of progress. The process of changing classroom (or school) routines began with introducing students to the teachers' virtual classroom as a place for teacher/student communications, where the activities of the class have been extended to, or as a means for accessing their class content. It struck me that this approach for most of the teachers did not rely on any novelty in the use of technology and teachers were not aiming for 'fun', although Martha and Beverly felt that diverse content should engage students more. Olive described how she introduced students to basic tasks and developed their abilities and comfort level over time:

```
OLIVE:              No, this is part of how we do things.  You know, I'll
                    put notes up here, you'll be putting notes up here.
                    Eventually, when we started first of all, it was just
                    very basic, I was putting stuff up where they were
                    saying what was the homework and then we progressed
                    to them taking Educreations and putting them up or
                    taking videos of what they were doing and putting it
                    up as they got more used to working with it.
```

<div align="right">(Olive, Hillview School)</div>

Dan in Seafront School took a similar approach to guiding students, but admitted that he was at an earlier stage of progress and still developing his abilities:

```
DAN:                Yes, I think as I get more familiar with it and as I
                    have more practice using it, then I'll be able to
                    instruct them better.
```

<div align="right">(Dan, Seafront School)</div>

All teachers in the study, as well as the principals, reported that students were now expected to take responsibility for their academic work, especially catching up when they missed something. While it is clear that students were part of the process of changing routines, it is not evident that they were aware or consulted on the rationale for those changes. This point will be echoed in an upcoming discussion on how expectations were set but not negotiated.

Dan described his expectation of students to engage in that process and how he instructed them:

```
DAN:                as I do the tasks I allow access so suddenly they're
                    able to - it only becomes available after we've done
                    it in class. Anyone who's missed anything, literally
                    straight away I tell them okay we've covered that, we
                    covered that, go away, read it, come back to me if
                    you've any questions.
```

<div align="right">(Dan, Seafront School)</div>

He muses whether students will do so when bored:

```
        DAN:                    If they're feeling bored, they can still take out the
                                iPad, go onto Schoology and find out what they've
                                missed, they can just keep up to date with
                                everything. Now whether everybody is going to be
                                motivated to do that, that's a different
                                question.
```

Not only is the new expectation concerned with work and content, but with communications. Students are expected to use their teacher's virtual classroom as a way to remain connected to and engaged in the work of their class. As a means of communication, it is no longer bounded by the time of the school day or the physical space of the classroom. The expectations for communications will be explored shortly, but at a high level the teachers now expect students to collaborate and respond to each other.

A potential way to understand the new practices and expectations is to picture the old-fashioned homework journal. In the scenario where a student is not in class to record homework (or receive materials physically), they felt little or no obligation to get materials or to do the work. Students are now expected to do the work, as they have the ability to check for assigned work and have access to the materials, instead of being excused due to absence.

```
        AMY:                    ... in the past it would have been - 'we didn't know,
                                we weren't here, we weren't told' ... it was a given
                                that you didn't have to have your homework done
                                unless you were specifically told, whereas now it's
                                kind of changed. It kind of is a given that if you
                                aren't here, you're still expected to have the
                                homework. So whether you've got it off the teacher or
                                if you got it off the other students, and it will be
                                mostly off the other students in my case anyway.
```

Indeed, the principal of Hillview School, while reflecting on the experience of supervising a class, stated that the idea of there being a free class had disappeared. The data supports that being extended to say there is no such thing as 'no homework'. These new

expectations are not without tensions. Students in Dan's class confirm the new expectation, but one student acknowledges that they struggle to remember to check Schoology regularly:

```
STUDENT:       Just like that really annoys me because, if you don't
               see it, then you get in trouble.
INTERVIEWER:   Have any of your teachers set the expectation that
               you've to check it every day?
ALL:           Yeah.
INTERVIEWER:   Okay.  That's a general yes, is it?
ALL:           Mm-hmm.
INTERVIEWER:   And what happens there?
STUDENT:       I always forget.
```

(Students in Dan's class, Seafront School)

The student in Dan's class highlights an important point and potential tension. There is a subtle distinction between the type of training (or scaffolding) that Amy and Dan described earlier in this section, where students' abilities to undertake more complex tasks were developed over time, and of establishing the new routine 'check Schoology' on a regular basis. The student's comment reveals that a tension exists between their teacher's expectation that they would check Schoology, and the reality that they didn't. I must acknowledge that this tension only emerged in the data from Seafront School, and indeed this may well be the type student who would forget other elements of schoolwork.

To summarise the changes in routines (or procedures), I will draw on three familiar concepts: the space of the classroom, the time of the school day, and the homework journal. Ann describes how her virtual classroom extends the class so that a channel of communication exists where one would usually not.

```
INTERVIEWER:      How does Edmodo add on to the physical classroom?

ANN:              Edmodo is great; it kind of extends, I suppose it
                  extends the classroom outside of the school day so
                  rather than, I won't see them until Thursday or I
                  won't see them until Friday or I won't see them until
                  next week, if you really need to see them or to talk
                  to them or to give them a message or whatever between
                  this and then you can do that.
```

<div align="right">(Ann, Hillview School)</div>

Martin describes how students can catch up with a missed class, where the details of what was covered in class and the homework are accessible to students in a way that compensated for not being physically present to fill-in the homework journal:

```
MARTIN:           'So I have found that in terms of students who miss a
                  class catching up, that is not as much of a problem
                  now as what it was before the days of Edmodo.'
```

<div align="right">(Martin, Hillview School)</div>

The principal of Hillview School sums it up by saying "the routines of the school day are transformed".

Teacher-controlled Space

Students reflected on their use of and participation in their teachers' virtual classrooms and were firm in their belief that they were teacher-controlled spaces.

```
STUDENT 8:        I suppose that's a way of just the teacher giving us
                  the homework and, like, when we are, like, don't
                  understand the homework we just ask each other, like,
                  over iMessage or Facebook.
STUDENT 7:        Yeah. [Teacher] can see everything we put on
                  Schoology as well whereas iMessage or Facebook and
                  we're, say we're talking about something else she
                  can't see that whereas she can see everything [on
                  Schoology].
```

<div align="right">(Students in Martha's class, Seafront School)</div>

All students concurred with the views expressed by Martha's students which appeared to cause little or no concern to them. Their lack of concern was likely due to their ability to use other means for informal communications as a student in Tanya's class illustrates:

"That's not really what Edmodo is for though. If you wanted to just talk to each other, you should just check, start email instead of just using Edmodo". I have repeated that quote as it exemplifies students' beliefs about the virtual classrooms being teacher-controlled and also acknowledges that they serve different purposes (than intra-student communications) which are defined by the teacher. Students extended that belief to include the sharing of content, which they saw as a one-way process, controlled by the teacher:

```
INTERVIEWER:    So is that sharing files with each other or [Teacher]
                sharing files with you?
STUDENT:        Ms. [Teacher] sharing.
```

<div align="right">(Students in Amy's class, Hillview School)</div>

In Olive's and Martin's classes there is an example of another use however, where students shared artefacts of their work with each other and their teacher using Edmodo. These activities are captured in the coding of the teachers' virtual classrooms in Chapter 4 and will be discussed in Chapter 7. Moreover, when thinking about it as a communications space, it is again presented as a one-way system for announcements:

```
INTERVIEWER:    Okay.  So, when you think about using Schoology would
                you ever have a chat on there about your homework?
STUDENT 4:      No, you can't.
STUDENT 1:      That's mainly just the teacher.
```

<div align="right">(Students in Olive's class, Hillview School)</div>

The students' beliefs, expressed in interviews, can be triangulated with data from teachers and principals to see that the virtual classrooms are firmly teacher-owned and controlled from the moment of their creation and throughout their use. Indeed, even when they are used for student-generated content, the agenda or plan for use has been set by the teacher. The implications of this finding are not necessarily negative as the data show that students still engaged willingly with their teachers' virtual classrooms, and in Chapter 7 I will explore the patterns of use and benefits that accrued to the schools, teachers, and students.

A further consideration is that while the virtual classrooms were teacher-owned and controlled, they were not teacher-designed as teachers were required to accept the design choices made by the creators of Edmodo and Schoology in a way quite similar to how they would accept a textbook author's design (and editorial) choices. Taking Edmodo as an example, teachers indicated that the Facebook-like design was seen as attractive as it lessened the need for training of students. Students were eased into using Edmodo for schoolwork which likely lessened the friction in changing the routines of classes and the school. The extent to which the design choices of the platforms determined how they are used now emerges, i.e. did those designs have a deterministic effect on usage? To answer this question, I will add further data throughout the chapter and present a grounded theory at the end of Chapter 7.

I can return to the tentative grounded theory which I identified earlier, where I stated that *students are taking school-related conversations out of the teacher-controlled space and are using their networks as backchannels for class*. It is now evident that in addition to students believing that teachers controlled the virtual classrooms, teachers themselves did not envisage or place importance on facilitating intra-student communications in their virtual classrooms. Indeed, in a later section describing the focused code *drawing a line*, it will be explicitly stated that teachers either accepted or encouraged intra-student communications to move into their informal networks. With this grounded theory strengthened and established, I can bring in a perspective from the literature to help understand the students' actions and beliefs. Lodge and Lynch's (2002) seminal work on equality and power in schools in Ireland describes how certain less-regulated or unsupervised spaces are seen to be outside the control of teachers; a

phenomenon which may have increased since the research due to increased monitoring and surveillance. Those places, including students' toilets in particular, are used by students to retreat from supervision, allowing them to experience a measure of privacy and control. I can draw a comparison between the teacher-controlled virtual classrooms in this study, and the teacher-controlled physical classrooms described by Lodge and Lynch (2002). In this comparison, there is a striking similarity in how students move conversations, whether they are physical or digital, into unsupervised or less-regulated spaces. Indeed, it is important to note that students' iPads and Edmodo (in the case of Hillview School) would be on their desks during class, and a student could quite easily initiate a conversation by posting in the group or responding to an original post from the teacher or a classmate. In general, they did not do this as the coding of the virtual classrooms revealed. So while the tools were at their fingertips, and even permissible to use during class, they opted to take the conversations into different spaces, even with the potential difficulty of using a personal (non-school) device for that conversation. The similarity in the ways conversations moved into unsupervised spaces suggests that the power relationship currently at work in Irish schools is being perpetuated into new virtual spaces, as students move their conversations beyond the sight of their teachers. Lynch and Lodge's (2002) work provides an insight into the Irish context and cultural norms and places the grounded theory firmly in the realm of expected, or at least explained, patterns of behaviour in schools in Ireland.

Place is irrelevant. This focused code is an 'in-vivo' one, and it refers to students' and teachers' beliefs that it is easy to remain connected from almost anywhere and at almost any time. I will present two perspectives, the first returns to students who are just

'chatting' and brings in a view from the literature to help understand those networks, and second, of teachers who may be thinking of pedagogical uses. I will then illustrate the point with an event which took place during the field work.

It has been established that students have a high propensity to be online and that they are likely to always have a mobile device with them. Students' conversations may be social for the most part, although they admit that schoolwork can be part of the conversation. A perspective which may provide an insight into how students conceptualise these networks can be added by returning to the work of Castells (2008) in the literature review. When the students in this study describe how they get online, and how they use internet access, they indicate that they too have created a wireless skin that overlays their lives. He describes how recent increases in connectivity, both in scale and degree, have created new ways for humans to associate, communicate, interact and ultimately form networks; Castells (2008) notes:

> We now have a wireless skin overlaid on the practice of our lives, so that
> we are in ourselves and in our networks at the same time. We never quit the
> networks, and the networks never quit us; this is the real coming of age of
> the networked society. (2008)

Castells (2008tg) still believes that physical proximity is necessary, that it provides a unifying place and in this study, that unifying place is the school. Dan and Beverly provide a pedagogical perspective from teachers, beginning with Beverly's reflection on an activity she experimented with where students participated in an online discussion activity. She highlighted that students did not need to be proximal to her or each other for learning to take place, echoing the 'place is irrelevant' code (we will return to this activity

again). While the data so far suggest that school-related conversations on students' informal networks are the minority, Dan offers a cynical view on both the potential and reality of students' communications:

```
INTERVIEWER:    Some of the students said that they will be using
                Wi-Fi on the bus home?
DAN:            Yes.
INTERVIEWER:    So do you think that can actually turn the bus into
                an extension of the classroom or become a learning
                space of its own?
Dan:            Well, I would be very pleasantly surprised if they
                were using the Wi-Fi on the bus on the way home to
                actually do work and to study.
```

<div align="right">(Dan, Seafront School)</div>

Martha echoed Beverly's discussion about the potential when she said "that's my understanding of virtual classroom, if you teach without a person being in the classroom" and her comment foreshadows an event which took place in Hillview School.

During the fieldwork, Martin was injured in an accident and hospitalised, but thankfully made a full and speedy recovery[20]. The incident presented an extreme case through which we can view the potential for teachers' virtual classrooms to work independent of physical place and yet the incident raises substantial concerns. Despite being injured and hospitalised, Martin felt a responsibility to his students who were approaching examinations and continued to communicate with them. In reality, he was leading the class from his hospital trolly by setting daily classwork and homework. He commented that having his smartphone, internet access, and Edmodo make it 'just so doable', not only was it doable but initially invisible to the students who were unaware of his accident:

```
INTERVIEWER:    What did you think about that?
STUDENT 5:      It never really clicked that he was still sending
                them from the hospital.
```

---

20 I was granted explicit permission to code and discuss this event.

The students recognised Martin's commitment to the class "that's commitment", but the data indicated that they would have preferred free classes instead! The Principal of Hillview School offers her view some weeks after his full recovery:

```
INTERVIEWER:    Okay.  One of your teachers continued to teach his
                class while in hospital. What did you think about
                that situation?
PRINCIPAL:      Well, I'd be all for it. It's the, what's the word I
                want, the flipped classroom, and students have
                continued to learn while they're at home, because of
                the way the thing is set up now with the Wi-Fi and
                the iPads and the Edmodo. But yes, I mean the teacher
                could - there was somebody supervising them and he
                could still teach them away and show them what to do.
```

(Principal, Hillview School)

Obviously with his health recovered, she was addressing the broader points raised by the incident and the potential for a flipped classroom approach. In this case, it was not the flipped classroom at work. Instead, these classes became revision classes with the directions and materials coming from Martin and the student physically supervised by a colleague - so while no new content was covered, valuable work was done. A few conclusions emerge from students' and teachers' perspectives on the ideas that place is irrelevant. At a high level, it does indeed appear that place can be irrelevant, but that *time* is a concern, although only for teachers, a point I will return to shortly.

6.4 Teacher/Student Communications

As I began to examine the functions of the teachers' virtual classrooms, it became clear that the prominence of *teacher/student communications* in the data warranted treating the topic separately. Indeed, *teacher/student communications* became a sub-category and within that three focused codes emerged, which were *initial tensions*, *experiences and expectations* and *'drawing a line'*. It was clear that both schools intended to avail of

mobile devices to increase communications between students and teachers–and also parents in the case of Hillview School–but the focused codes foreshadowed teachers' concerns about the implications. The discussion about communications in this chapter will therefore take place in two parts. This first part, which encompasses *initial tensions,* will discuss communications from a school-level perspective, where the school has aspirations to enhance collaboration, and also where concerns emerge from teachers. The second part will examine the class-level aspects, where the ability to communicate outside class time was central to the emergence of new or revised classroom routines.

Initial Tensions

The interview guide for teachers, and later interviews with principals, explicitly asked if there were initial tensions after the introduction of virtual classrooms, in an attempt to directly address one of the research questions. In the few cases where tensions were reported, they were around the timing of communications, maintaining professional communications, and managing internet access. This section will explore those tensions and how they were prepared for and resolved. The potential for communications between students and teachers outside of class time or the school day existed from the beginning of the projects as all teachers and students had email accounts supplied by their respective schools. Some of the responses in Seafront School mentioned email, as Schoology was introduced in the second year, but overall most related to Edmodo or Schoology as email did not appear to achieve the same impact. The principal of Hillview School discussed initial tensions by saying there were very few and that 'for teachers and students it seems to be working very well'. She recalled only two complaints since they began using

Edmodo, both were the result of miscommunications which were resolved easily by a conversation with staff, which she illustrated with this example:

> PRINCIPAL: Another tension though that did arise twice this year was a parent ringing in to say that a teacher had put up work late at night on Edmodo and the student was in a tizz because they hadn't got it done for the next day.

(Principal, Hillview School)

While investigating, the principal discovered the miscommunication and realised they had not agreed on revised routines for communications, which were then enacted in response:

> PRINCIPAL: No, when we checked it, the teacher was going to be out the next day and there was just a bit of miscommunication. But that was something I wouldn't have thought of so we went back to the teachers and we said, look, make sure you have it up before six o'clock or whatever time it is…

(Principal, Hillview School)

It is evident that as the school went about changing some of its routines (as discussed), specific areas had been overlooked. The solution, which resolved the tensions, was to set clear expectations which would provide students with a consistent experience of using Edmodo with all (or most) teachers in the school and there is evidence of a positive change as a result. This approach also addressed the second tension, that teachers may not respond to students, and it was agreed between the principal and teachers that they would set clear expectations which we will shortly explore. She took the opportunity to acknowledge that teachers will have other commitments to balance:

> PRINCIPAL: … teachers might be playing a match or doing whatever themselves in the evening or training or at the gym or whatever so they mightn't get back to them. So sometimes students feel certain teachers don't get back to them.

(Principal, Hillview School)

The principal's example of work being sent late by a teacher actually occurred in Olive's class allowing for triangulation of that data, and the students' account of the incident shows it as an exception which caused little to no stress for the majority of the class:

```
STUDENT 5:      Ah, she only, she only did it once though because
                she, like, thought no one was awake.
INTERVIEWER:    And was it at 11 for the day after?
STUDENT 5:      Yeah, I don't think many people actually got that
                work done.
STUDENT 2:      Yeah, and she was okay with not having it done, like.
STUDENT 3:      She was okay.
INTERVIEWER:    Okay.  Normally what time is it?
STUDENT 3:      She normally does it, like, in class, like,
                when you're leaving, like she'd do it, like, for us,
so…
```

(Students in Olive's class, Hillview School)

Olive experienced the reverse situation where she was contacted one night at 23:30 by a student who was concerned about homework. Rather than engage, Olive instructed the student to go to bed; a response which shows a certain blurring of the lines between teacher and parent:

```
OLIVE:          one student emailed me at 11.30 at night and said,
                'Miss, I can't do this.  This won't open' and I said
                'Why are you still doing homework at 11.30 at night?
                Go to bed, we'll sort it tomorrow'.
```

(Olive, Hillview School)

For a variety of valid reasons, a teacher may be posting messages, content or be otherwise active on their virtual classroom late into the evening, which presents a potential tension where a teacher may be in a similar position to Olive and potentially step into a different role. I will approach this tension from two perspectives, the first being a policy one which brings in the Teaching Council's (2012) *Code of Professional Conduct*, and second, from an ethical perspective by considering Hogan's (2011) view on the ethical orientation of education.

A specific question was put to each principal about maintaining professional communications between students and teachers, and whether the schools had policies or relied on the Teaching Council's (2012) *Code of Professional Conduct* or an in-house policy. In both cases, the principals had respect for their teachers' professionalism and praised the quality of the rapport and relationships between students and teachers:

```
PRINCIPAL:      I would say it hasn't changed things much at all
                because I think we always had good relations in this
                school between teachers and students, there was
                always good respect, good rapport and people, most
                teachers followed this anyway before it was in print.
```

<div align="right">(Principal, Seafront School)</div>

```
PRINCIPAL:      ... well, all teachers would – we haven't got a
                school one but all the teachers would have the
                Teaching Council one and we'd refer to that very much
                in all that we do with our teachers as well.  If
                there was an issue between a student and teacher, we
                very much always say well, you're the professional in
                this situation so, yes, they would be very aware.
```

<div align="right">(Principal, Hillview School)</div>

The relevant sections from the Teaching Council's (2012) *Code of Professional Conduct,* which describe how teachers should communicate, including digitally, are quoted below:

3.6 [Teachers should] communicate effectively with pupils/students, colleagues, parents, school management and others in the school community in a manner that is professional, collaborative and supportive, and based on trust and respect.

3.7 [Teachers should] ensure that any communications with pupils/students, colleagues, parents, school management and others is appropriate, including communication via electronic media, such as e-mail, texting and social networking sites.

To return to Olive's scenario, and to use the *Code of Professional Conduct* as a lens, we can see the apparent tension where by directing a student to 'go to bed', she had assumed a role greater than that of a teacher. The *Code of Professional Conduct* requires that any

communications are 'appropriate' and here we can see at least two possible interpretations. The first is that a parents/guardian would be grateful to Olive for calming their child (potentially an anxious teenager) and regard the instruction as appropriate and indeed helpful. A different interpretation, however, is that the parent/guardian may object to any communication late at night and also the instruction to 'go to bed', regarding both as inappropriate. The reality may be somewhere in between these two examples, but is it clear that a significant amount of professional judgement will be required of the teacher in judging 'appropriateness'. I will now present a perspective which may assist in that judgment.

In his discussion of ethics and education, Hogan (2011) describes the relationship that may exist between students, teachers and parents. He contends that the legal concept of *in loco parentis* distracts from the educational responsibility of teachers with a legalistic focus on being stand-ins for parents, in contrast, he suggests "... the teacher's first responsibility is to the child's progressive and healthy learning" (2011, p. 37). Accepting Hogan's position, I can draw a distinction between *in loco parentis* and what could be called *in pedagogis virtualis* – where the teacher is virtually present with the student(s). It is through this distinction that Olive's experience can now be re-framed.

In Olive's description of the event, once she realised the student was up late, she instructed them to go to bed. It is plain to see that she acted in place of the parent by enforcing a bedtime. That act becomes problematic when one considers that Olive did that without an invitation from the parents or an awareness of the rules of the house. In that household, it may have been acceptable to have a late bedtime and Olive's un-negotiated stepping in

brought her values and beliefs about parenting to bear on that child. Re-imagining Olive's conversation to reflect an *in pedagogis virtualis* approach reveals the tension. Rather than instructing the child to go to bed, she could have said 'you have done enough, we will resume tomorrow'. In this scenario, Olive would have only invoked her authority as the teacher to bring the task to a conclusion for the night, and would likely have achieved that aim without giving the type of instruction typically reserved to a parent. A strict reading of the *Code of Professional Conduct* may have sensitised the teacher to the potential issue and tension, but does not offer a way to judge an appropriate course of action. Adapting Hogan's view on educational ethics could allow a teacher to manage this new tension brought about by the use of teachers' virtual classrooms.

A tension which was actively prepared for in Hillview School was the lack of internet access at home. We have already heard of one student's difficulty as well as Olive's change in routines to mitigate the issue. Not only is the potential for lack of internet access to be an issue, but students may avail of the excuse that there was no internet access, turning it into the digital equivalent of 'the dog ate my homework' excuse.

```
PRINCIPAL:      sometimes there might be Internet issues at home too.
                Not that often but we thought in a rural community
                that would be a huge tension but it hasn't really
                been.
```

(Principal, Hillview School)

Despite these concerns, and likely because the teachers were actively prepared, the issue was ultimately very manageable at a whole-school level; a finding triangulated from multiple sources of data.

In Seafront School, the same initial tensions did not arise prominently in the data. Based on earlier coded interviews, I probed the topic with specific questions. As an example, Beverly gave an estimate of the number of messages she received outside of school hours and was unperturbed by them:

```
BEVERLY:        altogether there's probably been ten since September
                [7.5 months prior], you know, that gives you an idea
                around that amount.
```

<div align="right">(Beverly, Seafront School)</div>

Beverly also reported that teachers were firm in setting expectations, which I will explore next and likely contributed to the lack of reported tensions. It may also be the case that the pattern of use for Schoology, which involved far fewer messages, also lowered the potential for tensions in the same way as in Hillview School.

Experiences & Expectations

A number of focused codes emerged around the topic of students' experiences of teacher/student communications using their teacher's virtual classrooms; those experiences may have prompted, or been the result of, teachers setting clear expectations. Four themes emerged sharply, and when posed as questions, allowed me to make comparisons between teachers, those questions were:

- What experiences and expectations did students have of messaging and communications in their teachers' virtual classrooms?
- What expectations did teachers set with their students? Would communications be one-way or two-way?
- What was the reported or observed timeframe for messages and communications each day on the teachers' virtual classrooms?
- What aspirations, intentions, or concerns were expressed by teachers?

Interestingly, while the questions are framed around students, the answers primarily come from teachers' perspectives, lending further weight to the grounded theory that these are teacher-controlled spaces. The comparison across the set of teachers is presented in Tables 6.3 & 6.4 below, followed by a summary discussion.

Table 6.3

Table showing extracts from focused coding of responses by students and teachers from Hillview School which present a view on experiences and expectations for teacher/student communications using teachers' virtual classrooms.

Teacher	Students' expectations and experiences of messaging	Expectations of messaging set by teachers	Reported/observed timeframe for messages	Aspirations, intentions or concerns expressed by teachers
Tanya*	Students experienced two-way messaging.	Tanya responded to 50% of students' messages which posed questions (n=8)	There is no time index on Edmodo. Unable to state reliably.	N/a
Amy	Students experienced one-way messaging. *They kind of just say they'll reply when they can, like they don't really say'* *'You have to respect too they have lives as well ... Like everyone gets that at this stage'*	*When I started with Edmodo I replied to messages. Then it drove me mad because you could have a class where there could be 10 missing on a day ... so I used to reply to it; now generally I don't want to reply to it. I let the other kids reply to it themselves.'*	Early morning to 22:00.	*Most of them just accept it, that's right across the board, all their teachers and that's just the way things are done.*
Martin	Students experienced two-way messaging. *Well, he probably won't answer after a certain time but you can still ask, somebody else might answer."* *'He could be in bed'*	*It's something that they can use to catch up on if they've missed a lesson or to know where they stand.'* *'So I have found that in terms of students who miss a class catching up, that is not as much of a problem now as what it was before the days of Edmodo.'*	Early morning to 22:00.	*Yeah. I presume it's the same with every ... teacher in the school. The expectation is that if you miss a lesson, you make every effort to catch up. You should catch up unless you have a valid reason that you haven't been able to do so by that time'*

Teacher	Students' expectations and experiences of messaging	Expectations of messaging set by teachers	Reported/observed timeframe for messages	Aspirations, intentions or concerns expressed by teachers
Olive	Students experienced two-way messaging. *Usually most teachers say, like, if it's past eight o'clock don't bother learning it, like ... It's for the next class'.*	*So I'll tell them I may not get home until 7.00pm ... I may not be able to answer you back. And I'll tell the students to answer them back.'*	Early morning to 21:00.	

Notes: quotes are from the named teachers or their students, unless otherwise indicated. *Tanya went on parental leave and was unavailable for further interviews, therefore some of her data is observational only.

Table 6.4

Table showing extracts from focused coding of responses by students and teachers from Hillview School which present a view on experiences and expectations for teacher/student communications using teachers' virtual classrooms.

Teacher	Students' expectations and experiences of messaging	Expectations of messaging set by teachers	Reported/observed timeframe for messages	Aspirations, intentions or concerns expressed by teachers
Dan	INTERVIEWER: *Okay. Have you ever had to email [Dan]?* STUDENT 1: *No.* INTERVIEWER: *Has he ever emailed you?* ALL: *No.*	*Because I'm a Year Head and they would have been more practical kind of issues or ... an issue with work experience ... and they'd had to send me an email then obviously I reply to that. But I would imagine down the line [with other students], I would probably ignore it until the next day.'*	During school hours generally, but also *'straight after school'.*	*You know, but I do think you have to draw a line and have your personal and working life.'* *'Now, I do have a little problem with it that I think we need to be very careful that this doesn't turn into a 24/7 job. You know, that I work from nine until 4 o'clock.'* *'... as I get more familiar with it and as I have more practice using it, then I'll be able to instruct them better.'*
Martha	INTERVIEWER: *Okay. Someone said she sends you messages late at night.* STUDENT: *No, it's just, it's kind of a reminder about the homework. So, before she said, 'Just to remind you that you have…', I don't know if it was a test or homework or whatever, she goes, 'Just a reminder that you have this the next day', or whatever.*	*If I sit down and I open up Schoology if someone has commented and I would actually look at it and if I assess whether it's an urgent thing or it's something that can wait 'til the next day ... But, yes, I will, I will look at it, I won't ignore it and if it, no, I won't ignore it but I may not take act on it.'*	Early morning to midnight.	*It's a learning thing, as in they're learning to use this system. I want them to embrace it and, therefore, I encourage them to put up the messages on it.'* *'And if it's something I think that will get the kid less stressed I will answer it. If it's something that won't have them stressed and it's something that they probably can access somewhere else I will leave it go until the next day.'*

Teacher	Students' expectations and experiences of messaging	Expectations of messaging set by teachers	Reported/observed timeframe for messages	Aspirations, intentions or concerns expressed by teachers
Beverly	STUDENT 2: *If you needed her, you could email her.* INTERVIEWER: *Okay. And what happens?* STUDENT 2: *She'll email back.* INTERVIEWER: *Always? Sometimes?* STUDENT 2: *Most times.* STUDENT 5: *Most of the time.*	*I will reply all right, at whatever time. I might see the message when I check, but it would usually be through email.'* 'And it would usually be about making sure that they're doing the right thing. But one student did say they had difficulty with one thing, but I wasn't going to explain it then and there because I'm in bed at home'	Early morning till late at night.	*... before I go to sleep and I'm on my email. Why am I on my school email? I don't know, it's bloody addictive is what it is, and I want to check and see what's - if I've missed anything.'*

When considering the students' experiences and expectations presented above in Tables 6.3 & 6.4, they align with their beliefs that the virtual classroom is a teacher-controlled space where the expectations are set rather than negotiated, and therefore the experiences are of a space that operates as the teachers wished or intended. Students showed a general awareness that teachers have other commitments and appear to have moderated their expectations. As a result, in many cases they expect another student to answer the query.

When looking at the expectations that teachers set (usually whether students will get a response or not), we continue to see that it is the teacher in control of students' experiences with the virtual classroom, and while many show great care for their students, the teacher still controls it. The expectations that teachers set (expressed or implied through experience) were varied, ranging from 'ignoring' a message to 'looking at it but not acting' to answering a student promptly. In many cases, they encouraged other students to answer, but again those decisions are exercised solely by the teacher. In some cases, the teachers have deliberately stepped back to allow students to reply, the next section on

'drawing a line' will look at two examples where virtual classrooms which had two-way communications changed to mostly one-way communications. That said, other teachers including Martha, Martin and Olive, were still communicating with students well past the traditional end of the school day up until late in the evening.

Most teachers expressed an aspiration, intention, or concern about their use of a virtual classroom, of course, many of the aspirations are implicitly shown by most of the teachers, but their answers in the areas they chose to highlight presented an interesting perspective. For example, Dan expressed concern about teaching not being '24/7'; but he aspires for students to take more responsibility for their work, although there are sacrifices (of personal time) he will not make for that. In contrast, Martha is deliberately sacrificing personal time to answer messages from students to avoid causing them stress and also to encourage them to embrace Schoology.

The data gathered for each teacher, and the ability to compare them presents the opportunity to classify not only how they used their virtual classroom as I have done in this section, but to characterise their level of enthusiasm or their level of embrace. Based on a combination of data in Table 6.4 (showing expectations and experiences) and coded observations of patterns of use in Appendices 4A & 4B, I can triangulate to classify the teachers accordingly in Table 6.5:

Table 6.5

Table showing characterisation of each teacher's embrace of their virtual classroom.

Teachers	Characterisation of adoption of teacher's virtual classroom	Notes
Hillview School		
Tanya	Enthusiastic	
Amy	Cautious	
Martin	Enthusiastic	
Olive	Enthusiastic	While Olive may temper how and when she responds, her patterns of use (in particular) for peer assessment), justifies her classification.
Seafront School		
Dan	Cautious	
Martha	Enthusiastic	Martha was the heaviest user of Schoology, and sacrificed personal time to encourage students to participate
Beverly	Enthusiastic	

While it is evident that each of the teachers has embraced their virtual classroom, it is possible to see and classify those embraces as either *cautious*, where concerns and reservations exist and must be managed, or *enthusiastic*, where aspirations are to the fore and issues will be managed as they arise.

'Drawing A Line'

I have identified two teachers as having embraced virtual classrooms cautiously; it is these two teachers who provided the 'in-vivo' code drawing a line, although each has a different rationale. By examining data from each teacher, one can better appreciate their caution.

Amy describes how her interactions with Edmodo changed, where initially she replied to messages but found they were often procedural, with students querying assigned homework. Amy was not inclined to respond to trivial queries, as she felt they could be

answered by the students and she suggested it was an unnecessary duplication of effort. For educational queries (i.e. non-procedural), she would still engage to help and support students, for example with project work. Amy stated '... I think you have to draw a line somewhere', and potentially drew it along traditional lines where she is responsible for teaching and students are responsible for homework.

Dan's reluctance stems from a firm belief in the boundaries of his job and is keen to stress that it is a 'nine to four' job, and while he does work beyond that, he counts that as being over and above his contracted hours.

```
DAN:                    Now, I do have a little problem with it that I think
                        we need to be very careful that this doesn't turn
                        into a 24/7 job.  You know, that I work from nine
                        until 4 o'clock.
```

<div align="right">(Dan, Seafront School)</div>

He has a concern about the collaborative and conversational elements of Schoology creating an expectation of a '24/7 on call' situation. In some limited cases, he does respond to students emails - although the example he gives is urgent contact from transition year students on work experience. He feels that he would likely ignore student contact via Schoology until the next school day if it became common practice, stating '... I do think you have to draw a line and have your personal and working life'. The legacy of Ireland's economic crash (discussed in Chapter 5) and resulting industrial relations difficulties should be borne in mind when discussing Dan's concerns about new expectations of teachers. The conversation with the students confirm that there is little interaction via Schoology, and certainly none after school hours. Dan does describe other scenarios though, as a year head and coordinator, where he would respond to urgent issues:

```
DAN:                    … because I'm a year ahead and they would have been
                        more practical kind of issues or someone mightn't be
                        in the next day or there's an issue with work
                        experience …
```

He has made a similar decision to Amy, though he has set a higher threshold where he would respond or intervene. He declines to respond as a classroom teacher but will where he has a pastoral or organisational role.

While Amy and Dan are the teachers most concerned with their work/life balance, these concerns may well be shared by all teachers even if they chose not to highlight them to the same degree in their interviews. The principal of Seafront School offers her view on the concerns for teachers' work/life balance, which contrasts strongly with the teachers' views:

```
PRINCIPAL:              I suppose I don't have a huge amount of patience with
                        it, I'll be honest. I think work-life balance is
                        important but I think there's no better profession
                        for having a work-life balance in the overall scheme
                        of things than a teacher.

                        This is a great school, I know that. There's a huge
                        amount of work going on. But even if they work 28
                        hours, even if they work 30 hours tell that to
                        somebody who's working a 39-hour week anyway by
                        prescription and then, as I know, a lot of people are
                        working 'til seven-eight at night. I see my own kids,
                        they don't get home 'til seven-eight-nine in the
                        evening. I think teachers sometimes don't live in the
                        real world so I wouldn't have a huge amount of
                        sympathy for that.
```

Martin provide an example of a teacher who did not draw a line. His example of teaching from the hospital is a useful one; it shows a blurring of the boundaries between work/ school life and private life. For some, teaching while hospitalised would be an extraordinary and outrageous demand, that the time ought to have been spent resting and recuperating instead of 'teaching'. Two closely related implications emerged in response.

The first, and also most likely to occur, is that imposing on personal time can become problematic and this emerged in the focused code *work/life balance* which will be discussed in an upcoming section. The second is the distinction of whether one is fit or unfit to work/teach, which is likely to be a rarer situation. In the example of Martin being concussed and in hospital, he was deemed medically unfit and indeed may be barred from the school premises for insurance reasons, but could still engage in the virtual teaching space. Before Edmodo it would have been highly unlikely to be both unfit to teach (medically) and physically present in school, yet when place is irrelevant a teacher can continue to teach and must now manage that tension. Place may be irrelevant, but time and fitness to work/teach are highly relevant.

6.5 Grounded Theories And Chapter Summary

In this final section of the chapter, I will bring together the grounded theories which have emerged from the categories *getting online and communicating* and part of *teachers' virtual classrooms*. The theories are stated as a series of propositions, conforming with Creswell's (1997, p. 56) suggestion that a grounded theory "can assume the form of a narrative statement, a visual picture, or a series of *hypothesis or propositions*" [my emphasis]. I also performed a clustering exercise and have presented the theories as a concept map in Figure 6.3. The map allows a thematic visualisation of the theories as well as the inter-relationships between them; the map will be updated again at the end of Chapter 7. While *teachers' virtual classrooms* and *students' informal networks* were separate categories, the visualisation is useful in highlighting that strong relationships do exist between them.
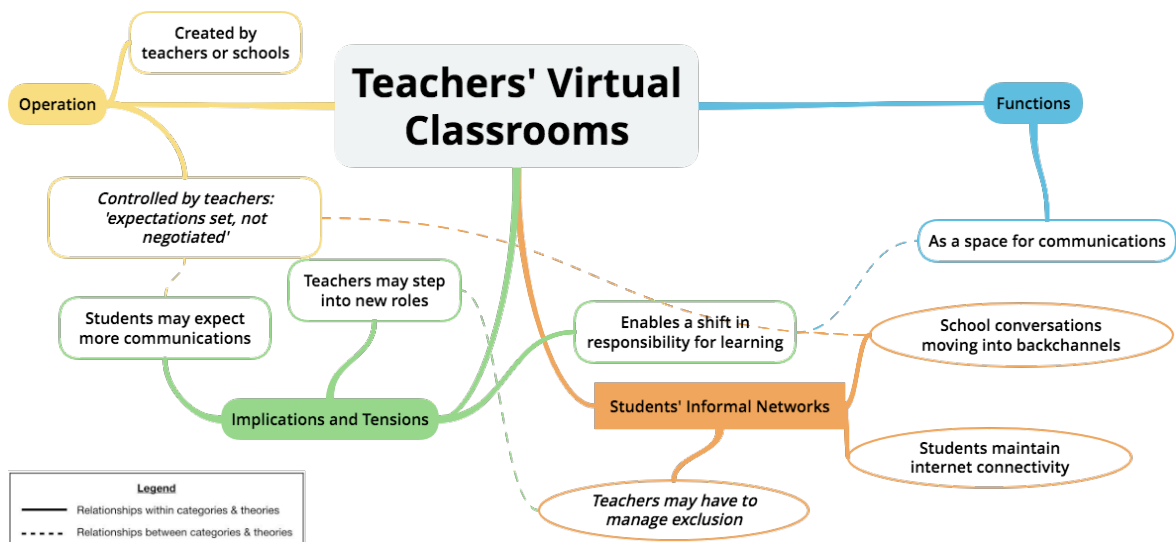
Figure 6.3. Figure showing a concept map of the grounded theories at the end of Chapter 6.

Many of the theories emerged and strengthened throughout the chapter as more data were added. This chapter also addressed one of the research questions, specifically the sub-question *identify any tensions that may have resulted from changes in students' expectations of teachers within a mlearning practice paradigm*. The theories which emerged were not limited to the research questions. As a grounded theory study, it was able to use the research questions as sensitising topics and adjust the focus by drawing on participants' experiences, actions, and beliefs to uncover the functions, operation, and implications of teachers' virtual classrooms, while also addressing students' informal networks and the inter-relationships between them. This section will summarise and discuss the grounded theories, address the research questions by adding additional perspectives, and allow me interrogate some earlier analysis and theories.

Students' Informal Networks

While *students' informal networks* emerged as a category, there was substantial evidence of strong inter-relationships with *teachers' virtual classrooms* as has been

discussed. The networks were enabled by students' internet access, which was presented as a 'wireless skin', although issues of exclusion also emerged.

Students remain connected. It is evident that students are adept at maintaining internet connectivity throughout the day and in various places. They place great importance on maintaining that and have sufficient technological skills to manage the process of getting online and establishing networks of communications across various social network, messaging apps and platforms.

Managing exclusion. Students were shown to create backchannels for classes using their informal networks. It emerged that there is a potential for exclusion of some students from those networks. The potential tension for teachers is to consider if and how they may become aware of this exclusion and if they would then be required to manage it.

School conversations moving into backchannels. Students acknowledged that virtual classrooms were teacher-controlled spaces, and as a result took school-related conversations out of that space and are using their informal networks as backchannels for class. In some cases they did this to avail of other ways of communicating as we saw with video calls, but for the most part because they felt that their communications were not the purpose of the virtual classrooms, or even that they may be intruding on their teacher's private time. The implications and tensions will be examined next.

Student/Teacher Communications

Teachers' virtual classrooms enabled the increase in student/teacher communications, coding revealed that very few initial tensions were evident and that schools availed of these new ability to change school routines.

Initial Tensions. The data revealed very few reported tensions, those that were foreseen, for example, the availability of internet access, were well managed and unproblematic. When unforeseen tensions arose in Hillview School, they were around after-school communications and were resolved through setting clear expectations, which form a theory to be discussed shortly. In Seafront School, there were very few tensions reported, but as the school had a highly structured introduction of Schoology, it is evident that the issue of after-school communications had been foreseen and addressed.

Changing routines, enabling a shift in responsibility for learning. The ability to communicate at whole-school or class level enabled schools and teachers to change the routines of the school, either by modifying and creating new ones. Hillview School presents a whole-school view of these changes (for example in the supervision of classes), while the teachers in Seafront School show the same view but without generalising to the entire teaching staff. The implication was a shift in responsibility for learning, from the teacher to the student; the shift was generally expressed as students' being expected to stay connected with their classes and up-to-date with classwork or homework, whether they were in school or not. The change in responsibility provides evidence of a change in the relationship of learning between students and teachers.

Operation Of Teachers Virtual Classrooms

The creation of virtual classrooms was led by teachers and schools; as a whole-school initiative in Seafront School, and in Hillview School it was adopted by staff on the recommendation of a few pioneering teachers. In both schools the operation of the virtual classrooms, including the changing of school routines, was determined by the teachers, this can be most clearly seen when teachers set expectations, rather than negotiated them. Students responded by acknowledging these are teacher-controlled spaces, which presents us with three implications and tensions to explore.

- Students may have increased expectations for communications with or from teachers
- Teachers may step into other roles
- Students will move school-related conversations into their informal network

Students may expect more communications. Students across the study had a varied experience of communicants with teachers; this was reflected in the characterisation of each teacher's embrace of their virtual classroom, being either cautious or enthusiasm. All teachers valued the ability to communicate, but teachers who approached virtual classrooms cautiously set a higher threshold before they would engage with students. The implication is that teachers will have to manage this expectation from students. It is evident that this tension appeared briefly in Hillview School but was quickly managed. In that case, and also with the cautious teachers, expectations were managed *down*. Interestingly and in contrast, the expectations of students from teachers are being managed *up*!

Assuming other roles. A particular aspect of managing these expectations emerged in Hillview School where Olive directed a student to go to bed. The tension for a teacher is

that the increase in communications beyond the traditional school times opens the possibility that they step into other roles. In Olive's case, she stepped into the role of parent by directing the student to go to bed. While this was an isolated example, it shows the limits of the Teaching Council's (2012) *Code of Professional Conduct* which requires teachers to exercise substantial professional judgement in managing similar incidents. By invoking Hogan's (2011) perspective on the ethical orientation of education, I was able to suggest a way for teachers to act *in pedagogis virtualis*, rather than *in loco parentis*, thereby managing this tension.

Chapter Summary

This chapter has presented a set of grounded theories based on the analysis of two categories: *getting online and communicating* and *teachers' virtual classrooms*, and has pointed towards continued analysis of teachers' virtual classrooms in Chapter 7. Looking back at the schools' initiatives it is possible to say that each school succeeded in *their* aims for introducing teachers' virtual classrooms, although they came from very different starting points. The similarities and contrasts between the schools and teachers provided many points for discussions and analysis. In the next chapter, I will present data which will show that each school and its teachers are on a spectrum in their use of educational technology, potentially with quite a space between them.

Chapter 7: Teachers' Virtual Classrooms

7.1 Introduction

This chapter elaborates on the category *teachers' virtual classrooms* introduced in Chapter 6. It will also introduce the category *teachers' relationships with their subjects*, and Table 7.1 below shows the categories, with the sub-categories and focused codes. The analysis presented in this chapter continues the format from Chapter 6 and will develop the grounded theories which emerged. This chapter will, therefore, begin with an analysis of the functions, or patterns of use, or teachers' virtual classroom, before posing an additional question for the data to understand and explain those patterns of use.

Table 7.1

The categories 'teacher's virtual classrooms' and 'teachers' relationships with their subjects' with sub-categories and focused codes.

Category	Sub-category	Sub-category	Focused codes
Teachers' Virtual Classrooms	Functions of the TVCs	-	*Extending the activities of the class* *Storing and distributing content* *Dynamic Lesson Planning* *Intentions for future use (growth)*
	Embedding in school life	-	*Providing a focal point for dissent* *Embedded in school practices* *School-wide approach* *Enhancing school practices*
Teachers' Relationships With Their Subjects	External influences	Shaped by the examination system	Coming to fruition' - Measures of Success Critiquing assessment Resisting the focus on exams Accepting exam culture Focused on examinations Reflecting on academic outcomes Restricted by exam culture
		Challenged to design content	Challenged to design content
	Subject Beliefs	-	Discernible in their use of textbooks Fosters students' interest Distinguished from the curriculum Accepting challenges to subject knowledge

Note: the sub-categories *Purpose & Implementation* and *Teacher/student communications* were discussed in Chapter 6and are omitted from this table for clarity.

The analysis of these categories provided significant data to support the emergence of grounded theories which classified the functions of the teachers' virtual classrooms. Following the discovery of those functions, and particular patterns of use, I was prompted to ask *why were the teachers' virtual classrooms used in the ways observed, and why did they tend towards a different pattern of usage in each school?*

The category *teachers' relationships with their subjects*, including its memos and focused codes, indicated that two types of forces shaped the patterns of use. The first were the external forces which created expectations of teachers, with Ireland's state examination system being prominent in the data. The second type was teachers' beliefs about their subjects, which included the use of appropriate methods for teaching, and the intrinsic value they placed on the subject. Chapter 6 demonstrated that the newfound ability to communicate beyond the physical time and space of the classroom created expectations that students would take greater responsibility for their work and learning in both schools. This topic warrants further analysis in this chapter, because of the impact observed in both schools. In Seafront School, the ability to communicate, and the impact of those communications, was sufficient to re-engage teachers with the school's iPad initiative. In Hillview School, the school's self-identity created an environment where these technical abilities were welcomed and used to promote educational innovations. Examples include extending the activities of classes and changing school routines; managing homework and absences in particular. Changes in students' responsibility, especially the increase, imply

an increase in trust in students by teachers, which may change the relationship of learning between them.

At this point in the thesis, I must acknowledge the practical limits in reporting on the study; in particular the breadth of content and depth of analysis possible within a PhD thesis. I will, therefore, narrow the focus of this final analysis chapter to establishing the functions of teachers' virtual classrooms and an examination of the dominant external influence on patterns of use seen in the sub-category *shaped by the examination system*. I will also present a summary of one remaining topic in this chapter, which relates to teachers' beliefs about their subjects. The summary is presented for two reasons, first, to ensure theoretical saturation of the grounded theories which emerged, and secondly, to establish avenues for further analysis and research for post-PhD publication of this study's data.

7.2 Functions Of Teachers' Virtual Classrooms

In Chapter 6, I examined the rationale each school and their teachers had for introducing teachers' virtual classrooms. At a high-level, Hillview School sought to increase communications and student responsibility, while Seafront School sought to re-engage teachers with their mobile device initiative. Following the discussion and analysis of the category teachers' virtual classrooms, from which a series of grounded theories emerged, this section will continue the analysis of the functions and patterns of use which were observed. The categories and focused codes for this section are shown in Table 7.1, presented at the start of this chapter. It will be evident that the high-level purposes which

the schools envisaged, discussed in Section 6.3 and summarised above, were visible in day-to-day usage in the schools. This section will deepen that analysis by examining the classroom-level functions which coding revealed were evident.

Two patterns of use were observed in the coding and are presented below in Table 7.2. First, where the teachers' virtual classrooms serve to allow the extension of the class and its activities beyond the physical room and set time, and second, as a mechanism to store and distribute content. Table 7.2 also shows how the codes were distributed by school, with each school leaning towards a particular pattern of usage; it then shows the dominant pattern of usage for each teacher; the platform in use, and the earlier characterisation of teacher's embrace of their virtual classroom, see Table 6.5. Unsurprisingly, there were teachers in each school whose pattern of use differed from their colleagues, and indeed some teacher's use would have spanned both classifications. Their points of difference signal areas for examination and analysis as well as prompting further questions for the data.

Table 7.2

Classification of the functions of the teachers' virtual classrooms by school, teacher and platform.

Focused Codes	# of focused codes from Seafront School	# of focused codes from Hillview School	Teachers from Seafront School	Teachers from Hillview School	Platform	Embrace of teachers' virtual classroom
Extend the Activities of the Classroom • Communications • Extending tasks after school	3	9	Beverly		Schoology	Enthusiastic
				Tanya	Edmodo	Enthusiastic
				Martin	Edmodo	Enthusiastic
				Olive	Edmodo	Enthusiastic
Storing and Distributing Content • Distributing Content • Storing Content	*10*	*3*		Amy	Edmodo	Cautious
			Martha		Schoology	Enthusiastic
			Dan		Schoology	Cautious

'Content' appears in both classifications above and it is necessary to differentiate between them now. Where content is discussed under *Extending the Activities of the Classroom*, it is integral to the task, being either an input or an output, but always secondary to the task and often ephemeral. Examples include videos that students record or a mathematical problem set for homework. When looking at content in uses classified as *Storing and Distributing Content*, the content itself is the primary concern, for example, PowerPoints or Word documents with revision notes. This content is formal, permanent, and usually strongly linked with the exam or exam preparation. This distinction will be examined in greater depth in the following section.

Beverly from Seafront School describes her efforts to use her virtual classroom (Schoology) for both functions, and she makes a useful high-level distinction between the two when she states that "the sharing of resources to me is not them [students] learning … they could be using paper." In contrast, she describes a discussion activity she tried which did involve students learning from a distance:

```
BEVERLY:        That discussion board was a way of interacting where
                they were actually having a group discussion far away
                from each other, do you know what I mean?  At home.
INTERVIEWER:    Yes.
BEVERLY:        That's really - yes, that was a good example of that.
INTERVIEWER:    And did you feel that learning took place in that
                discussion?
BEVERLY:        Yes, I think it did.
```

(Beverly, Seafront School)

The distinction she makes contains a critique of using a virtual classroom for *Storing and Distributing Content*, implying that is not a pedagogical strategy and that to achieve meaningful learning, other approaches should be used. She points to the discussion activity, which would fall under the classification of *Extending the Activities of the*

Classroom as an example. She clearly believes that learning can take place within a virtual classroom, or at least at a distance from the physical classroom, a belief which is shared by Martin:

```
INTERVIEWER:    Where do you see students learning?
INTERVIEWEE:    Where in terms physically?  Both in the classroom and
                at home.
```

(Martin, Hillview School)

Beverly points to the obvious pedagogical tension between the two uses, which will be examined in the following discussion.

Extending The Activities Of The Classroom

The classification of usage in Hillview School mainly falls within *Extending the Activities of the Classroom* as shown in Table 7.2. Martin, the teacher who continued to direct his class from hospital, provides a summary of how Edmodo extends his classroom, which also summarises the uses by other teachers:

```
MARTIN:         Well, how does it relate to the physical classroom?
                Again, continuation of group work is one thing.  Like
                you saw the exercise there with Padlet. So that's a
                group-based activity and they'd access that Padlet
                through Edmodo, and that's one way. As a whole class
                activity, obviously the homework goes up on it. Any
                questions, they can ask fellow students or myself on
                it. This is just a good base to communicate really.
```

(Martin, Hillview School)

By adding interview and observation data to Martin's summary I can state the two ways in which the activities of the class are extended:

- Enabling communications between students and teachers (although a teacher-controlled space as discussed)
- Extending the activities of the class allowing for continuation of tasks after the physical class as well as distributing resources for home work, including links, worksheets, videos, exam questions or marking schemes.

Martin takes a pragmatic view, relying on functionality over novelty when he states 'I don't think they find it a particularly exciting tool at all', he is not expecting any novelty or excitement to generate or sustain interest from students. I will briefly revisit the increased ability to communicate (discussed in Chapter 6), followed by three examples of types of activities which extended beyond the classroom.

The extension of communications allows students to "catch up on if they've missed a lesson or to know where they stand." In this way, there is a sustained connection enabling teachers to teach remotely or students to take more responsibility for their learning.

```
MARTIN:          As a teacher, I think it's great because I know,
                 compared to previous years, how hard it was to get
                 homework to students that did miss a lesson, do you
                 know?  The current students obviously because they're
                 so familiar and used to it now, they mightn't even
                 have thought, 'Okay, yeah. Before we had iPads, if I
                 missed a lesson, I'd just, I'd have to phone somebody
                 up or get the work off them that way.'  So I have
                 found that in terms of students who miss a class
                 catching up, that is not as much of a problem now as
                 what it was before the days of Edmodo.
```

(Martin, Hillview School)

The first example comes from Olive and Martin, who described several ways in which their virtual classrooms extended class activities. They have designed after-class steps in their activities, for example continuing group-work "putting them in their respective groups, they have smaller groups then within Edmodo" or continuing collaborative research "going home today … they'll have time to elaborate if they need to, so they'll have a document then they can feed back to the group tomorrow." These activities, which move some learning outside of the physical class, are visible when

looking at the implied lesson plans in Appendix 4B, for example in Martin's 3rd and Olive's 2nd observation. The referenced step from Martin's class is extracted and presented as an example in Table 7.3 below.

Table 7.3

Extract from initial coding of video observations for Martin; showing steps for completion after school.

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space / teacher's website
Observation 1: 3rd year History - teaching class on *The Irish War of Independence* (31 minutes) Apps & tools: PicCollage, Digital Textbooks and Edmodo			
Set homework *Whole-class activity* (3 mins)	Projected homework task and discussed Uploaded resource to teacher's website Posted homework task to Edmodo feed	Directed to research the participants in *The War Of Independence* by picking 1 person and looking up 10 facts. Directed to record facts on iPad and prepare to share with their groups in the following class	Homework task and link to resource posted on Edmodo feed

The continuation of activities is neither accidental nor poor planning, and it is certainly not a case of the teacher simply saying 'continue that for homework'. Instead it is a deliberate extension of the teaching and learning activities beyond the traditional limits of the classroom.

```
MARTIN:          Yeah.  You've only got a certain amount of time to
                 feed back, plus it's very hard to make sure that
                 everybody got the key points. So when they have it as
                 a Padlet everyone would get a chance to put down
                 everything that they researched, rather than just the
                 bare minimum they fed back on.
INTERVIEWER:     Sure.  So does it extend the classroom activity?
MARTIN:          It does, big time. Do you know what I mean, like even
                 going home today now and they'll have time to
                 elaborate if they need to, so they'll have a document
                 then they can feed back to the group tomorrow.
```

(Post-observation Interview with Martin, Hillview School)

The second example comes from students in Olive's and Martin's classes who were asked to upload the artefacts from certain classwork activities. Looking at Olive's students

in particular, their task, shown in Table 7.4 below, was to record themselves practicing geometric constructions in Mathematics.

Table 7.4

Extract from initial coding of video observations for Olive; showing steps for completion after school.

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space / teacher's website
Observation 3: 3rd year Maths - revision class on the topic *Coordinate Geometry of the Line* (32 minutes)			
Apps & tools: Edmodo and Geogebra			
Set homework *Whole-class activity* (<1 minute)	Directed to complete 1 more example for homework, following the same steps in class	Followed procedure from class to complete one more example for homework Review peers' examples and prepare to critique in class.	Completed homework to be uploaded to Edmodo

While this was a form of content distribution, in this case, the purpose of that content was different, a point which Olive's students appreciate:

```
INTERVIEWER:    Which part of that helped you learn most?
STUDENT 4:      Recording each other.
STUDENT 1:      Keep on doing it, like.
STUDENT 3:      And looking at the other people actually doing.
                Like, say, they could be doing it better than what
                you were actually doing it and you could see the
                different things that they're doing that you're not
                doing. And [inaudible] recording so much you have to
                keep on doing it and keep on doing it.
INTERVIEWER:    So, you made mistakes?
STUDENT 1:      Yeah.
INTERVIEWER:    Okay. Can you remember how to do them now?
STUDENT 1:      Yeah.
```

(Students in Olive's class, Hillview School)

Interestingly, the students identified two of the deliberate pedagogical aims that Olive had for this task; she wanted the students to construct the graphs themselves and then review and critique their peers' graphs. Olive also placed value on students actively creating graphs themselves rather relying on the passive experience of watching them being constructed online:

```
INTERVIEWER:    Okay. So I was looking at the videos when you got the
                students to do the constructions so would you just
                take me through your thought-process about setting up
                that activity?
OLIVE:          Why I did it you mean? The textbooks do them, on-line
                they do them but all they're doing is watching it
                whereas if they're actually engrossed in constructing
                it, recording it and then they had to review it, they
                tend to remember it a little bit better.
INTERVIEWER:    Okay.
OLIVE:          That was my thinking behind it.
```

<div align="right">(Olive, Hillview School)</div>

Olive describes not only her rationale for designing tasks to actively engage students and move some learning outside of the classroom but the tangible benefits she observes compared to previous years:

```
OLIVE:          Well, I suppose I'm just going back to one of the
                lessons we did drawing graphs, before we had the
                technology, you would have to actually go through
                every little minute detail … it took forever. It
                could have taken three or four classes to actually
                get it right.
```

<div align="right">(Olive, Hillview School)</div>

The last example comes from Beverly in Seafront School, who discussed her attempts at online discussions, which have been alluded to several times. There was a deliberate pedagogical aim in moving the discussion (or learning), online and she saw value in allowing students greater time to develop their thinking and argumentation. Ultimately, she felt that more support and scaffolding would be required:

```
BEVERLY:        I'd need to do it again with them. I need to build up
                on that and that they get better at making comments
                and adding to it. Some of them were good and others
                weren't so good. So, because what they had to do was
                follow on the thought of a previous student, maybe
                and add to it and that requires them to be reading
                the previous comments. So the skills weren't there.
```

<div align="right">(Beverly, Seafront School)</div>

As Beverly discussed this activity, I can return to initial coding and my preconceptions which I discussed in Chapter 4. It is clear now that I had expected to see more activities of

the type Beverly experimented with across all the teachers' virtual classrooms. Beverly also provides the reasons why I did not see those activities, although she feels there is greater potential value in that type of work, and so they form part of her aspirations for the future.

The type of content distribution I have described is content to support a task, or from a task and in either case, it is a deliberate part of a planned activity. In the case of Edmodo, the content was almost ephemeral, in that over time it dropped down the feed and would be difficult for students to return to, yet it served its purpose, and it is evident that students understood this:

```
STUDENT 1:      It's really hard to find them though because they're
                not in folders, they're, like, all in different
                posts.
STUDENT 2:      They're everywhere.
STUDENT 1:      Yeah, like, they're so hard to find.
INTERVIEWER:    So, they were kind of scattered around Edmodo?
STUDENT 2:      Mm-hmm.
```

(Students in Olive's class, Hillview School)

In contrast, in the following section I am about to discuss a more formal use as a repository, where the ability to access the content later is a defining feature. It is also important to distinguish this type of task, which is a collaborative one where students learn from each other and reflect on their ability relative to their peers, from a traditional set of homework tasks or problems which are usually solved or completed individually.

Storing And Delivering Content

When looking at the teachers' virtual classrooms as mechanisms for storing and delivering content, coding revealed that teachers described their use and benefits mainly in two ways, with a third use described by one teacher only, see Table 7.5 below.

Table 7.5

Table showing teachers' view on the benefits of using virtual classrooms for Storing And Delivering Content

Storing And Delivering Content	Benefits for teachers	Benefits for students
Distributing Content	• Reduced time spent photocopying	• Not missing content
Storing Content	• Dynamic lesson planning (one teacher) • Re-using content from year-to-year	• Able to access all course content over two or three-year cycle • Caters for less organised students

The first was as a means of delivering content where efficiency and convenience were benefits to the teachers. Amy from Hillview School, whose use was closely aligned with *Storing And Delivering Content*, succinctly described the change in how notes were distributed.

```
AMY:            I think it's a good way of putting information
                together for them to have access to outside of the
                classroom because the days of giving them copious
                amounts of notes and hand-outs and stuff like that,
                is definitely gone.
```

(Amy, Hillview School)

The second use was as a permanent repository which provided benefits to students who would have access to course content, and for teachers to efficiently re-use content from year-to-year. In Beverly's case, she felt the the ability to draw on that content during a lesson was an additional benefit. While discussing *Storing And Delivering Content*, teachers and students frequently described them in terms of benefits, where they could clearly identify that by using a virtual classroom there were benefits for someone. Table 7.5 below, shows a summary of the benefits and will be discussed in turn (except 'not missing content', which has generally been discussed)

Distributing Content. I will first look at distributing content, followed by storing content. Although an interesting point will emerge in use with non-iPad students. The efficiency of

distributing content was highlighted by all teachers in both schools. In Hillview School, Dan stated that "it helps from an organisational point of view" and both Dan and Olive suggest that virtual classrooms are displacing the photocopier, with Dan saying "I'm not running to and from the photocopier all the time, it's as simple as that". Amy echoed these sentiments by saying "You don't have to photocopy everything, you put it up there instantly, they have it. So it is great." Amy, who was classified as a cautious user, shares the experience of using the photocopier less, but her use is with predominantly non-iPad students.

> AMY: I would say the most I would use Edmodo would be with third years, fifth years and sixth years, even though it's the first, second and third years who have the iPads.

<div align="right">(Amy, Hillview School)</div>

She acknowledges that she has more content to give these students as they are in their exam year. This point echoes Martha's comment about using her virtual classrooms to reinforce how she teaches:

> MARTHA: So now I can talk about it, introduce it by PowerPoint, I can reinforce it with reading and then I can show them a little YouTube clip and then they can take their notes, okay, which they do and the reason they do is because then it sticks in their head a little bit better.
>
> What Schoology has done, it has meant that I can now send that to them so that there isn't an issue if they lose that information, that information is now stored for them so they can access it and if they want to look at the clip again themselves they can go look at that clip themselves again. And then I can, I'll put questions related to the exam so they can practice those and I've given them an answer so that's the way they have to do it. So, that's what I use Schoology for, to reinforce what I do in exam classes.

<div align="right">(Martha, Seafront School)</div>

Martha's use of Schoology, as well as Amy's use of Edmodo with non-iPad classes, indicate that the iPad initiatives and the use of virtual classrooms can be seen as separate

and not necessarily interdependent. It struck me that Amy may well have appreciated the features of Schoology, specifically the ability to store and distribute content, if given the opportunity. Unfortunately, that was beyond the scope of this study, but will allow me to consider technological determinism in the following section.

Beverly describes two aspects to her use, and in this regard, she bridges both categories in this section. Similar to her colleagues, she uses Schoology as a way to distribute content "I think for distributing resources, that's what I mainly use it for, so that they can use handouts, they can see past examination questions, I can send them stuff immediately". Mostly she uses it to distribute handouts, exam questions (with this class), quizzes and other activities. She praises the ease of distribution, which enables her to respond immediately to students' needs. She recalls how she would have done this in the past, with photocopies and acetates. She feels that students now have a richer experience and that higher quality resources contribute to students' engagement. Beverly describes the impact that using Schoology has had on her lesson planning, in particular how immediate access to resources has made her classes more responsive and in her opinion, dynamic.

```
BEVERLY:        What's great is the immediate access … let's say
                something emerges in the middle of teaching,
                something that I think, oh, gosh, I've got something
                - that's just happened, I didn't prepare it.
                Something has arisen that I know I have something on,
                I'll then quickly find it, which I can do it all very
                quickly. I can get that handout and I can get that
                video or whatever.
```

<div align="right">(Beverly, Seafront School)</div>

She sees Schoology as her primary tool for distributing resources to students and an essential part of lesson planning, which is no longer a static process completed before class but has become something that can continue right through the class. She can respond to the direction of the class and students' needs immediately and change the plan on the fly. She

sees that immediacy, supported by students' devices (which allow them immediate access to the resources), as enabling her to plan rich and diverse lessons - she emphasises having variety in the plans and approaches. Later she describes the steps of lessoning planning and how she prioritises student activities, then looks at the resource bank, checks for handouts/videos, taps into school resources, uploads to Schoology and teaches. There is a risk in this approach; that responding in the moment can seem haphazard and unplanned rather than responsive. Students appear to grasp this tension and commended Beverly on her ability to think on her feet and respond to the direction of a lesson and adapt to it.

```
INTERVIEWER:    Okay. And if something goes wrong for her, does she
                always have a plan B ready?
ALL:            No.
INTERVIEWER:    No.  Plan B?
STUDENT 4:      Well, we don't know that.
INTERVIEWER:    Does she have a plan B or does she just think on her
                feet?
STUDENT:        Think on her feet.
STUDENT:        Think on her feet.
STUDENT:        She does.
STUDENT 3:      Oh lads, you're making her sound bad.
```

<div align="right">(Students in Beverly's class, Seafront School)</div>

One student admits that they may not even know they are in 'plan b' if the course of the class had changed. Another student interjects to say "oh lads, you're making her sound bad", a caution and defence of her abilities. There is a tacit understanding of this process, even that there are elements invisible to students, and an evident strength of trust in this student/teacher relationship.

Storing Content. Dan describes the benefits of having a repository and is aiming at exam-year students, but he also describes a benefit for students who might be seen as less organised and prone to losing handouts and notes. The teachers are using virtual classrooms to give permanence to the content they are distributing, which is often their own, and formalising it for all students - not just the 'good' ones:

```
MARTHA:          What Schoology has done, it has meant that I can now
                 send that to them so that there isn't an issue if
                 they lose that information, that information is now
                 stored for them so they can access it
```

<div align="right">(Martha, Seafront School)</div>

During interviews with Dan, Martha and Beverly's students, they confirmed these patterns of use, and when triangulated with the online observations, provide a robust account. In Dan's case, the students confirm that Schoology is used mainly for 'PowerPoints', and in Martha's, students confirm the organisational benefits:

```
STUDENT 2:       Yeah, I was just going to say, yeah, it's all very
                 organised and everything is in the one place so it's
                 much easier than having loads of sheets and
                 everything.
```

<div align="right">(Students in Martha's class, Seafront School)</div>

7.3 Embedded In School Life

The discussion of the categories *getting online and communicating* and *teachers' virtual classrooms* has spanned Chapters 6 and 7, and throughout the chapters has considered the rationale, introduction, experiences, and functions of the teachers' virtual classrooms. It is useful now to consider the categories collectively and examine the reflections of the principals, teachers, and students on how they had an impact on school life. Returning to the rationale and method of introduction in each school, it should not come as a surprise to see contrasting experiences and outcomes. In Hillview School, a whole-school 'mind shift' enabled changes in routines and a refusal by teachers to go backwards. In Seafront School, there was re-engagement by staff after a period of dissent, and a willingness to consider the benefits of using virtual classrooms, with some enthusiastic champions like Martha taking the lead. In this examination on the impact on

school life, I will draw on teachers' reflections on their use of, and their intentions for future use of, their virtual classrooms.

In Hillview School, the principal describes substantial changes in the routines of the school and I will take two examples. The first is that the ability for communications provided by Edmodo extended beyond the teachers and their classes; it spread to extra-curricular activities as the principal reports: "even down to the sports teams have their own Edmodo and students link in with it." The second is how the school manages teachers' absences and the process for substitution and supervision, which has now become more efficient:

> PRINCIPAL: It certainly lent a lot to what we do; if a teacher
>   is out for a day doing CPD or doing whatever, very
>   often the word that we would get now, the deputy and
>   myself will get is an email to say, 'All work on
>   Edmodo'.

<div align="right">(Principal, Hillview School)</div>

What may otherwise have been seen as a 'free class' is now a working class, and she offers a personal experience of substituting in one of those classes:

> PRINCIPAL: You go into the class; you say to the students, you
>   know, 'did Mr So-and-so leave you work?' 'Oh, yes,
>   it's here on Edmodo' and they know what they're
>   doing. And teachers even now, before you wouldn't say
>   to a student you weren't going to be there tomorrow.
>   The teacher will now often say to their students, 'I
>   won't be here tomorrow but I will be putting your
>   work on Edmodo' and that really works.

<div align="right">(Principal, Hillview School)</div>

Amy, who was a cautious user of her virtual classroom, had a unique view of the school's experiences as she came back from maternity leave. As she returned to school in January, she could see the breadth of changes which took place during the Christmas term:

<pre>
        AMY: I have to say, it hasn't been a major push for me; I
                          don't feel that it has anyway. I think that the whole
                          school, it's just been a complete mind-shift with
                          Edmodo and with the iPads and everything else that
                          people just accept it now. Most of them just accept
                          it, that that's right across the board, all their
                          teachers and that's just the way things are done.
</pre>

<div align="right">(Amy, Hillview School)</div>

While using Edmodo was not her priority as she returned to teaching, the change throughout the school was evident, in particular in students' responsibility for their work. Indeed she acknowledges that the process may not have been entirely smooth and there may have been 'battles', but ultimately "at this stage it just seems to be that's the way things are done".

I had previously looked at the example of Martin continuing to teach from hospital and can now we see from the principal's description that the entire environment was receptive to that approach, in that teachers were accustomed to setting work in advance (or remotely) and students understood they were expected to do it. Martin's example shows an admirable commitment to his students, but the example should not be looked at in isolation from the whole-school changes which created an environment where students were not only able but indeed expected to respond and continue working. Summing up the experience in Hillview School, Olive predicted a 'mutiny' if the programme were to end:

<pre>
        INTERVIEWER: What will happen if the school decided to end the
                          mobile learning programme?
        OLIVE: Mutiny. I think the staff will go mad. Absolutely, I
                          really do. Yes, I mean it's not just an eBook reader
                          that we have, you know.
</pre>

<div align="right">(Olive, Hillview School)</div>

Olive's comment about their mobile devices being more than e-readers is insightful, showing that the school and teachers have come to value not just the devices, but the pedagogical strategies and new routines that were enabled. In Chapter 5, while examining

the category *responding to the introduction of mobile devices*, it was evident that the classroom implications had not been examined thoroughly (with Olive being an exception). The school's development from that point until the time of fieldwork is quite remarkable. The routines and pedagogical strategies which had not been considered are now so thoroughly embedded in school practices as to be indispensable. Table 7.6, below, shows the future intentions of the teachers in Hillview School which could be characterised as humble, forward-looking and do not privilege the technology.

Table 7.6

Table showing characterisation of each teacher's embrace of their TVC with their intentions for future use.

Teacher	Characterization of adoption of TVC	Intentions for future use
Tanya	Enthusiastic	Tanya was on parental leave.
Amy	Cautious	*So that's why we're only really getting going on it you'll see hopefully now over the next few weeks, things starting to build up on it. But with the accounts, I wouldn't have used it. That's just doing questions and if I'm doing questions, I'm doing questions the old-fashioned way.*
		Amy was concluding a practical section of the Business Studies and moving to a theory section which she felt was more suitable for Edmodo.
Martin	Enthusiastic	*So if you're over−dependent on something and become stale, the whole teaching and learning experience becomes stale then. So am I using as much as I'd like to? I think on the whole, yes, but I'd also be aware and I would like to maybe find out other ways and other applications and methodologies I could incorporate in the use of it.*
		Martin intends to adapt as technology changes, but is broadly happy with his approach.
Olive	Enthusiastic	*I use it as much as I can at the minute ... You know, so you do have to do research yourself so time is a bit constraint.*
		Olive is generally happy, but acknowledges that a lack of spare time holds her back from trying new Apps and features.

Notes: quotes are from interviews with teachers (unless otherwise indicated).

The principal of Seafront School provides a contrasting view of a more challenging experience, although not entirely unexpected given the rationale and methods for their initiative. The principal describes how the mobile device and Schoology initiatives provided a focal point for dissent among staff:

<pre>
PRINCIPAL: So, I think tensions have risen, yes, but I think
                  tensions have risen anyway in education because of
                  the expectations on teachers. And I, once again I
                  think it's very hard to isolate and just say, 'Well,
                  it's due to iPads in the school'. Some teachers
                  didn't like being sent out on these, well, a lot of
                  them, the ones who went individually on these courses
                  they would have been reasonably interested in going
                  but when we did the whole school, some people might
                  have thought, ah, you know, what's this guy? I'm
                  grand the way I'm doing things. So there would have
                  been a tension there. Does he expect me to go back
                  now and start doing all these fish bones and getting
                  kids think-pair-sharing. Ah, I haven't time for
                  that, like you know, I just want to teach the way
                  I've always taught.
</pre>

<div align="right">(Principal, Seafront School)</div>

Many factors may be part of this reaction, but as an 'academic' school, which considered itself to be highly-achieving in a competitive area, it is expected that teachers would be averse to changing methods which they felt were working well. The ideas they were being exposed to were pedagogical innovations, the need for which was not entirely established with them. Despite the more challenging experience, she goes on to report that introducing Schoology succeeded in re-engaging staff to the point of changing the views of staff, including Martha, who had previously dismissed the iPads:

<pre>
PRINCIPAL: But I think we've got in a new group of people with
                  Schoology,people who before might have thought, oh,
                  yeah, the iPads, not too keen on those but when they
                  see how useful it is for managing their classes,
                  coming out of them a different angle I think they're
                  now saying, 'Oh, yeah', and they're now talking at
                  the staff meetings and they're getting more people on
                  board.
</pre>

<div align="right">(Principal, Seafront School)</div>

What is interesting is that she feels the appeal for Schoology is how it enhances the management of classes. When I examined the purposes of the virtual classrooms in Chapter 6, I can clarify that the principal more accurately means 'managing the content of the class'. The principal's view on the success of Schoology is confirmed by Martha's students, who contrast her earlier disdain with her new found enthusiasm and provide triangulation for characterising her embrace of her virtual classroom as *enthusiastic*:

```
STUDENT 7:      The fact that she found Schoology definitely changed.
                She's kind of like obsessed with it now and
                everything goes on Schoology now.
STUDENT 5:      School, Schoology.
INTERVIEWER:    You think it changed her outlook?
STUDENT 7:      Yeah. Because she used to be very like, 'Oh, those
                iPads, you're looking up everything', but now she's
                all like, 'Oh, Schoology'.
```

(Students in Martha's class, Seafront School)

The intentions expressed by the teachers in Seafront School, see Table 7.7, are more firmly focused on expanding their use of Schoology. Dan and Martha focus on having more content and activities which align with the sequence of the curriculum and their teaching plans. In addition to a continued effort with content, Beverly intends to develop the discussion activities she experimented with.

Table 7.7

Table showing characterisation of each teacher's embrace of their virtual classroom with their intentions for future use.

Teacher	Characterization of adoption of TVC	Intentions for future use
Dan	Cautious	*... the plan or my aim then for next year is that I'll have, rather than a folder with my lesson plans, I'll have everything done in Schoology, so basically this is topic 1, this is the notes, these are the assignments, the tasks we are going to do on the day, next topic and so on they'll have the entire thing laid out like that and then it's accessible from anywhere, from any computer, it's brilliant.*
Martha	Enthusiastic	*They expect me to be able to present the information, or to make sure the homework is written up on the Schoology and this is where I would sometimes fall down. I'd say, 'I'll put the assignment up', ad then I forget to put the assignment up ... those kind of things happen all the time because I'm only getting used to it.*
Beverly	Enthusiastic	*that's something new I've done so I will work on that and see if I can get more out of that.* Beverly is taking about the discussion activity and her intention to develop it.

Notes: quotes are from interviews with teachers (unless otherwise indicated).

As this sections draws to a close, I am prompted to ask if in each school the purposes envisaged were served. In Seafront School, they appear to have been as the iPad initiative was revitalised somewhat, although the mobile device initiative and Schoology are not

necessarily linked. In some instances, the more significant uses of Schoology took place with non-iPad students. Indeed, one could say that the earlier shortcomings of the iPad initiative, for which Schoology offered a solution, worked mainly because the technology matched how the teachers taught and wanted to continue teaching. The importance of teachers' intentions was also evident in Hillview School, which will be touched on in the next section where I will discuss the potential for technology to have a deterministic impact on how it is used.

7.4 Examining The Functions Of Teachers' Virtual Classrooms

My analysis of the category *teachers' virtual classrooms* in the previous section established the functions that virtual classrooms served, as well as their patterns of use as a grounded theory. To answer the question *why were the teachers' virtual classrooms used in the ways observed, and why did they tend towards a different pattern of usage in each school,* I must look within the category *the teacher's relationship with their subject,* where focused codes emerged to provide data to answer this question, see Table 7.8 below. To rule out technology having a deterministic influence on the patterns of use, I will consider affordances and technology determinism and establish a grounded theory.

Table 7.8

Category 'The teacher's relationship with their subject'

Sub-category	Sub-category	Focused codes
External influences	Shaped by the examination system	*Coming to fruition' - Measures of Success*
		Critiquing assessment
		Resisting the focus on exams
		Accepting exam culture
		Focused on examinations
		Reflecting on academic outcomes
		Restricted by exam culture

Sub-category	Sub-category	Focused codes
	-	*Challenged to design content*
Subject Beliefs	-	*Discernible in their use of textbooks*
		Fosters students' interest
		Distinguished from the curriculum
		Accepting challenges to subject knowledge

A variety of forces influenced teachers' relationships with their subjects. Chapter 5 demonstrated that external influences and agendas had an impact on schools and teachers as the analysis of the categories *possessing a self-identity* and *engaging with its community* revealed. A perspective from the literature shows the prominence of these forces in the data to be unsurprising. Ertmer's (1999) research on barriers to technology integration extended Cuban's (1993) work on educational technology and Fullan's (1991) on change management in education. Ertmer (1999) identified two classifications of barriers. First-order, or barriers extrinsic to the teacher; and second-order, or barriers intrinsic to the teacher. Extrinsic barriers included 'lack of access to computers and software, insufficient time to plan instructions, and inadequate technical and administrative support', while intrinsic barriers included beliefs about teaching, beliefs about computers, established classroom practices, and unwillingness to change' (1999, p. 48). In a later reflection on the 1999 paper, Ertmer (2012) stated that her subsequent research in the field validated the classification of first and second-order barriers and she went on to state "underlying second-order barriers were thought to pose the greater challenge" (2012, p. 423). While the codes and categories in this study have emerged exclusively from the data, alignment with Ertmer's (1999; 2012) findings strengthens the validity of the grounded theories and also the editorial choices for this chapter.

Affordances and Technology Determinism.

Based on the data, I can state that the patterns of use for the virtual classrooms were determined by teachers and schools rather than by the technologies/platform. To support this grounded theory I will revisit some activities which were aligned with *Extending the Activities of the Classroom*. Martin's examples of continuing group-work on Padlet and Edmodo, and Olive expanding peer assessment using Edmodo, demonstrate that the teachers were extending current practices using their online classrooms. To examine this theory further it will it will be useful to draw on the concepts of affordances and technology determinism, which were discussed in the literature review. This is the first point in the analysis where we must consider the affordances of each platform, which are described as "the purposes to which they seem most easily to lend themselves" (Pegrum, 2014, p. 6), and ask if those affordances influenced the way the virtual classrooms were used by teachers in a deterministic way? The use of affordance as a theoretical basis for education technology is not without its critics, Oliver (2013) notes that "accounts based on affordances, and even common-sense claims about technology, have been criticised for being technologically deterministic: in other words, they position technology as a cause of some change (such as learning) inappropriately".

The evidence presented thus far would reject the idea that the Edmodo, Schoology, or even the iPads has shaped the pattern of use in a deterministic way and I can review examples from the data. During initial coding of the virtual classrooms, I examined how each of the platforms operated and the observed patterns of use. Edmodo is structured around a feed of activity, in a way familiar to users of Facebook, whereas Schoology is structured around the course (or class) content similar to Moodle or Backboard. While it is possible to say

that the affordances of each platform lend themselves to a particular pattern of use, I can state that in each school one teacher used it in a different way to their colleagues, as shown in Table 6.6. To illustrate the point we can see that in Hillview School, Tanya, Martin, and Olive's usage is classified as *Extending the Activities of the Classroom*, whereas Amy's is as *Storing and Distributing Content*.

In Chapter 5, I looked at Beverly's experiences with a visiting teacher from Apple and the prior 'sales' pitch' for iPads. As she reported, advocates of educational technology often suggest that the mere presence or provision of technology, whether hardware or software, is sufficient to cause positive changes. While it was unlikely that the visiting teacher was diminishing the importance of good teaching, Beverly felt there was a deterministic belief about the power of technology. Beverly was ultimately disappointed that the 'sales pitch' did not become a reality, that students possessing iPads did not automatically lead to "independent student learning" (in her reflection she arrived at the conclusion that *she* must orchestrate that change). Martha, whose usage does align with the affordances of Schoology, offers a comment:

```
MARTHA:          I use Schoology to reinforce the way I teach as is
                 and possibly to make things more interesting for the
                 kids.
```
<div align="right">(Martha, Seafront School)</div>

Martha's comment is a clear statement that she is the one making the decisions, and coupled with her ambivalence to the iPad project until Schoology was introduced, strongly suggests that it is Martha and not the technology who was defining the pattern of use. Indeed, throughout the data it is evident that the reason for choosing the platforms was that they appealed to the ways in which teachers were already teaching or intended to, and it is implicit that students also exercised little to no influence in those decisions. In answer to

the question of determinism, the evidence from the participants is that they mostly taught as they did previously (or intended to), using the technology to reinforce or enhance current methods, and that it was not intrinsically an agent of change. Interestingly, to return to Klopfer & Squire (2008) belief that mobile devices produce unique affordances in educational contexts which enable mlearning to flourish (discussed in Chapter 1), it is evident that some of characteristics they cited (portability and connectivity in particular), those affordances alone were unable to change the underlying patterns of use. Having established how the technology was used and that it did not force the change, a further question for the data is *'why did teachers' usage of their virtual classrooms tend towards a different pattern of usage in each school?'* The data tentatively suggests that the pattern of use is shaped by a teacher's belief on how their subject should be taught, and that a focus on examination may have a contributing impact. I will address this question in the next section.

Impact Of The Examination System

The examination system is another such external influence, and indeed its impact is reflected in the forces discussed in Chapter 5: for example, Seafront School's identity as an 'academic' one is achieved through high exam performance; or the trust the community placed in Hillview School was also earned through strong academic performance. The impact of the examination system is therefore observable, directly or indirectly, in several categories of the data in this study and warrants detailed analysis. In the next section I will analyse the impact of Ireland's examination system on the functions of teachers' virtual classrooms, as it emerged in the data as the dominant external force.

7.5 Shaped By The Examination System

The coding and memoing process revealed that Ireland's state examination system exerted a strong influence over the schools, teachers, and students; and the data demonstrated how the Junior Certificate, including its exam, touched on most decisions taken in the classroom as well as many general aspects of school life.

```
MARTIN:          At the end of the day, they have to sit an exam and
                 as a teacher, your main responsibility is to make
                 sure that they reach their potential and so in third
                 year from now on, you know, it's all focused on
                 exams.
```

<div align="right">(Martin, Hillview School)</div>

The data demonstrates that teachers took a pragmatic view, recognising the inevitability of a terminal exam, as Martin confirms. While many teachers would share Martin's pragmatic view on the inevitability of the exam, they may hold differing views on how students reach their potential and when to focus on the exams. The variations and nuances in their views and approaches to the exams provide opportunities for comparison and analysis in this section.

While the exams feature prominently in the data from teachers, awareness of the exams and their influence was also reported by students. Tanya's first year and Martin's third-year classes were fully aware of how they were being prepared for exams:

```
STUDENT:         And if you don't have it in your Christmas tests,
                 then she'll mark you down on that
```

<div align="right">(Students in Tanya's Class, Hillview School)</div>

```
STUDENT 4:       You have a sense of the exam.
```

<div align="right">(Students in Martin's Class, Hillview School)</div>

For students, the focus on exams also provided ways to assess their teachers' level of commitment to them, and indeed to see how a teacher perceives their role and

responsibilities. Students in Dan's class commented on how other teachers balance

teaching exam and non-exam classes at the same time.

> STUDENT:　　　　Sometimes you get the teacher that just, you can just
> tell that they don't care about the subject they're
> teaching and they don't care about us as a class
> they're just trying to get us through as quick as
> possible and a lot of the time they'll say, 'Oh, I
> can't correct your test because I've got this class'
> test to correct', and you kind of feel, why is our
> test not as important and it's just because they're
> not really bothered

<div align="right">(Students in Dan's Class, Seafront School)</div>

Students are aware of the potential for the focus on exams to have negative consequences,

which they may experience early in the post-primary school lives.

The influences that the state examinations system exerted formed the sub-category *shaped*

by the examination system, and can be analysed in three classifications, demonstrating

how: the exams act as: (a) a focal point for teachers and students, (b) a motivator and

measure of success, and (c) a constraint on innovations in practice. This section will

examine each of these impacts in turn.

Focus

> Where the exam system acts as a focus, it is as a terminal or endpoint that teachers

are working towards:

> MARTHA:　　　　How I teach is completely dictated by what I have to
> achieve, the goals I have to achieve at the end … So,
> as it is at the moment I have a specific goal to
> achieve, I have to prepare the kids for exams, okay?

<div align="right">(Martha, Seafront School)</div>

Martha indicates a goal-oriented approach to her teaching, taking a pragmatic view of the

need to prepare students for exams that is shared by Martin and all the teachers in the

study. Notwithstanding their shared pragmatism, Martin and Martha have notably different views which are reflected in their actions. Martin critiques the examinations system sharply, questioning if the approaches it encourages are 'real learning' and as a result of these beliefs, he only re-focused his attention towards the exams from the beginning of third year. Martha, in contrast, had been focused on the exams and exam preparation with her students since the start of second year. The differing views and approaches expressed by these two teachers represent the breadth of opinion across the data. To employ an analogy with athletes, I could say that Martin sprints toward the exams with a brief intensity, whereas Martha approaches it like a marathon runner with sustained effort over an extended period. The ability to re-focus on exams is exemplified by Olive, who elaborates on what that means in practice when she describes how during the revision period before the exam she used different teaching resources and decreased her use of technology:

```
INTERVIEWER:   So we've kind of touched on this and the exams but
               how do you think the exams affect how you use
               technology with your students?
OLIVE:         Towards the end of the year [3rd year] now I'm not
               using the iPads as much because we're focussed on the
               exam papers, the exam system. Like the course is out
               of the way so we're kind of rehashing the stuff. So I
               suppose then it kind of puts it to the background.
```

<div align="right">(Olive, Hillview School)</div>

The focus on exams is universally shown in the data, but whether that focus is a short or long-term orientation is dependent on each teacher. In the following sub-sections, I will explore the different decisions teachers made while focused on exams, including the changes in their approaches, the teaching materials they used, and what and how technology was used.

Teachers' Approaches. Teachers describe the changes to their approaches and methods over the three years of the Junior Cycle, in keeping with the timelines discussed already. Indeed, they also allude to changes in how they see their roles and their level of satisfaction with their practice over that time, although not universally. I will discuss those changes when I explore motivations shortly. Amy introduced the concept of a spectrum along which a teacher must move throughout the Junior Cycle, and she described how the exam required a more disciplined, focused, and didactic approach.

> AMY: But I do suppose with an exam class you kind of have to be a little bit more towards the end of the spectrum where you wouldn't generally like to see yourself all the time for sure.
>
> (Amy, Hillview School)

Amy acknowledged that it was not an approach to teaching that she would like to employ long-term, and Martha starkly describes the system and the goal as the Junior Certificate exams approach:

> MARTHA: So, ... the Junior Cert exam at the moment expects the kids to take in a particular amount of information and then expects the kids to be able to give back that information in a particular way
>
> (Martha, Seafront School)

Martha's description of the Junior Certificate (and by extension, the entire exam system) is a facsimile of Freire's (1970) banking model of education where teachers 'deposit' information with students to be withdrawn in later exams. Indeed, her description also evokes the use of Schoology for *Storing and Distributing Content.* Amy describes the opposite end of the spectrum with a contrasting experience from first year, she was joined in that view by Olive:

> AMY: whereas first year it's, God knows what will happen in a year, what we'll end up talking about when you go into a classroom.
>
> (Amy, Hillview School)

```
OLIVE:              whereas with the First Years and there's a lot more,
                    let's say they call it 'Fun stuff' that you could do,
                    but everything gets a little bit serious when it gets
                    to exam-time.
```

<div align="right">(Olive, Hillview School)</div>

The descriptions of first year generally portray it as an unpredictable, enjoyable, and often exciting experience for many of the teachers. While first year can be seen as open and exploratory, it did not appear chaotic or without direction, as the data shows that the development of exam technique starts early, although the intensity of preparation varies between teachers. The changes to approaches, or the movement along the spectrum as Amy describes are also reflected in the teachers' choices of teaching materials and resources, and what and how they use technology, which I will examine next.

Materials. Coding revealed that the examination system had a significant impact on the choices teachers made about materials and resources for teaching in both the short term and long term. Two prominent examples emerged: the use of past exam papers and a digital equivalent to developing exam technique, and teachers' selection of which textbook(s), if any, to use over the duration of the course. Interestingly, the process of developing exam technique, both observed and reported, shows an intersection of methods, materials and technology.

The past papers were a distinctive and popular set of resources, which teachers reported using extensively to develop exam technique and focus students' attention on the examinations.

```
AMY:              so that they know the layout of the paper, that they
                  know where to find the questions that they're meant
                  to do because with business, it's quite predictable.
                  So like when they're going in, there's six questions.
                  They're going to do four. They should have a good
                  idea of the four that they're going to do before they
                  go in.
```

<div align="right">(Amy, Hillview School)</div>

```
OLIVE:            Because it's maths and because all the questions will
                  be answered on the paper, they have a booklet of
                  their maths papers. So they have an actual booklet of
                  maths papers that they write all their answers into
                  because that's the way they do it in the exam, so
                  they have to get used to it.
```

<div align="right">(Olive, Hillview School)</div>

In these examples, which span all subjects in the study and apply from second year onwards, the teachers are concerned with the parallel development of students' exam technique and a high level of familiarity with their specific exam paper. Tanya provided an insight from first year (as the only first year teacher in the study) when she reported working on exam technique by using simplified versions of exam questions, and she exemplifies a teacher who works towards the exam over a long and sustained period:

```
TANYA:            ... but I still get them to write their own stuff
                  because I  adapt the stuff to match exam technique.
```

<div align="right">(Tanya, Hillview School)</div>

An online tool called StudyClix.ie was observed and reported by six of the seven teachers in the study, and reportedly enjoyed wide popularity generally in both schools. StudyClix.ie is a tool that remixes past examination papers by topic and presents them to students or teachers:

```
DAN:              What I've done over the last few years and I use it
                  now almost entirely, I don't use the old exam papers
                  at all anymore ..., I think Studyclix.ie is
                  brilliant.
```

<div align="right">(Dan, Seafront School)</div>

The use of StudyClix.ie is noteworthy as it intersects with teachers' choices of approaches, materials, and technology; and in these cases is used as an exam preparation tool. Two examples of how StudyClix.ie was used come from Martin and Dan. Martin uses StudyClix.ie to create homework worksheets on exam topics for students which were distributed via Edmodo. In the following classes, students engaged in a peer-marking exercise to correct their homework, followed by group feedback to correct errors or misconceptions. Dan takes a different approach, where students also complete worksheets as homework, but Dan projects the correct answers in-class to allow a questioning session to test whether students "have retained that information, do they actually understand it". These examples show how the same tool, used for the same purpose of preparing students for exams, can include different teaching approaches and methodologies.

Martha, whose approach was similar to Dan's, described why she employed such a tool and presented her rationale for the use of technology which is focused firmly on the examinations.

```
MARTHA:          So, I teach and I'll use every technology I can or
                 everything I can to try and help those kids get
                 practice for that exam.
```

(Martha, Seafront School)

As a teacher who embraced her virtual classroom *cautiously* (see Chapter 6), her rationale is noteworthy for two reasons. First, as she considered herself a technological 'dinosaur' with a lower level of technological skills (see Table 5.5 *teachers' initial questionnaire*), and second in that a perceived or potential benefit to students' exam performance was enough incentive for Martha to overcome her fears and beliefs about technology as well as her skill level. While there was a change in her practice, it was a first-order change as

described by Ertmer (1999) where Martha adjusted her current practice incrementally, making it more efficient and effective, but her underlying beliefs remained unchanged.

Across all teachers in the study, there is a concern about the suitability of course content to the extent that none of the teachers reported relying exclusively on a textbook as their primary resource. Teachers discussed their use of textbooks (print or digital) as resources, and in a similar way to past examination papers, the relevance to the examination was an important consideration. Amy describes how her use of the textbook is limited and her main criterion to judge the quality of the book is whether it reflects the topics that appear in each year's examination papers:

```
AMY:              I find for the likes of the theory, the questions in
                  this book are not reflective of what comes up in the
                  exam at all. It's a couple of years old now anyway …
                  but even when it was new, it wasn't reflective. So
                  they use the books mainly for the accounts [book-
                  keeping in business studies]… otherwise I use it
                  very, very little.
```

(Amy, Hillview School)

Teachers' concerns about content are addressed by using a variety of other sources, which in this study included teachers' content via Word documents and PowerPoints, musical workbooks, services like StudyClix.ie, students' independent research, or a diversity of other sources.

The critique of textbooks as suitable teaching resources expressed by Amy is shared by all teachers, although the variety in their reasoning warrants further analysis. It is useful therefore to return to the teachers' virtual classrooms, where I established a grounded theory that two of the functions or patterns of use for teachers' virtual classrooms were *storing and distributing content* and *extending the activities of the class*. By using those

patterns of use as a lens, I can elaborate on teachers' concerns about content. Looking at those teachers whose usage pattern was *storing and distributing content*, they were distributing formal content for teaching or revising the course. This content supplemented the textbook, and in many cases largely replaced it, especially as the exams approached. Simply stated, the virtual classroom was an ideal distribution method for exam-focused content. For those whose usage aligned with *extending the activities of the class*, the content being distributed was often ephemeral and the emphasis on student research and group work, usually used for students constructing or co-constructing their knowledge on a topic. In both cases, teachers were making editorial choices about content, believing theirs (whether created by them or their students in guided activities) to be superior to the textbook. The use of virtual classrooms in this way embodies teachers' critique of the textbook, where they may have had concerns, including: the ability to encourage students to research and learn for themselves; the relevance of content for students; or more traditionally, the relevance of the content to the exam. It is evident that there is a strong link between teachers' choices of teaching materials and their pattern of use of their virtual classroom, and therefore we see that the exam system shapes the use of virtual classrooms.

Use of technology. In this section, I sought to understand the reasons for the patterns of use of teachers' virtual classrooms that I established in Section 7.2. The use of technology in the mobile device initiatives was not limited to just teachers' virtual classrooms, and this section has introduced StudyClix.ie as a tool that is directly focused on exam preparation as well as other uses of technology by teachers and students. By looking at those uses of technology through the lens of the exam system, an approach justified by my previous finding, I can further demonstrate the link between the exam system and the choices

teachers make. I will also be able to explore an alignment between these choices and teachers' *cautious* or *enthusiastic* embrace of their virtual classrooms to further develop a grounded theory.

The use of technology (aside from the teachers' virtual classrooms) by teachers, including their intentions and tools used, was reported in a variety of ways, and quite often they indicated that the examination system was a focal point. The nature of that focus varied across the sample of teachers, Table 7.9 below, shows the emergence of two broad classifications of teachers' use of technology, including their intentions and the technologies employed. The classifications have both a direct and contingent relationship with the exam system. There is a caveat in the naming of the classification as the naming of 'non-exam uses' belies its contingency on good academic performance, which I will now explore. The naming of 'non-exam uses' has connotations of a negative space, defined by what is absent. The data however did not support any other 'positive space' classification.

Table 7.9

Table showing classification of teachers' use of technology, including their intentions and tools used.

Classification	1. Preparation for Examinations	2. Non-examination uses
Rationale	• Distributing Course Content • Course Revision	• Enabling Student Research • Engaging Students with Course Content
Tools	• StudyClix.ie • Teachers' Virtual Classrooms: *Storing and Distributing Content*	• Creative Apps • Multimedia • Student Research • Teachers' Virtual Classrooms: *Extending the Activities of the Class*

Sources: observations of classes, video recordings of observed classes, and interviews with teachers, students and principals.

While examining the classifications above, I was prompted to return to the spectrum which Amy introduced when she indicated that her approaches changed over time as the exams approached. It is evident that other teachers' uses of technology also changed over time as Olive indicated "towards the end of the [3rd] year now I'm not using the iPads as much because we're focussed on the exam papers". In the first classification *exam preparation*, technology was used to prepare students for the examination, examples include StudyClix.ie and using teachers' virtual classrooms to distribute exam revision notes. For teachers who focused on the exam over the long term, they would also have used their virtual classroom for *storing and distributing content*. The second classification is for non-exam uses which included a broad range of approaches and technological tools, including the use of multimedia, students' independent research, and a broad range of Apps, see Appendix 4D.

Based on interviews and observations, I was able to extrapolate and visualise Amy's and Olive's use of technology over time, see Figure 7.1 below.
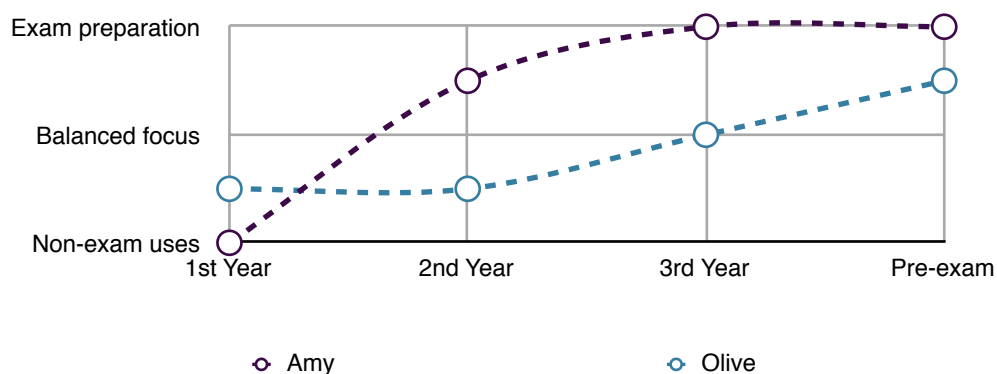

Figure 7.1

Graph showing Amy's and Olive's focus for technology use over time.

I selected Amy and Olive as they most clearly articulated this re-focus towards during initial coding. The figure demonstrates that as the exams approached, teachers changed their focus towards them and also changed their uses of technology; a point I will return to and develop when I present the grounded theories. Mindful of the spectrum that Amy introduced, I must also acknowledge that no teacher's pattern of use of their virtual classrooms, or their classification of technology use was static; instead they tended towards one at various times, and indeed they moved over time. Prompted by that concept of a spectrum along which a teacher must move, and Olive's comment 'towards the end of the year I'm not using the iPads as much because we're focused on the ... exam papers', I wanted to examine their use of technology over time further.

All teachers reported or embodied a conditional disposition towards the use of technology. This conditionality was made explicit by Martha when discussing her use of technology and stated:

```
MARTHA:          But I will only continue through that if the learning
                 outcomes are the same and if they're learning the
                 information the way they should be learning it for
                 the exam.
```

<div align="right">(Martha, Seafront School)</div>

Regardless of the classification of use, teachers placed a value on the ways that technology use could enhance students' engagement with their subject and their own experience of teaching it. The value, however, was limited and contingent:

MARTHA:	And that's one other thing I'd like to say. Does technology improve the learning? And I don't know that it improves the learning. I think you still have to have that teacher. It's all about the outcomes, you know what I'm saying like, for the Leaving Cert? I think that if you had me and I had no iPad and no PC I would probably still get the results for the kids and it would be less hassle for me to get the results for the kids but the kids would be so bored you know, that's it, you know, and I want them not [inaudible] boring.

(Martha, Seafront School)

TANYA:	I mean the way we learn, the way they learn [using technology] is better for them and it's more interesting for me, and I think a good kid will always do well, one way or the other. Maybe the weaker kid is going to do a little bit better, but in terms of the overall grades, I don't know if they're scoring any higher.

(Tanya, Hillview School)

Martha's views are reflective of the other teachers from Seafront School, and are unsurprising in light of the school's self-identity and reinforce the conclusion that the changes were first-order only. Coding of the data from Hillview School did not reveal the same contingency initially, but later interviews, in particular with the principal, revealed that technology use was similarly contingent. The teachers' level of confidence in the technology was greater in Hillview School, both as a result of greater maturity in the mobile device initiative (overcoming first-order barriers) and the school's self-identity, which welcomed innovation. In both schools, however, the exams provided a measure to judge success, although not exclusively, and the use of technology is contingent on continued academic success.

```
PRINCIPAL:        Maybe I'm in the ivory tower in here now, you know.
                  Yet there's a fear there of, we have to teach for the
                  exam. There would be a few subjects [teachers] that
                  we'd be sort of looking at and saying, you know, come
                  on, come on, trust it. But, when you look at the
                  results of the teachers who are actually allowing the
                  students to learn themselves [aided by mobile
                  devices, etc.], they speak for themselves and we'll
                  continue to work on that and let subjects see that
                  you don't have to be giving them notes and notes and
                  notes and PowerPoint – death by PowerPoint is the
                  last thing that kids need.
```

<div align="right">(Principal, Hillview School)</div>

Having examined how the examinations system was a focal point for teachers when making decisions about approaches, materials, and technology, it is useful to look at how the system acts as a measure of success and motivator.

Measure Of Success And Motivator

The exam system acts as a measure of success for both students and teachers and provides a sense of motivation for teachers regardless of their views of the system. Martin previously discussed his desire to help students 'achieve their potential', and despite his critique of the exam system, his comment confirms that the system is the measure of success for most students. Dan bluntly agrees:

```
DAN:              I don't think anybody hides behind the State exams. I
                  think that they see their role… And they, and they
                  are good teachers, that is, I will not be judged on
                  whether I use my iPad or whether I use my PC. I will
                  probably be judged on whether my kids get As, Bs and
                  Cs and that is the way it stands at the minute. I
                  don't think they're hiding.
```

<div align="right">(Dan, Seafront School)</div>

Dan's comment on how he will be judged is a realistic acknowledgement of the reality of Seafront School's competitive local environment as discussed in Chapter 5, where the impact of that environment on the school's self-identity was established and acts as a reminder of the external influences on the school and teachers. The keen focus on the

output of the exams, using the grades that students achieve to measure the success of both students and teachers is therefore unsurprising. Dan also alludes to teachers' understanding of what their 'roles' are, indicating that they have internalised the focus on the exams, a point Olive picks up when she acknowledges her role is to get students through the exams:

```
OLIVE:          There's a challenge at the end of the day with the
                exam, you know, you have to get these students
                through, you've taken them for First Year, so you
                want to see the outcome of all that work. So I
                suppose that's where it lies with the exam classes.
```

<div align="right">(Olive, Hillview School)</div>

For clarity, I am not suggesting a reductionist view that limits the purpose of schooling to passing exams. Instead, the data support a finding that exams are a significant part of that purpose, at least in the practices observed and reported in this study as Martin acknowledges when he says 'it is your main responsibility', or more accurately, that is his view for his third year class as they approach their exams. Teachers report an ability to derive professional satisfaction and enjoyment from the exam process as it provides a tangible outcome and conclusion after several years' work with a group of students. Some teachers therefore accept the exams not for their own sake, but for the sense of conclusion they bring, as well as the focus and motivation they can provide to students (mindful of the potential to de-motivate non-exam years). For most teachers in the study, the exams dominated third year (and second year for some), but not at the expense of enjoying both their teaching and their students' exploration of their subjects over the previous years, as I demonstrated in the descriptions of first year. Indeed, at other points in the data, teachers acknowledge and discuss other dimensions in their roles, whether pastoral or inculcating an affinity for a subject.

Returning to Dan's comment that teachers do not 'hide behind exams', he rejects the idea that the exams constrain innovation, believing that the focus, approaches, and content are entirely appropriate to his role and how he will be judged. His comment strengthens the case that the exam system heavily impacts teachers and that judgements about the quality of an individual teacher are likely to be informed by their students' exam performance. In Chapter 5, I discussed the challenge in measuring quality in schools and teaching, so it is unsurprising that teachers can be judged using the only measure widely available that offers an ability to measure and compare schools.

Having examined how the examinations system is a focal point for teachers when making decisions about approaches, methods, and technology, it is useful to look at how the system places various constraints on students and teachers.

Constraint

Students and teachers discuss the ability of the exam system to act as a constraint; two types of constraint are identified: in practices, and in content. When considering how practices are constrained, or more particularly, how innovation in practice is constrained, students report that teachers (outside the study) invoke the exam as justification for their unwillingness to alter their approaches or use technology. That view is confirmed by students in Martin's class who implicitly acknowledge that a culture which focuses on exams can restrict more exciting or interesting teaching methods:

```
INTERVIEWER:   Would you like other teachers to, to make things a
               little bit more interesting and exciting?
STUDENT 2:     Because they always come back with an answer, oh, you
               have to write your exam out, so…
```

<div align="right">(Students in Martin's Class, Hillview School)</div>

In the case of Hillview School, that constraint does not go unchallenged. Martin, while pragmatically recognising how students will be measured, critiques the process:

> MARTIN: Junior Cert cycle reform is round the corner. One of the reasons obviously is because, this is the information, go learn it and regurgitate it. Do you know, is that a sign of learning, of developing certain skills that young adults need? Communication, working as a group, identifying key ideas that you need to bring into an answer – possibly not.

(Martin, Hillview School)

Dan previously defended teachers from the accusation of hiding behind the exams, he expands on that defence, citing the curriculum, a topic I will return to later in the chapter. The principal in Hillview School has noted that innovation in practices does not necessarily lead to a drop in standards or students' achievements and speaks passionately about letting students learn for themselves while still achieving success in the exams; a view that is in opposition of Dan's. Interestingly though, when Martin described students reaching their potential, that potential was measured in large part through the exams, indicating that even a teacher whose views of the exam system are both critical and pragmatic can be constrained by how students' success is measured.

Students may also resist innovation in practices; students in Martin's class express some reticence to engage with group work and would prefer to sit separately and passively. Coding of Martin's classes shows them to be the most active for students so it perhaps unsurprising that they resist the workload. So it must be acknowledged that in addition to the exam system, students in this class reported an aversion to the increased workload that technology enabled.

```
INTERPRETER:    If you could change one thing about the class what
                would it   be?
STUDENT 5:      No more group work.
STUDENT 4:      Yeah.
INTERVIEWER:    You don't like sitting in groups?
STUDENT 5:      [Inaudible], it's just –
INTERVIEWER:    Okay, this is interesting.  You'd like less group
                work?
STUDENT 5:      Yeah.
INTERVIEWER:    You'd like to just, kind of, sit quietly and listen?
STUDENT 4:      Yeah.
INTERVIEWER:    And –
STUDENT 2:      Don't like sitting in groups.
```

(Students in Martin's class, Hillview School)

Looking at how content is constrained, students are reported to resist extra work or

reading by Beverly from Seafront School, who describes how she has given students

additional reading or links to primary sources:

```
BEVERLY:        They never really go that extra mile in general.
INTERVIEWER:    Is it that, are they too busy with other schoolwork
                or -
BEVERLY:        Yeah, it's other schoolwork and it's sometimes
                they're going, 'Well, is that curriculum or is this
                me just doing extra work?'
```

(Beverly, Seafront School)

She states that in general the students do not 'go that extra mile' to engage with those

resources and she suggests two reasons. First, that they have a hectic workload in 3rd year

and are balancing personal lives with school work, and secondly, they ask her if this is on

the curriculum, demonstrating a strategic view of what work is needed on their part. In

many cases, she reported that they are content with the textbook.

A sub-category entitled *students and information/knowledge* emerged and was

concerned with students' relationship with and understanding of knowledge. As a topic for

exploration, it is beyond the scope of this thesis, but I will flag it as a perspective that was

considered and presented in summary. Echoing the comments from students in Beverly's

and Martin's classes, most students reported a strategic view of knowledge acquisition,

preferring teachers' notes or textbooks as authoritative sources over a process of knowledge construction. Indeed there was a resistance to extra content for two reasons. First there was the strategic view that it was a diversion from the curriculum, and second, establishing the authority of a source was problematic for students, an issue they did not encounter with teacher-curated or textbook-sourced content. The experience with Dan's students above allows a potentially cynical view, that students would prefer the easiest option with least work by relying on their teachers' editorial choices for content rather than independent research. Students did demonstrate an awareness of the purposes of being exposed to diverse sources of content, but with a similar care for exam performance, their strategic focus on the exams reinforced the constraints of the exams on teachers. Some perspectives from the literature echo these concerns, lending them credibility and suggesting value in further research.

Mobile devices and mlearning may also have a direct and pervasive impact on knowledge itself, and how it is generated, transmitted, owned, valued and consumed in our societies. As a means of delivery, mlearning can provide information almost immediately and in many formats. Traxler argues that knowledge is not an absolute, 'it is socially determined and socially constructed but it has also always been mediated by its container, its medium, its repository' (Traxler, 2009, p. 9). Sharples explains this concept in more depth:

> Every era of technology has, to some extent, formed education in its own image. That is not to argue for the technological determinism of education, but rather that there is a mutually productive convergence between main technological influences on a culture and the contemporary educational theories and practices. In the era of mass print literacy, the textbook was the medium of instruction, and a prime goal of the education system was effective transmission of the canons of scholarship. During the computer

era of the past fifty years, education has been re-conceptualised around the construction of knowledge through information processing, modelling and interaction. For the era of mobile technology, we may come to conceive of education as conversation in context, enabled by continual interaction through and with personal and mobile technology (Sharples, 2005, p. 1).

Teachers may also be concerned that mlearning and mobile devices can serve up vast amounts of information in small disconnected and trivial chunks (Traxler, 2009). Traxler quotes T.S. Elliott (1934) who eloquently expresses this fear, which appears to be timeless in its relevance:

> 'Where is the Life we have lost in Living? Where is the wisdom we have lost in knowledge? Where is the knowledge we have lost in information? (Elliot, 1934)

Traxler offers a view on how new forms of knowledge and the methods to access that knowledge are altering the debate on the purposes of education:

> This generation of new knowledge intrudes a new protagonist into the debate and dichotomy between utilitarian and liberal views of education, and challenges the idea of a common curriculum or universal canon of accepted and useful knowledge that an education system must deliver. It challenges too formal learning, its institutions and its professionals, in their roles as society's gate-keepers to learning and technology for disadvantaged individuals and communities. (Traxler, 2009, p. 9)

7.6 Subject Beliefs

Mindful of the practical limits discussed at the outset of the chapter, this section will summarise the relevant focused codes and memos from the category *teachers' subject*

beliefs. I have already touched on those beliefs earlier in the chapter when discussing how Dan and Olive had internalised the importance of the exams in their practice, and this section will present two further contributing aspects of teachers' beliefs: (a) on their roles as teachers, and (b) their views on the syllabus (curriculum). While identifying avenues for further research, this summary will ensure theoretical saturation for the grounded theories already discussed with the addition of further relevant data.

Dan and Martha reflect on their roles as teachers in the quote below, with Martha seeing hers primarily as a giver of knowledge, most often expressed as the preparation of students for exams:

```
Interviewer:    So, listening to those last few answers would it be
                fair to say that, that maybe there is a bit of a
                change in, in your role happening but you're kind of
                negotiating that and dipping your toe in the water
                and testing?
Martha:         Oh, and, definite, yeah. My role as a teacher. I
                think as a question it shouldn't be as my role as a
                teacher, my role as a teacher is to give the
                knowledge.
```

(Martha, Seafront School)

While Dan and Martha internalised the importance of exams and offer no critique of them, Martin provides a contrast, and as his second subject is Geography allows a direct comparison with Dan and Martha. Martin recognises the importance, but also the limits of the exams, and that 'learning' and 'regurgitating' content does not 'develop certain skills that young adults need' some of which he identifies as 'communications, working as a group, identifying key areas'. He indicates that while his role has changed:

```
MARTIN:              I find that I'm  much more, playing much more of the
                     role of coordinating the learning, making it a bit
                     more accessible, if you like, and giving them the
                     task, letting them go in to do the research of the
                     course content, letting them discuss it, letting them
                     put something together to present it, presenting it
                     to each other. So effectively, you know, you're
                     talking about the teaching and the learning there and
                     it very much was a case, well, I was doing the
                     teaching and you go and do the learning. Whereas now
                     it's more of a case where they're doing the learning
                     and they're doing the teaching.
```

Unlike Martha, Martin's states that his role has changed and he highlighted how students access course content differently, through their guided research rather than didactically. Dan tacitly aligns his beliefs with Martha's when he discussed the syllabus and what he felt was the large volume of content contained in it, which he felt precluded him from engaging in different methods as Martin had done.

```
Dan:                 There's a big sort of anchor that's slowing us down
                     from really pursuing that and that's the fact that
                     course content, there's an amount we have to get
                     through which doesn't lend itself to this open-ended
                     [learning].
```

It appears therefore that teachers' beliefs about their roles are to some degree shaped by the curriculum, whether they see it as failing to develop specific skills or as a pathway to academic development and success (via exams).

Dan describes the course content of the curriculum as an 'anchor', a comment which will enable a comparison to be made shortly, although I must clarify he may more accurately be referring to the syllabus rather than the curriculum. Dan indicates that the volume of content is burdensome, that it constrains teachers as they hew closely to the content of the syllabus, always with a focus on the exam. Dan was aware of and discussed the diversity of subject-related content available to students online; a body of knowledge

he accepted was larger and more current that his domain knowledge acquired in university. In his interview, Dan distinguished between a syllabus's defined body of knowledge and the body of knowledge of a subject or domain which is substantially larger. Dan's beliefs, similar to Martha's, restricted his teaching to only that which was relevant to the syllabus and the exams, whereas Martin would direct students to research widely to develop skills and construct knowledge before narrowing down the focus to exam-related content.

Martin described how technology, and access to information, was one of the enabling factors in his change of role. Dan, however, felt that while technology had changed and the classroom had evolved, that the course content has not kept pace.

```
Dan:              ... so I think the curriculum hasn't caught up with
                  the technology. The curriculum hasn't changed but the
                  technology has, the classroom has...
```
<div align="right">(Dan, Seafront School)</div>

Dan discussed the revised Junior Cycle, offering a critique that there is more content, more prescription and less space for technology use or student discovery, exploration or individual learning. He states:

```
Dan:              So the technology is there to allow that [student
                  research] to happen, that is probably the best way to
                  learn because they pick up some things they're
                  interested in and if they're really interested in it
                  they are going to run with it and they're going to do
                  the research and all the background work and then you
                  suddenly have to the teacher, no ,time up, we cant do
                  any more that because we have to get X,Y and Z done
                  by such and such a date
```
<div align="right">(Dan, Seafront School)</div>

It noteworthy than Dan indicates he would forego students developing research and analytic skills as well as background knowledge to cover the rest of the content, rather than seeing a benefit that those skills and background knowledge could provide as both a scaffold and framework for later related content. While Dan may profess a belief in the

benefits of technology that is contradictory to his observed practice, this is perhaps unsurprising as deep-rooted beliefs or 'traditional perceptions of what teacher, learning, and knowledge should look like are major limiting factors to integrating technology' (Ritchie & Wiburg, 1994, p. 152). The comparison between these teachers reveals beliefs about their roles and curricula to be a relevant factor in their use of technology, but not to the detriment of the grounded theories discussed in this chapter. It is also interesting to return to the literature review for a moment, and Cochrane's (Cochrane, 2013) contention that successful mobile learning projects require a change in pedagogy (also assuming an underlying change in beliefs). The data in this study and the grounded theory that technology usage was appropriate to the context of each school indicate that at least in Ireland's context a wider lens is needed to consider these initiatives; for example, a sociological lens to understand student's resistance to structures of power in their use of informal spaces for communications.

This summary of teachers' beliefs about their roles as teachers and their views demonstrates a strong link between these beliefs and classroom practices. Indeed it almost raises a paradoxical question of whether beliefs, exams, or the curriculum are the major influences on technology use. I must add a caveat that this summary is skirting close to the realm of curriculum studies, which is out of scope. Some teachers see a curriculum as a base of knowledge to be imparted to students for later examination, others as an introduction to a domain both for examination but also enabling lifelong access via a set of skills. The overwhelming evidence of the impact of the exams in the data and the lack of contradictory data in the category *teachers' subject beliefs* justify the approach taken. This summary has achieved its aims, by first identifying a future pathway to research into

teacher' beliefs, and second, by searching for additional data relevant to the categories already presented to ensure theoretical saturation.

7.7 Grounded Theories & Chapter Summary

In this final section of the chapter, I will bring together theories which emerged from the categories *teachers' virtual classrooms* and *teachers' relationships with their subjects*. Continuing the approach from Chapter 6, the theories will be stated as a series of propositions. I continued the clustering exercise and have expanded on the concept map from Figure 6.3 and present the complete version in Figure 7.2, below. The content of the map will be elaborated on throughout this section.
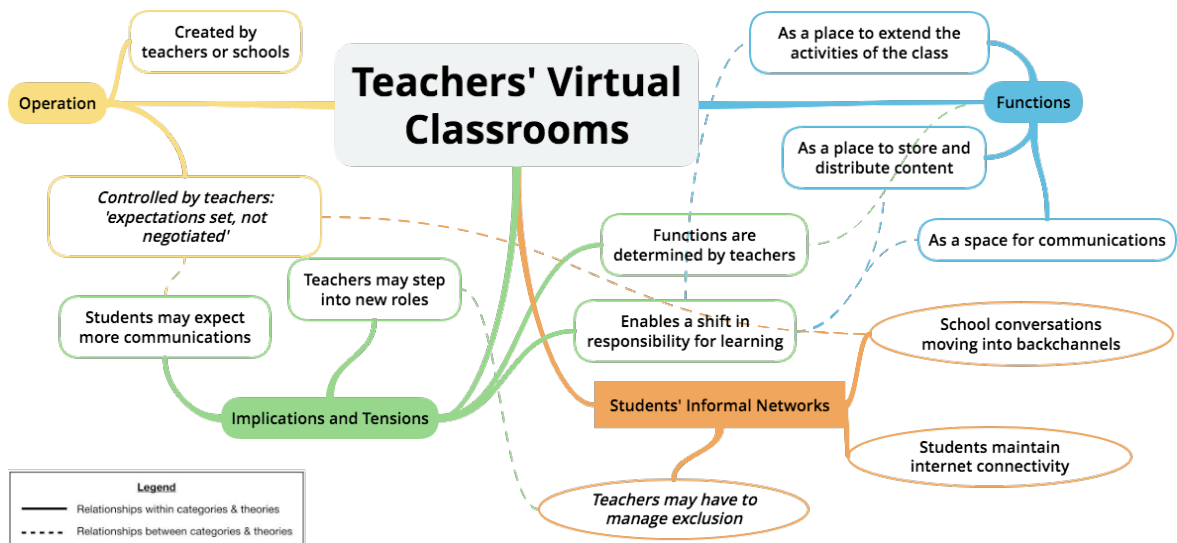

Figure 7.2

Figure showing a concept map of the grounded theories.

Functions Of Teachers' Virtual Classrooms

The data showed that teachers' virtual classroom performed three distinct functions in the schools. The first being as a space for communications which had a whole-school impact in both schools, the remaining functions operated mainly at class and teacher level:

- As a space for communications;
- As a place to extend the activities of the class, predominantly seen in Hillview School;
- As a place to store and distribute content, predominantly seen in Seafront School.

In Chapter 6 and the beginning of this Chapter, I established the functions of teachers' virtual classrooms, listed above. The latter part of this chapter sought to answer the question *'why were the teachers' virtual classrooms used in the ways observed, and why did they tend towards a different pattern of usage in each school?'* The data and analysis presented support a grounded theory that there is a strong link between many of the choices teachers make and the exam system, in particular, teachers' choices of teaching materials and their patterns of use of their virtual classrooms. It is evident that not only are those patterns shaped by the examination system, but that technology use more generally is mediated by and contingent on, the exam system. The exams provide measures of success and engagement for students and teachers, but can also constrain innovation and narrow content options. Indeed, the exam system has a discernible and substantial impact on day-to-day decisions in classrooms. With the theory established at a high level, I can state that the exam system shaped the use of teachers' virtual classrooms and that a substantial amount of technology use was contingent on the exam system.

To develop the theory further, and continue to answer the question about different patterns of use in each school, I will explore and analyse the schools and teachers by drawing a series of comparisons of similarities and differences between them. To compare the schools, I will return to a category presented in Chapter 5, *responding to the introduction of mobile devices*, and a sub-category, *possessing a self-identity*, as well as data from Chapter 6 and 7. It is evident that between the schools there are different levels of confidence that technology will enrich the learning experience and will not be detrimental to academic or exam performance. The level of technical maturity in each school's mobile device initiative is a significant contributing factor to this level of confidence. I have shown in Chapter 5 that Hillview School had a mostly trouble-free introduction, whereas Seafront School had substantial technical difficulties which created an atmosphere of frustration with the initiative amongst teachers. The adoption of teachers' virtual classrooms, including their rationale and method of introduction, is also a contributing factor. In Hillview School, it was the natural evolution of the initiative, spearheaded by teachers with support and encouragement from the school leadership. In Seafront School, that rationale was to reboot the initiative and was led by the principal with a structured and well-supported programme; although it was building from a lower base. Based on this evidence, I conclude that each school's mobile device initiatives were at different levels of maturity, both technically and pedagogically. The impact of the different levels of maturity is especially apparent when looking at the contingency of technology use on academic achievements. In Hillview School, it is accepted that results are sustained, yet in Seafront School that confidence is at best tentative and the lack of adverse impacts on academic performance remained to be proven to teachers (and parents). Further insights can be gained by comparing within the sample of teachers.

Shaped By The Examination System

To begin a comparison of teachers, I will select one from each school whose use of their virtual classroom and classification of technology use represents the dominant use in their respective school. Those teachers are Martin from Hillview School and Martha from Seafront School. Martha and Martin share several similarities, including a commitment to their students' performance and that they can reach their potential; both recognise that the exam is a measure of success, although Martin has concerns which have been noted. Both teachers welcome and embrace the potential for technology to enliven their subject for their students and their experience of teaching it by enabling access to more diverse sources of content. Their use of technology, however, reveals differences; Martin is confident that creative and collaborative uses of technology can deliver the required academic outcomes while also developing students' ability to learn independently, developing their critical skills, and fostering a positive disposition to the subject. Martha, in contrast, has only tentative confidence that the technology will not harm academic outcomes, although she has a firm belief in the administrative and organisational benefits. Martha is, therefore, more singularly focused on the exams as the product of her efforts, while Martin sees greater value in the process. Both teachers' focus on the exams shifted over time, with Martha taking a long-term approach that began in second year, while Martin shifted only at the beginning of third year. The data from Martin and Martha prompts me to apply the same process used with Olive and Amy, and plot their technology use over time. Placing Martin and Martha on the spectrum that Amy introduced shows them on opposite ends, with the remaining teachers spread between them. Figure 7.3, below, extends this analysis by plotting the focus for technology use over time for all

teachers using interview and observation data. It shows that in all cases, teachers became more focused on the exams as they approached, but that there were significant variations in the timeframe and intensity of focus.
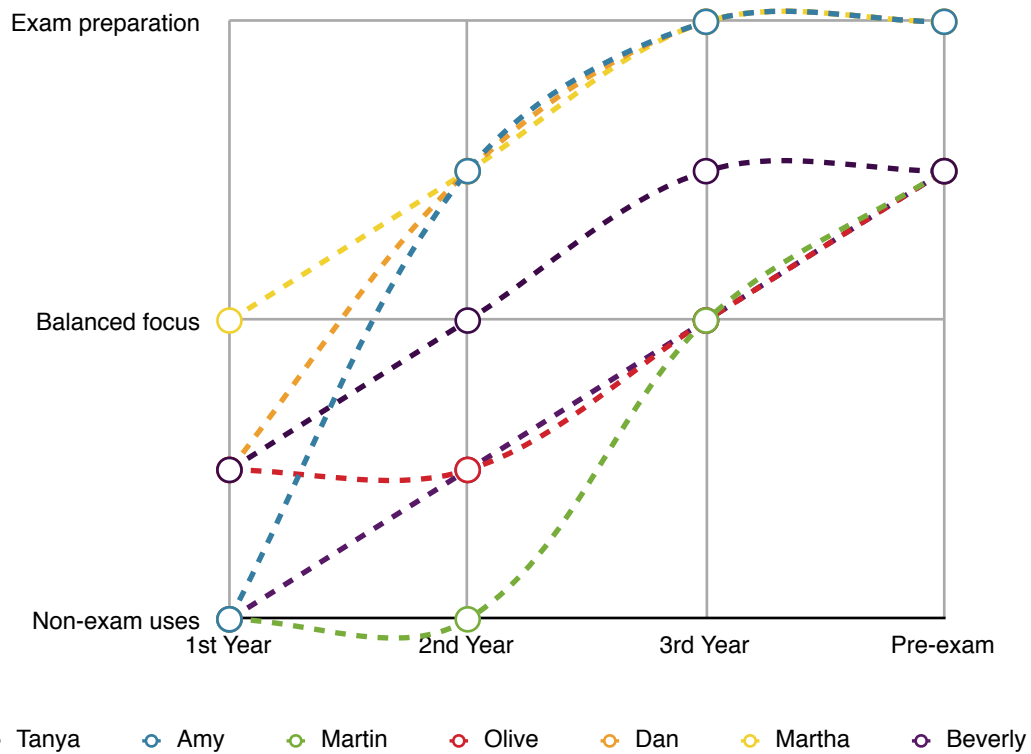

Figure 7.3

Graph showing teachers' focus for technology use over time.

It is possible to extend this analysis further by examining teachers' technology use over time to establish which classification of use was dominant and placing that alongside the data on teachers' use of their virtual classrooms, see Table 7.10 below.

Table 7.10

Table showing each teachers' use of their virtual classroom, including embrace and pattern of use; together with the dominant classification of their technology use.

Teacher (School)	Characterisation of their embrace of their TVC	Pattern of use of their TVC	Classification of use of technology (dominant)
Tanya (HS)	Enthusiastic	Extending the Activities of the Class	Non-exam uses
Martin (HS)	Enthusiastic	Extending the Activities of the Class	Non-exam uses
Olive (HS)	Enthusiastic	Extending the Activities of the Class	Exam focused & non-exam uses
Beverly (SS)	Enthusiastic	Extending the Activities of the Class	Non-exam uses
Martha (SS)	Enthusiastic	Storing and Distributing Content	Exam focused
Amy (HS)	Cautious	Storing and Distributing Content	Exam focused
Dan (SS)	Cautious	Storing and Distributing Content	Exam focused

Two broad patterns are immediately discernible. The first is a set of teachers who enthusiastically embraced their virtual classrooms, using them for *Extending the Activities of the Class* and using technology for non-exam purposes. The second was a group of teachers who embraced their virtual classrooms cautiously, using them for *Storing and Distributing Content*, and whose technology use was mainly focused on the exams. Two exceptions emerge, the first is Olive who reported a firm focus on exams with technology mainly set aside in third year; except for her virtual classroom, which she continued to use. Olive uses technology extensively for the teaching of mathematics, with some examples of her activities already discussed in Chapter 6, but she adopted a different approach when she focused on the exams during the revision period. Olive's continued use of her virtual classroom reflects how they were integrated into the changed routines of the schools and classroom, in particular as a tool for communications. The second exception was Martha, who eagerly embraced her virtual classroom, but mainly for the purpose of *Storing and Distributing Content*. In contrast, to other teachers of her age and level of experience, she

was undeterred by a lack of technical skills and once she perceived a benefit for students she became a vocal champion for the use of Schoology amongst her peers, although her other uses of technology remained limited and purely exam-focused. Returning to the teachers' initial questionnaire, see Table 5.5, it is noteworthy that Martha reported the lowest level of ICT skills, making her journey from self-confessed 'dinosaur' to Schoology champion a remarkable one.

The question *why did they tend towards a different pattern of usage in each school?* is more complicated to answer. The level of technical maturity and confidence in technology have already been acknowledged as factors. It is also relevant that each of the platforms for teachers' virtual classrooms was used for the purposes it was best suited by most teachers, for example, Schoology was mostly used for *Storing and Distributing Content*. The idea of technology determinism has been discussed and discounted, as it is evident that the schools selected different platforms for teachers' virtual classrooms because their respective features and natural uses resonated with the teachers. The central position that teachers have in the decision process is unsurprising in light of the previous research from Dexter, Anderson and Becker (1999), who state:

> ... Although culture and context create norms of teaching practice ... Teachers can choose, within these limits, the approach that works for them. This autonomy provides teachers with choices to adopt, adapt, or reject and institutional reform (Dexter et al., 1999, p. 224)

The exam system and each school's self-identity formed the culture and context in which teachers operated. I can now extend the theory to state that the exam system shaped the use of teachers' virtual classrooms and that their usage was appropriate and predictable in the context of each school.

Chapter Summary

The data showed that teachers' virtual classroom performed three distinct functions in the schools. The first being as a space for communications, then as a place to extend the activities of the class, and finally, as a place to store and distribute content. The chapter then focused on the questions *why were the teachers' virtual classrooms used in the ways observed, and why did they tend towards a different pattern of usage in each school?* I have established a grounded theory that draws on several findings:

1. The level of technical maturity and confidence in technology had a significant impact on teachers' use of technology, including their virtual classrooms.

2. Where teachers' virtual classrooms were used for *Storing and Distributing Content,* there was a strong focus on the exams and an intention to prepare students for them.

3. Where teachers' virtual classrooms were used for *Extending the Activities of the Class*, teachers were confident that other approaches would enliven a subject and enhance a range of skills for students, but without risking academic performance.

4. In all cases, the use of technology, including teachers' virtual classrooms, was contingent on maintaining academic standards and students' examination performance.

In summary, the use of teachers' virtual classrooms, and technology generally, was shaped by the examination system, and the uses in each school were consistent with the self-identity and context of that school.

Chapter 8: Conclusion

8.1 Introduction

In this final chapter, I will revisit the research questions which guided this study and look at them through the lens of the grounded theories which emerged from the data. While the questions were used as sensitising concepts to guide the research, the methodology of grounded theory ensured that they did not constrain the data with implicit biases, assumptions or misconceptions. As sensitising concepts, they provided an initial structure and framework for inquiry, enabling the experiences of the participants to emerge, and supported the development of grounded theories. Following the reconciliation of the research questions with the grounded theories, I will explore the theories which extended beyond the scope of the questions, including those emerging from the category *teachers' virtual classrooms*. The use of virtual classrooms by teachers emerged as a set of important theories and findings in the study; while they addressed some research questions, they extended well beyond them. Those theories established a classification framework for the functions and operation of teachers' virtual classrooms and went on to reveal that Ireland's examination system shaped their use. The study's claim to significance begins with the grounded theories and their contribution to the academic knowledge base of the discipline. The significance is further enhanced by the study's application of grounded theory in an unfamiliar discipline, i.e. educational technology; its innovation in the research methods; its elucidation of the implications for teachers in their practice; and finally, the opportunities it identifies for new research to extend or enhance the study's findings. I will then summarise and conclude the thesis.

8.2 Grounded Theories & Research Questions

The purpose of revisiting the grounded theories and research questions is twofold. The first is a procedural step to ensure that the study comprehensively addresses its intentions, that each research question has been treated, and that the research process has been correctly described and documented. The second is to ensure fidelity to the methodology and rigour in the analysis. By looking at the questions through the lens of the grounded theories, I show where the data have already answered some questions, I will reframe other questions to show how they have been addressed in full or in part, and finally, I will identify where the data moved beyond the questions to reveal potentially fundamental shifts in teaching and learning. It is this step which reconciles the intentions of the study, framed by ethical and institutional requirements, and its outcomes which, through the careful application of grounded theory, have vividly described the experience of the participating schools, teachers and students.

Grounded Theories

From the focused codes and categories presented and discussed in this thesis, nine grounded theories emerged, which I will summarise below with some contextual information from the chapters where they were presented:

1. The categories *planning to introduce mobile devices* and *responding to the introduction of mobile devices* which were analysed in Chapter 5, provided data to establish the theory that **mobile learning as a pedagogical practice was not present** in the schools in the study.
2. While examining the category *responding to the introduction of mobile devices* in Chapter 5, the data demonstrated that **the classroom implications [of having mobile devices] were unexamined** by teachers.

3. While examining the category *getting online and communicating* (students) in Chapter 6, students were shown to be adept at getting online and maintaining near-ubiquitous internet connectivity. They created informal networks, which could be understood as a metaphorical 'wireless skin'.

4. The operation of teachers' virtual classrooms were discussed in Chapter 6, where it was established that they **operated as teacher-controlled spaces where expectations were set rather than negotiated**. Potential tensions in practice arose for teachers, including the expectations for increased level of communications and that teachers may step into new roles.

5. In Chapter 6, the analysis of the category *informal communications and networks* revealed that **students are taking school-related conversations out of the teacher-controlled space and are using their networks as backchannels for class**.

6. The ability to communicate beyond the traditional physical limits of the classroom, enabled by teachers' virtual classrooms, caused school and class routines to change; **students were expected to stay connected with their classes and up-to-date with classwork and homework**.

7. The analysis of teachers' virtual classrooms in Chapter 7 revealed that they performed three distinct functions in the schools, as: (a) a space for communications, (b) for *extending the activities of the class*, and (c) for *storing and distributing content*.

8. While analysing the functions in Chapter 7 (see 7 above), it emerged that **the patterns of use for teachers' virtual classrooms were determined by teachers and schools rather than by the technologies or platforms**.

9. The question of *why* teachers' virtual classroom were used in the ways observed was answered in Chapter 7, where it was shown that their use was **shaped by the examination system**; and their uses (and of educational technology generally) in each school were consistent with the context and self-identity of each school.

Research Questions

   This study intended to inquire into *the impact of mlearning and access to mobile technology on relationships of learning between students and teachers*. As discussed in

Chapter 3 and above, the practicalities of research required a set of detailed research questions before research could commence. The questions, listed below, were used as sensitising concepts rather than a rigid set of tests, in a manner consistent with grounded theory:

(a) identify the changes (if any) in relationships of learning between students and teachers,

(b) determine if these changes (if any) were brought about solely by the use of mlearning and adoption of mobile devices or if other factors contributed to the changes,

(c) identify any tensions that may have resulted from changes in students' expectations of teachers within an mlearning practice paradigm, and

(d) establish which theoretical framework(s) underpins the mlearning practice paradigm in the subject schools.

8.3 Integrated Discussion

This section presents an integrated discussion of the research questions and theories, see Table 8.1, followed by a discussion of the theories which extended and moved beyond those questions, see Table 8.2. The purpose is not to re-analyse the data, but to draw connections which crystallise the significance of the study and highlight areas for future research.

Table 8.1

Table showing an integrated summary of research questions and the grounded theories which address them in whole or in part.

Research Questions	Grounded Theories
A) identify the changes (if any) in relationships of learning between students and teachers, **and** B) determine if these changes (if any) were brought about solely by the use of mlearning and adoption of mobile devices or if other factors contributed to the changes.	(1) *Mobile Learning As A Pedagogical Practice Was Not Present in the schools* in the study. (7a) Functions of teachers' virtual classrooms: as a space for communications. (6) *Students were expected to stay connected with their classes and up-to-date with classwork and homework.*
C) identify any tensions that may have resulted from changes in students' expectations of teachers within an mlearning practice paradigm	(4) The operation of teachers' virtual classrooms were discussed in Chapter 6, where it was established that they *operated as teacher-controlled spaces where expectations were set rather than negotiated.* Potential tensions in practice arose for teachers, including the expectations for increased level of communications and that teachers may step into new roles. (5) *Students are taking school-related conversations out of the teacher-controlled space and are using their networks as backchannels for class.*
D) establish which theoretical framework(s) underpins the mlearning practice paradigm in the subject schools.	(1) *Mobile Learning As A Pedagogical Practice Was Not Present in the schools* in the study. (2) *The classroom implications [of having mobile devices] were unexamined* by teachers (7) It was the teachers and not the affordances of the platforms which determined how they were used. (9) The uses of technology and mobile devices was *shaped by the examination system* and in each school were consistent with the characteristic spirit and context of each school.

In the following section, I will revisit the concept of mobile learning as a practice which featured in the literature review and design of the study. While the presence of mobile learning was not established in the data, several relevant grounded theories allow the research questions to be re-framed to reveal further insights from the data. Through the discussion, I can begin to address question (A) changes in relationships, and (B) on the nature of those changes. Throughout this discussion, I will draw on the theories which reject the premise of question (D) on theoretical frameworks, although those theories have

opened up new lines of inquiry. I will then discuss changes in relationships of learning, a particular aspect of which does address question (C) on tensions which may have arisen in teachers' practice.

Mobile Learning As A Practice

While analysing the category *responding to the introduction of mobile devices*, I was prompted to ask if I had conflated mobile *learning* initiatives with mobile *device* initiatives in the design of the study? I concluded that I had indeed conflated them, although, in the resulting discussion in Chapter 5, I demonstrated that there were no methodological implications. The research questions, in particular (a) and (b), were therefore prefaced on the assumption of mobile learning as a practice existing in the participating schools, or at least the potential for it to exist, as described in the invitation letter to principals (see Appendix 3D). The definition of mobile learning was derived through a synthesis of the literature, where I established the conceptual framework for mobile learning as a practice which comprised a mobile device, internet connectivity, socially-connected learning spaces, a change in the role of the teacher, and the use of constructivist pedagogies[21], see Figure 8.1, below.

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21 While the characteristics are not arranged as a hierarchy, for ease of reference in the subsequent discussion, I will refer to them in sequence beginning with the technological characteristics.
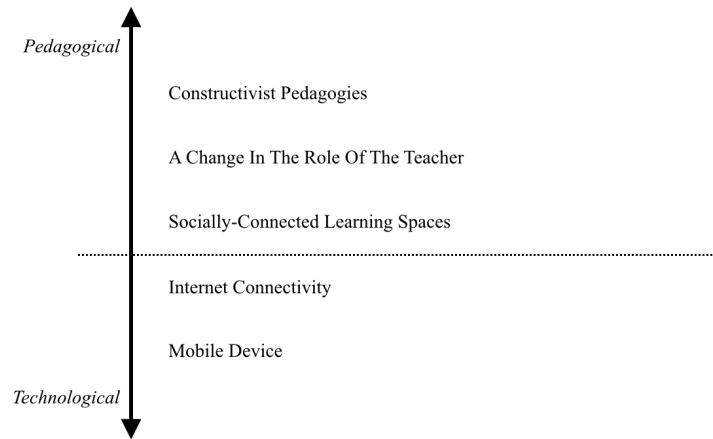
Constructivist Pedagogies

A Change In The Role Of The Teacher

Socially-Connected Learning Spaces

Internet Connectivity

Mobile Device

Technological

Figure 8.1

Figure showing the characteristics of mobile learning as a practice.

Two of the three sample schools exhibited the potential for mobile learning, but Meadowbrook School did not and was excluded from further participation; a decision I will reflect on shortly. In this discussion of mobile learning, I am responding to the first two grounded theories which found that in the remaining schools *mobile learning as a pedagogical practice was not present,* and even when mobile devices were introduced that *the classroom implications [of having mobile devices] were unexamined* by teachers. Examining these two theories in light of the research questions opens avenues for discussion, including the potential for further research.

Revisiting the characteristics of mobile learning. As the potential for mobile learning was one of the primary selection criteria for participating schools, it is interesting to return to those characteristics and ask if, ultimately, any were present? The grounded theories showing students' ability to get online and that *students are taking school-related conversations out of the teacher-controlled space and are using their networks as backchannels for class* strongly suggest that some were present and provide a starting

point for discussion of the technological characteristics and socially-connected learning spaces. A mobile device, often a mobile phone, and ubiquitous internet connectivity were shown to be the essential technical requirements (or characteristics) for mobile learning, and indeed they also created the 'wireless skin' that Castells (1999) described. Students were adept at getting online, which was shown to require minimal technical skill, and placed emphasis on being in near-constant communication with peers. Their networks were typically accessible using a mobile phone or their school tablet computer. So while it is clear that the first two characteristics mobile devices and connectivity were present, it becomes difficult to say that of socially-connected learning spaces.

Socially-connected learning spaces were envisaged as open spaces for communications and where learning may be evident as seen in the literature review and practitioner blogs. There was the potential, from a technological perspective, for teachers' virtual classrooms to perform that function; Edmodo stands out as being the most technically-suited to the task because of its Facebook-style feed of activity. In Chapter 4, I discussed the expectations of such visible evidence of learning but concluded it was absent in these contexts. Some explanation was provided by two grounded theories which address this characteristic directly, stating that teachers' virtual classrooms *operated as teacher-controlled spaces where expectations were set rather than negotiated* and that *students are taking school-related conversations out of the teacher-controlled space and are using their networks as backchannels for class*. The virtual classrooms, therefore, lacked any meaningful social interaction or visible learning and operated in strong contrast to examples in the literature, or from practitioner blogs (generally written by teachers from the United States). Despite the technical ability to operate in more 'social' ways, they were

not used for those purposes, and therefore the third characteristic was absent. Reflecting on the decision to exclude Meadowbrook School, and considering that the school did not use *any* platform which could have operated as either a socially-connected learning space or teachers' virtual classroom, that decision has been validated.

I will begin to address the fourth and fifth characteristics, which were changes in the roles of teachers and the use of constructivist pedagogies, by revisiting the discussion on technology determinism. The discussion will extend to the next section, taking into account the contexts of the schools and their mobile device initiatives. In Chapter 7, I discussed technological affordances, defined as "the purposes to which they seem most easily to lend themselves" (Pegrum, 2014, p. 6), and technological determinism and asked if those affordances influenced the way teachers used their virtual classrooms in a deterministic way? Klopfer & Squire (2008) defined the affordances relevant to educational contexts with mobile devices as as (a) portability, (b) social interactivity, (c) context sensitivity, the ability to "gather data unique to the current location, environment, and time, including both real and simulated data", (d) connectivity, to data collection devices, other handhelds, and to networks, and (e) individuality, a "unique scaffolding" that can be "customised to the individual's path of investigation" (Klopfer & Squire, 2008). The data instead produced a grounded theory stating that *the patterns of use for teachers' virtual classrooms were determined by teachers and schools rather than by the technologies or platforms.* Throughout the data, it was evident that the reason for choosing each platform was that they appealed to how teachers were already teaching or intended to. As a result, the evidence from the data shows that teachers continued to teach using their current approaches, although the scale and degree of technology use may have increased.

Where there were changes in approaches, teachers were enacting latent intentions to make those changes rather than being led by the technology, and those changes were taking place in the context of school-level (or systemic) changes. This finding echoes my critique expressed in Chapter 2, where I posed the question of whether technology determinism was a simplistic binary, and that other social, cultural, political and environmental factors may be at work. I can therefore state that the technology was not an agent of change in itself but has been embedded into existing relations, practices and contexts of the schools.

This theory, which ruled out technology determinism as a factor, speaks to the earlier theory that *mobile learning as a pedagogical practice was not present in the schools* in the study. Where there were changes in pedagogical approaches, their cause was not a planned change by the schools or teachers, nor a change led by the technology. Rather, the changes observed extended existing approaches or enacted teachers' prior (or latent) intentions for innovation in their practice. Coded examples of tasks from Olive in Hillview School exemplify this finding (see Table 4.8 and Appendix 4B.)

Revisiting the mobile device initiatives. To continue examining the final two characteristics, it is useful to discuss them within the context of the grounded theories and the schools' mobile device initiatives. The theory that *mobile learning as a pedagogical practice was not present* emerged from the data and was supported by findings from Chapter 5, including:

- It developed and elaborated on an earlier theory stating that *the classroom implications [of having mobile devices] were unexamined.*
- The absence of an articulated and linked *change* in practice, for example, the flipped classroom.

- In both schools, devices were introduced in advance of anticipated pedagogical innovations that would come with curriculum reform. The principals and teachers saw the devices as supporting *later* innovations, but crucially, they were not the driving force.
- While examining teachers' virtual classrooms in Chapter 6, it was evident that most teachers took the opportunity to extend current practices or enact latent intentions.

A vision for the use of mobile devices was clearly articulated and evident in both schools, although they would start from different levels of readiness, with different ambitions for the outcomes, and with different implementation plans. Notwithstanding that there was an overarching vision in each school, a crucial step was neglected in both schools, which was to examine the classroom implications of introducing mobile devices. That is not to say that the schools' initiatives failed, instead that the processes and development of the initiatives were shaped by that first omission, with different impacts in each school; for example, the different rationales for introducing teachers virtual classrooms discussed in Chapter 6. Both schools warmly embraced the Junior Cycle reforms and the pedagogical innovations that were anticipated, including the use of constructivist approaches, and had made efforts to prepare. Hillview School's ambition for that year was "less teaching, more learning", while Seafront School had a voluntary Teaching and Learning Club (led by Beverly) and had engaged in whole-staff CPD for active learning methodologies. In both schools, initiatives like the teaching and learning club or focus on learning were seen as preparatory ones, laying the groundwork for the eventual introduction of the revised Junior Cycle. Both schools accorded the same status to their mobile device initiatives and did not explicitly link them to the introduction of constructivist pedagogies.

Having concluded that any pedagogical innovations in the schools, including the use of constructivist pedagogies, were separate from the mobile device initiatives, I can now turn to the changes in the roles of teachers. Both schools envisaged changes in those roles, and in both cases, the ability to communicate was leveraged to develop students' responsibility, which I will expand on in the next section.

Changes In Relationships And Tensions

While it was established that mobile learning as a pedagogical practice was not present, there were still apparent changes in relationships of learning as a result of having mobile devices which enabled new levels of communication between students and teachers. An increase in communications amongst students, teachers and even parents was both an objective and outcome of the mobile device initiatives. Several grounded theories emerged which touch on this topic, beginning with the finding that teachers' virtual classrooms operated *as a space for communications*. It is interesting to note that while there were two patterns of use of virtual classrooms, and that teachers tended towards one or other, their use for communications was universally reported and observed.

Communications. The newfound ability to communicate was embraced widely in both schools, and notably it included sports teams and extra-curricular activities in Hillview School. The changes in relationships came from the changed expectations of students, in particular, that they would be held to a higher standard of accountability for having completed classwork and homework. The routines of the schools and classes had changed dramatically. Absences of students or teachers, field trips and other activities were treated differently in daily school like, for example, an absent teacher would communicate a meaningful task to his/her students who would be supervised by a colleague, or a student

participating in another activity would be able, and indeed obliged, to catch up and complete their work. The data showed that the changed routines of the schools and classes raised teachers' expectations of students, and that students generally had no difficulty with these changes.

Tensions. Implicit in the research question "identify any tensions that may have resulted from changes in students' expectations of teachers..." is the assumption that the increased expectations would fall on teachers. With the aid of two grounded theories, I have demonstrated that not only did teachers face new expectations, but students did too. Initial tensions after the introduction of teachers' virtual classrooms were quickly resolved by clarifying the mutual expectations of students and teachers, although they were set not negotiated. Two further challenges arose for teachers: managing exclusions and the impact of after-hours communications. The grounded theory that students are taking school-related conversations out of the teacher-controlled space and are using their networks as backchannels for class indicate that students' networks were providing parallel spaces for conversations, some of which related to school life and work. It emerged from the data that some networks were *necessarily* exclusionary, for example by requiring a Facebook account or by design where there were girls-only groups. The potential tension for teachers is to consider if and how they may become aware of this exclusion and if they would then be required to manage it? After-hours communications raised the potential for teachers to be interacting with students at night or over weekends, times when it was traditionally unusual to have contact between them. An analysis of a particular incident in the data raised the potential for teachers to inadvertently encroach into a space typically reserved to

parents. Teachers would also face an additional pressure in managing their work/life balance.

Teachers' Virtual Classrooms

Table 8.2, below, shows the grounded theories which emerged and extended beyond the limits of the research questions (and scope of this study). Many of the theories listed have been treated while discussing the characteristics of mobile learning in the previous section, the remaining theories relate to teachers' virtual classrooms, including their functions and patterns of use.

Table 8.2

Table showing a summary of the grounded theories which extended beyond the research questions.

Grounded Theories
(2) *The classroom implications [of having mobile devices] were unexamined* by teachers
(3) Students were shown to be adept at getting online and maintaining near-ubiquitous internet connectivity.
(4) Teachers' virtual classrooms operated as *teacher-controlled spaces where expectations were set rather than negotiated*. Potential tensions in practice arose for teachers, including the expectations for increased level of communications and that teachers may step into new roles.
(5) *Students are taking school-related conversations out of the teacher-controlled space and are using their networks as backchannels for class.*
(6) *Students were expected to stay connected with their classes and up-to-date with classwork and homework.*
(7b) Functions of teachers' virtual classrooms: for *extending the activities of the class*.
(7c) Functions of teachers' virtual classrooms: for *storing and distributing content*.
(8) It was the teachers and not the affordances of the platforms which determined how they were used.
(9) The uses of technology and mobile devices was *shaped by the examination system* and in each school were consistent with the characteristic spirit and context of each school.

When teachers' use of the virtual classroom aligned with *Extending the Activities of the Class*, they were used as part of a deliberate strategy to enable communications between students and teachers and to extend activities to enable the continuation of tasks after the physical class had ended. Teachers were able to distribute resources for tasks, although the

content often became ephemeral. Teachers reported a variety of tasks that were well-suited to extension, including group work activities, individual practice activities which aided differentiation, and discussion and peer feedback activities. When teachers' use of the virtual classroom aligned with *Storing and Distributing Content*, the focus was on formal course content which was often linked to exam preparation. The ability to distribute content was a time-saver for teachers as well as a benefit to students, who could access all course content over a long period, an ability that was especially beneficial for weaker students. Teachers also reported a benefit in having a repository of teaching content readily accessible to allow dynamic lesson planning and being able to bring course content from year to year quickly.

8.4 Significance Of The Study

The study's claim to significance is built on the grounded theories presented in this thesis which add to the body of knowledge in the discipline. The significance is further enhanced by the study's contribution to the methodology of grounded theory, and the opportunities it identifies for subsequent research.

In addition to its principal findings, the study has contributed innovations to the methodology of grounded theory in two ways. First, it has demonstrated that the methodology is effective and suitable for use in the field of educational technology, in particular in the ways it revealed insights that other methodologies may not, in particular those that test hypothesis. Second, the development of new and innovative coding strategies expands the reach of grounded theory and its capacity to analyse different formats of data. The use of grounded theory, in an area fraught with methodological

deficits, has exposed previously unreported and fundamental shifts in the reach and pace of teaching and learning. It reveals new insights into the tensions that teachers may face in their practice while using educational technology and mobile devices in particular, allowing the implications of these tensions to be scrutinised in this thesis as well as subsequent professional dialogue and research. These implications require that a more comprehensive view of mobile learning is taken; more particularly of the use of mobile devices beginning with systemic and policy issues including school context, forms of assessment and curriculum reform. As an exploratory study, it has charted the landscape and shows that to fully appreciate the implications of technology use, some philosophical and sociological questions must also be considered, specifically around teachers' beliefs, democracy in education, and power and equality.

Methodological Innovations

Applying a methodology in an unfamiliar discipline may pose challenges, in this study it was the requirement to observe and record complex educational environments (in classrooms and online) that posed the challenge. An essential strategy for a grounded theory study is to analyse actions and processes, and in this case the early attempts (with line-by-line coding) to gather and analyse data in these environments did not meet that test. In keeping with Charmaz's (2014) belief that data collection methods flow from the research questions, and that methodological eclecticism is possible, I felt empowered to adapt the coding strategies to deal with the rich data from the observed environments. The task-by-task coding approach acknowledged that classes were structured events, that teachers had a plan (written or otherwise) for each class and how it would be conducted and the approaches to be used. Coding of tasks, therefore, revealed the teachers' intentions,

and the embodied beliefs that informed their decisions. This approach was instrumental in revealing the category *teachers' virtual classrooms* and in the generation of theories from it. The study has, therefore, contributed back to the methodology, enhancing grounded theory's eclecticism and ability to work with diverse data.

In addition to its contribution to the methods of grounded theory, the study has demonstrated its efficacy in complex educational environments where it has revealed shifts in some fundamental educational processes (changes in the reach and pace of teaching and learning). Grounded Theory is not only effective in the field, this study has demonstrated that it can address some of the discipline's deficits in research. Rushby (2012) provided me with an early impetus to research in the field when he identified failings in contemporary research, and advocated for new research to provide:

> proof of educational, economic and social outcomes and impacts (short term, long term and systemic) or show how and why such applications fall short of expectations or fail to gain traction. (Rushby, 2012, p. 355)

Notwithstanding that this study is limited in two of the ways Rushby lists: having a small sample size and being PhD thesis, it substantially addresses his other concerns. The study, through its grounded theories, demonstrates that teachers and the contexts they operate in should be the central concern, echoing Traxler's (2009) comment that context is everything. For the technology evangelists who believe that the new affordances of mobile technology would be irresistibly disruptive, there may be a sense of disappointment that the technology alone was unable to overcome established and enacted beliefs, forms of assessment, and other structures that exist in the context of Irish schools and classrooms. The study revealed that some of the implications are potentially radical, for example new

ethical challenges for teachers or historical structures of power being mirrored in new virtual spaces. Such implication may have a broader and more profound impact than can be measured with established and traditional approaches to research on education technology.

Opportunities For New Research

In the introduction and literature review, I discussed gaps in current research, whose limits were generally either methodological or theoretical. The methodological limitations, some of which are shared by this study, have already been discussed. The theoretical limits for potential studies are that even if they demonstrate increases in attainment, engagement, depth of knowledge and critical thinking, they might fall short of developing the body of research in the field because of a lack of theoretical depth and rigour. This study has demonstrated that in the fields of education, educational technology and mobile learning there is now an opportunity, indeed an imperative, for ambitious and theoretically-rich research to be conducted to examine the sustainable integration of mobile devices or mlearning into formal education contexts. Such research should also examine the impact of those technologies when their use spreads organically into formal contexts, but without being part of structured initiatives (for example WhatsApp groups). Traxler (2009) set out the imperative for research, implicitly acknowledging one purpose of education in preparing (young) people for the workforce:

> Obviously mobile devices, systems and technologies are also dramatically changing the economy ... and dramatically changing the nature of work itself. Educators must digest these too in the role preparing learning for employment. (Traxler, 2009, p. 8)

This study demonstrated that in the decade since Traxler (2009) wrote that, the impact of technology has deepened. It is no longer enough to see technology through the lens of one of the purposes of education; this study shows fundamental shifts in the educational processes themselves. The processes were shown to be complex and multidimensional, highly dependent on contexts, values and beliefs. The use of mobile devices must be understood in the broader context of schooling, including the intersection with curriculum reform, methods of assessment, schools' self-identities, and teachers' beliefs; all of which weigh on teachers' choices for what technology to use and for what purposes.

As an exploratory study, it has provided a vivid and detailed view of the context under investigation, as well as revealing the potential for new research. Those avenues of research have been flagged and discussed throughout this thesis, and I will lay out the case for research to engage with a dominant discourse of educational technology.

Democracy in education, power and equality. The grounded theory **students are taking school-related conversations out of the teacher-controlled space and are using their networks as backchannels for class** indicated that educational conversations were moving into unregulated spaces. A particular discourse of educational technology portrays it as a democratising force, enabling self-direction, goal-setting, independent research, and a general flourishing of individual achievement (Convery, 2009). The findings of this study call that discourse into question. While some of those benefits described above may indeed be evident, a view of the underlying structures of power suggests inertia. Decisions of priority, content, approaches and methods are still reserved to teachers, and even the teachers are constrained by forms of assessment, systemic priorities, and structures. This

study examined the use of *students' informal networks* through the sociological lens of Lodge & Lynch's (2002) work on power and equality in Irish schools. Future studies could extend this approach to examine any impact of mobile devices and connectivity on students' agency in the education system.

Constructivist pedagogies. The grounded theory establishing the patterns of use for teachers' virtual classrooms established that teachers used them to enact latent intentions or amplify existing practices, and I extended the theory to cover those teachers' usage of technology generally. The literature review identified Vygotsky's (1978) model of social constructivism as a potential theoretical underpinning to mobile learning, but the evidence to support that finding was not present in the grounded theories in this study. Although "mobile devices are inherently social collaboration and communication devices that provide powerful tools for enabling social constructivist pedagogy" (Cochrane, 2013, p. 8), the devices were used to amplify existing practices or enact latent intentions. Future research could examine any tensions between teachers' beliefs about learning, and their enacted practices. Critically, one could ask if there is a disjuncture between those beliefs and practices as the study's data did not indicate any epistemological shifts on the parts of teachers (from content deliverer to facilitator of authentic experience) or students (from passive participant to active co-constructor of knowledge). Examples of past research, especially Lim and Chai's (2008) findings of contradictions between teachers' self-professed pedagogical orientation and observed practices (discussed in the literature review), may have a renewed relevance in the mobile age.

8.5 Implications For Practice

The implications for practice can be seen at three levels: at the level of the education system and teaching profession, at the school level, and finally, in the individual practice of teachers. In addition to the discussion under each heading, I will speculatively note some current issues and reference some potential consequences of the introduction of mobile devices.

Implications For The Education System

At the system level, this study has revealed fundamental shifts in education, in particular, changes in the reach and pace of teaching and learning. The study demonstrated that there had been dramatic changes in expectations and responsibilities for both students and teachers. The use of teachers' virtual classrooms and students' use of informal networks showed parallels with modern workplaces as traditional boundaries of place and time are dissolved. While the practice of mobile learning was found to be absent, mobile devices, internet connectively and networks are enablers of these fundamental shifts which allow teaching and learning to occur anywhere, anytime (although not without tensions). Traditional accounts of educational technology usage fail to acknowledge (or in many cases even imagine) these changes (Rushby, 2012). The importance of this study comes both from revealing these new implications on practice, and in establishing an imperative to extend the research. The grounded theories presented indicate that multidisciplinary approaches which examine the intersection of technology with philosophy of education and sociology are now strongly indicated.

Implications For Schools & Principals

The implications for schools as they plan new initiatives are significant. Returning to Fullan's (1993) work on educational change, it is evident that in Hillview School the approach taken was indeed comparable to 'ready, fire, aim', although it was not articulated as such by the Principal. A contrast is evident between the schools when examining 'ready'. Hillview School had expressed a broad vision for the use of technology and with sufficient clarity to embark on their mobile device initiative, which was refined over time, a particular example of a refinement being the introduction of teachers' virtual classrooms. The school enacted practices and values before they were articulated or formalised, and in doing so, the school realised "deeper and more powerful shared visions which inspire committed action on a day-to-day basis throughout the organisation" (Fullan, 1993, p. 44). Seafront School achieved 'readiness' through financial and logistical planning, but at a pedagogical level, it had insufficient clarity to create a shared vision. The implication becomes clear when examining 'aim' and seeing that in Hillview School there were refinements, while in Seafront School there was a reboot.

Tensions that arose in the data, in particular on professional communications and maintaining work-life balance for teachers, were not considered by the schools at a 'whole-school' level in advance of their initiatives. That is unsurprising given that these impacts were unintended consequences of the initiatives, but they now provide points on a planning roadmap for schools planning mobile device initiatives. Each of the schools demonstrated a different capacity to plan their initiatives, demonstrating a need for more systemic supports and the development of schools' project management capacity.

Implications For Teachers

The study's significance for educational practitioners can mainly be seen through the research question on tensions in practice, and how they may be anticipated and managed. The grounded theories and analysis should, therefore, resonate with teachers, school leaders and those with a policy or research interest in practice. Many of these tensions are not new, in particular where technology has brought new dimensions to existing research on power and equality in schools. The increased ability to communicate, enabled by teachers' virtual classrooms, may present the most substantial tension in a teacher's practice. They must be prepared to manage their after-school communications to be compliant with The Teaching Council's (2012) *Code of Professional Conduct*, and be ready to make ethical judgements on what appropriate communications are, potentially aided by an ethical framework such as Hogan's (2011). Teachers may find that their in-class pastoral responsibility to foster inclusion amongst students is extended into the informal networks that serve as backchannels for their classes. Moreover, it is evident that the technical skills to create a virtual classroom are only the beginning of a teacher's experience of using them, where issues of exclusion, ethics, and professional boundaries emerge as relevant considerations.

Further Discussion

The study noted significant technical, logistical, and financial challenges in providing mobile devices and internet connectivity, challenges that the schools faced largely alone.

Affordability & Equity. In these early adopter schools, the principals made a particular effort to ensure that affordability was not a barrier to any students participating in the programme. It is arguable whether other schools would have the same ability to support families with challenged economic circumstances. It is important therefore to ensure that financial circumstances do not become a barrier to use where students may benefit from the use of technology.

Schools' Technical Capacity. The study uncovered the impact of poor Wi-Fi in Seafront School's initial year of using mobile devices. It also noted that the responsibility for connectivity was split between the Department of Education who provided the connection to the school, and the school itself which had to develop an infrastructure to share that connectivity. Such technical abilities are outside the core activities of a school resulting in them relying on 3rd party providers of technical support, resulting in potentially poor experiences based on limited resources or expertise. Consideration could be given to centralised solutions which would free schools from this responsibility and allow them to focus on pedagogical innovations. As an ETB school, Hillview School benefited from such a centralised solution.

The implications of the grounded theories and findings of this study can linked to some current issues or developments in the education sector:

Curriculum Reform. The study found that the examination system had a strong impact on the use of technology in the schools, and that even new and potentially disruptive technologies could not overcome that barrier. This finding suggests that initiatives that do not place pedagogical considerations (in particular the form of assessment) at their heart

may not create the changes they intend to. The study also demonstrated that the implications of mobile device were not sufficiently examined, and that the abilities they could provide to teachers and students were not considered at a pedagogical level. At the time this thesis was being submitted, the revised Junior Cycle in Ireland was in the final stages of being rolled out; the findings of this study could therefore provide a useful pre-reform data point for examining its implementation.

Teacher Education & Professional Development. The findings in this study highlight the importance of relationships of education, in particular between a teacher and (a) their students, and (b) their subject. This study illustrated some unintended consequences of the introduction of mobile devices in ways which now provide practical case studies for initial teacher education or during continuing profession. Two relationships stand out in particular:

- A teacher's relationship with their students. The impact of technology has been to remove the traditional boundaries of that relationship. Teachers will be required to have an awareness of new power dynamics, new expectations of them and of their students, and they will require strategies to manage these re-defined relationships.
- A teacher's relationship with their subject. Echoing the earlier point, particular attention should be paid to teachers' belief about their subjects, whether during their initial teacher education or during continuing profession development. The experience in Seafront School suggested that even when technology has the ability to transform pedagogical practices, teacher's underlying subject beliefs will persist. Developing a capacity to critically analyse a teacher's own subject beliefs and see those beliefs enacted (or not) in their pedagogical practices will allow for an effective self-evaluation of the role of technology in their practice.

8.6 Conclusion

The practice of mobile learning is an imagined future. In Chapter 2, I discussed the origins of mobile learning (by name and/or by characteristics) in science fiction, where it is a staple of many authors' vision for learning in the future. At different times, pioneers in education have taken inspiration and made attempts to have that vision become a reality. In 1972, Alan Kay imagined the DynaBook as one such revolutionary device (A. Kay, 1972) in , and while the technology did not yet exist and the device did not materialise, attempts to introduce mobile learning continued. In 1998, Heppel predicted that commercially-developed devices would become widespread (Heppell, 1998), and were followed by projects like the *One Laptop Per Child* programme (One Laptop Per Child Initiative, 2008), student laptop initiatives in the US State of Maine (Maine Learning Technology Initiative, 2001), and the recent ill-fated student tablet (iPad) initiative in the US City of Los Angeles (Blume, 2015). Unlike Skinner's (1958) behaviourist learning machines, which were early attempts at educational technology, these authors, educators, and project leaders advocate for uses of technology that embrace constructivist pedagogies, changes in the roles of teachers and students learning independently. There is an interesting similarity between the characteristics of mobile learning as a practice synthesised from the literature and Beverly's description of the 'sales pitch' from global technology companies (and one in particular). This similarity points to an ongoing discourse on the use of technology in education, and mobile technologies in particular. Implicit in that discourse are beliefs on teaching and learning, and value judgements on certain approaches as Beverly indicated in her reflection on 'modern' teaching and her aspirations to stay 'relevant'.

Venturing into the realms of conjecture for a moment, I can question if there is an alignment between three forces external to education (or at least outside classrooms); the first being the imagined future, where technology is a liberating and democratising tool changing the nature of classrooms and education. Next are the interests of global technology companies, advocating those same principles to 'transform' education, with the twin intentions of developing their workforces of the future while also selling their products. Finally, in the work of policymakers, who are striving to develop knowledge economies, where the development of 21st century skills in students has become a focus (although not without some dissenting voices). As a practice, mobile learning embodies a set of beliefs about education, teaching, and learning that may be culturally, philosophically, or financially at odds with a school or school system (national or otherwise). There may be substantial opportunities for future research on this question. I am left with an intriguing question as an avenue for future research, although well beyond the scope of this study; *is the discourse of mobile learning as a practice (or educational technology generally) a colonising one?*

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183–189.

Appendix 3A - Schedule Of Fieldwork

Table 1

Schedule of fieldwork.

	Hillivew School				Seafront School		
	Tanya	Amy	Martin	Olive	Dan	Martha	Beverly
Test observation	Declined	Declined	Declined	Declined	Declined	Declined	Declined
Observation 1	3 Oct 2014	6 Nov 2014	15 Dec 2014	27 Nov 2014	11 Nov 2014	4 Nov 2014	25 Nov 2014
Observation 2	15 Oct 2014	13 Nov 2014	12 Jan 2015	12 Jan 2015	18 Nov 2014	25 Nov 2014	9 Dec 2014
Observation 3	21 Nov 2014	27 Nov 2014	19 Jan 2015	19 Jan 2015	13 Jan 2015	13 Jan 2015	13 Jan 2015
Online Observation	Edmodo	Edmodo	Edmodo	Edmodo	Schoology	Schoology	Schoology
Whole-class interview	27 Nov 2014	20 Apr 2015	20 Apr 2015	20 Apr 2015	17 Apr 2015	23 Apr 2015	23 Apr 2015
Teacher interview	20 Apr 2015	20 Apr 2015	20 Apr 2015	17 Apr 2015	23 Apr 2015	23 Apr 2015	13 Jan 2015
Principal Interview		20 Apr 2014				23 Apr 2015	

Appendix 3B -

	Impact of *mlearning* on Relationships of Learning between Students and Teachers Initial Questionnaire for Demographic & Education Information
NUI MAYNOOTH Ollscoil na hÉireann Má Nuad	

1. Introduction

Purpose of Research:
This research study is 'An exploration of the effect of mobile learning and access to mobile technology on relationships of learning between students and teachers'. The purpose of this research is to: (a) identify the changes (if any) in relationships of learning between students and teachers, (b) determine if these changes were brought about solely by the use of mobile learning and adoption of mobile devices or if other factors caused or contributed to the changes, (c) examine the educational theories of mobile learning, and (d) establish whether mobile learning raises students' expectations of teachers to adapt their teaching practice and any resulting tensions from those expectations.

Ethical Information and Safeguards for Privacy and Data Security:
The following section repeats the ethical information sheet and informed consent form that you already received and signed. It does not alter the conditions of the study, or your engagement with it, in any way.

The questionnaire is administered using SurveyMonkey which complies with Data Protection legislation in the European Union by voluntarily adopting the policies of the United States of America's Safe Harbor Programme. The questionnaire requests your name and is therefore not anonymous. At the end of the data analysis phase the data will be anonymised by removing your identity from the data without retaining a key to allow identification at a future date.

Right to Withdraw from Research:
Participants may withdraw from the study at any point. Notice of your intention to withdraw can be provided by email. Your data will be withdrawn from the data set. The cut off point for withdrawal is the data analysis phase which is planned to commence in September 2015 and last for 12 months.

Contact Details of the Researcher:
Keith Young,
PhD Candidate, Education Department,
National University of Ireland, Maynooth.

wesley.young.2013@nuim.ie
+353879184244

Declaration from NUI Maynooth:
If during your participation in this study you feel the information and guidelines that you were given have been neglected or disregarded in any way, or if you are unhappy about the process, please contact the Secretary of the National University of Ireland Maynooth Ethics Committee at research.ethics@nuim.ie or +353 (0)1 708 6019. Please be assured that your concerns will be dealt with in a sensitive manner.

1

Impact of *mlearning* on Relationships of Learning
between Students and Teachers
Initial Questionnaire for Demographic & Education
Information

NUI MAYNOOTH
Ollscoil na hÉireann Má Nuad

2. Demographic Information

* 1. What is your name?

[   ]

* 2. What is your gender?

( ) Male

( ) Female

* 3. What is your age?

( ) 18 - 25

( ) 26 - 35

( ) 36 - 45

( ) 46 - 55

( ) 56 - 65

* 4. How many years teaching experience do you have?

[   ]

5. What subjects do you teach?

Subject 1   [   ]

Subject 2   [   ]

Subject 3   [   ]

* 6. Are you involved in extra-cullicular or co-curricular activities in the school?

'This question is asking whether you have contact with students outside class time that may deepen your working relationship with them'

( ) Yes

( ) No

2

* 7. What are your academic qualifications (tick all that apply)?

☐ Undergraduate Degree (e.g. BA, BSc, etc)

☐ Undergraduate Degree with Education (e.g. BEd, BSc Science Ed, BSc Maths Ed, etc)

☐ H.Dip.Ed / PGDE / PDE or other equivalent postgraduate teaching qualification

☐ Postgraduate Degree (e.g. MA, MSc, etc)

☐ Postgraduate Degree in Education (e.g. MEd)

☐ ICT in Education postgraduate qualification (any)

☐ PhD

Other (please specify)

[   ]

8. What Professional Development (CPD) courses have you had in the last academic year. Please include course type and duration in hours.

[   ]

3

NUI MAYNOOTH
Ollscoil na hÉireann Má Nuad

3. Technology Literacy / Fluency

These questions will measure your access to technology, competence in using it and how you implement it into your teaching and learning encironment.

* 9. What level of technology do you have access to in your school?

☐ Schools' Broadband Scheme - 100MB

☐ Classroom teaching computer

☐ Data projector

☐ Interactive whiteboard

☐ Access to a suite of computers (in class)

☐ Access to a suite of computers (in a computer room)

☐ School email account

* 10. What level of technology do you have access to in your home?

☐ Broadband

☐ Wireless Network

☐ Desktop Computer

☐ Laptop Computer

☐ Tablet Computer

11. Do you use any of the following for educational purposes?

☐ A virtual learning environment like Moodle

☐ Digital workflows between you and students like Showbie or Google Drive

☐ A collaborative learning environment like Edmodo, Schoology

☐ Twitter

☐ Blogs

☐ Wikis

4

12. Technical Skills

	Agree	Unsure	Disagree
I can use the internet, email and write documents	○	○	○
I can develop materials such as handouts and worksheets, I can capture and edit images, and make PowerPoint presentations	○	○	○
I can create edited video and audio files	○	○	○
I can combine different different types of digital resources that I have created	○	○	○
I can create interactive materials using iBooks author or similar authoring tools.	○	○	○
I can curate subject materials using iTunes U Course Manager or similar tools.	○	○	○
I can guide students to create a digital portfolio of their work (on any type of web service)	○	○	○

5

Impact of *mlearning* on Relationships of Learning
between Students and Teachers
Initial Questionnaire for Demographic & Education
Information

NUI MAYNOOTH
Ollscoil na hÉireann Má Nuad

4. Technological Pedagogical Content Knowledge (TPACK)

Technological Pedagogical Content Knowledge (TPACK), builds on Shulman's idea of Pedagogical Content Knowledge, and attempts to capture some of the essential qualities of knowledge required by teachers for technology integration in their teaching, while addressing the complex, multifaceted and situated nature of teacher knowledge.

At the heart of the TPACK framework, is the complex interplay of three primary forms of knowledge: Content (CK), Pedagogy (PK), and Technology (TK).
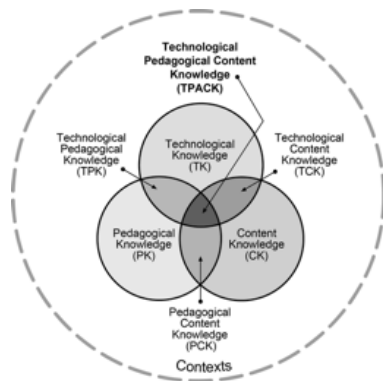
Technology is a broad concept that can mean a lot of different things. For the purpose of this questionnaire, technology is referring to digital technology/technologies. That is, the digital tools we use such as computers, laptops, tablets, iPads, handhelds, interactive whiteboards, software programs, etc.

Please answer all of the questions and if you are uncertain of or neutral about your response you may always select "Neither Agree or Disagree". Questions relating to Content Knowledge (CK) have categories based on the NCCA subject groupings, you need only answer the questions relating to the subject area you teach in.

* 13. Technology Knowledge (TK)

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
I know how to solve my own technical problems.	○	○	○	○	○
I can learn technology easily.	○	○	○	○	○
I keep up with important new technologies.	○	○	○	○	○
I frequently play around the technology.	○	○	○	○	○
I know about a lot of different technologies.	○	○	○	○	○
I have the technical skills I need to use technology.	○	○	○	○	○

6

* 14. Please select your subject area from the list of subjects below which are categorised according to the NCCA's subject groupings.

Questions 13, 15, 16 & 18 relate to Content Knowledge (CK) and are based on your chosen subject area.

○ Languages: English, French, German, Irish, Italian, Latin, Greek, Spanish, Arabic, Japanese, Russian, Classical Studies, Hebrew Studies

○ Sciences: Mathematics, Applied Mathematics, Biology, Chemistry, Physics, Physics and Chemistry

○ Business Studies: Accounting, Business, Economics

○ Applied Sciences: Agricultural Science, Construction Studies, Engineering, Home Economics, Physics and Chemistry, Design and Communication Graphics

○ Social Studies: Art, Geography, History, Home Economics, Music

* 15. Content Knowledge (CK)

Please only answer the questions relating to your subject area which are categorised according to the NCCA subject groupings.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree	Do not teach
I have sufficient knowledge about my subject area.	○	○	○	○	○	○
I can apply my subject area into my way of thinking.	○	○	○	○	○	○
I have various ways and strategies of developing my understanding of my subject area.	○	○	○	○	○	○

* 16. Pedagogical Knowledge (PK)

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
I know how to assess student learning in a classroom.	○	○	○	○	○
I can adapt my teaching based-upon what students currently understand or do not understand.	○	○	○	○	○
I can adapt my teaching style to different learners.	○	○	○	○	○
I can assess student learning in multiple ways.	○	○	○	○	○
I can use a wide range of teaching approaches in a classroom setting.	○	○	○	○	○
I am familiar with common student understandings and misconceptions.	○	○	○	○	○
I know how to organize and maintain classroom management.	○	○	○	○	○

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* 17. Pedagogical Content Knowledge (PCK)

Your subject area was selected in Q12 from the NCCA subject groupings.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree	Do not teach
I can select effective teaching approaches to guide student thinking and learning in my subject area.	○	○	○	○	○	○

* 18. Technological Content Knowledge (TCK)

Your subject area was selected in Q12 from the NCCA subject groupings.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree	Do not teach
I know about technologies that I can use for understanding and teaching my subject area.	○	○	○	○	○	○

* 19. Technological Pedagogical Knowledge (TPK)

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
I can choose technologies that enhance the teaching approaches for a lesson.	○	○	○	○	○
I can choose technologies that enhance students' learning for a lesson.	○	○	○	○	○
My teacher education program has helped me to think more deeply about how technology could influence the teaching approaches I use in my classroom.	○	○	○	○	○
I am thinking critically about how to use technology in my classroom.	○	○	○	○	○
I can adapt the use of the technologies to different teaching activities.	○	○	○	○	○
I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn.	○	○	○	○	○
I can use strategies that combine content, technologies and teaching approaches in my classroom.	○	○	○	○	○
I can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches at my school and/or district.	○	○	○	○	○
I can choose technologies that enhance the content for a lesson.	○	○	○	○	○

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* 20. Technology Pedagogy and Content Knowledge (TPACK)

Your subject area was selected in Q12 from the NCCA subject groupings.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
I can teach lessons that appropriately combine my subject knowledge, technologies and teaching approaches.	○	○	○	○	○

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5. Prior Views of Teaching and Learning

* 21. Please indicate your agreement with the following set of statements.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
All learning, except for simple rote memorisation, requires the learner to actively construct meaning	○	○	○	○	○
Because learning is a process of active construction by the learner, the teacher cannot do the work of the learner	○	○	○	○	○
Changing student behaviour is the teacher's primary goal	○	○	○	○	○
Everyone learns in the same way	○	○	○	○	○
Learning in cooperation with others is an important source of motivation, support, modelling and coaching	○	○	○	○	○
Learning is a process of accumulating information and skills	○	○	○	○	○
Learning is an ongoing process	○	○	○	○	○
Learning takes place in classrooms	○	○	○	○	○
Learning takes place in the head	○	○	○	○	○
Learning takes place in the space between people	○	○	○	○	○
The teachers primary goal is to generate a change in the learner's way of viewing and organising the world	○	○	○	○	○
The teacher's primary responsibility is to transfer his/her knowledge directly to students	○	○	○	○	○
Thinking and learning skills are transferable across all content areas	○	○	○	○	○
What is learned depends on what is already known	○	○	○	○	○

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6. Conclusion

The survey is now complete. Thank you for your time.

Right to Withdraw from Research:
Participants may withdraw from the study at any point. Notice of your intention to withdraw can be provided by email. Your data will be withdrawn from the data set. The cut off point for withdrawal is the data analysis phase which is planned to commence in September 2015 and last for 12 months.

Contact Details of the Researcher:
Keith Young,
PhD Candidate, Education Department,
National University of Ireland, Maynooth.

keithyoung@mac.com
+353879184244

Declaration from NUI Maynooth:
If during your participation in this study you feel the information and guidelines that you were given have been neglected or disregarded in any way, or if you are unhappy about the process, please contact the Secretary of the National University of Ireland Maynooth Ethics Committee at research.ethics@nuim.ie or +353 (0)1 708 6019. Please be assured that your concerns will be dealt with in a sensitive manner.

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Appendix 3C

Email dated 20th December 2013 - from K. Young

Hi [redacted],

Thank you for agreeing to pilot the questionnaire that forms part of my research into mobile learning and relationships of learning between students and teachers. I would ask that you take the questionnaire as if it were the final and approach it from the perspective of a teacher with a class where mobile devices are used. The aim of the pilot is to identify any questions that you feel are ambiguous or clearly not relevant and to ensure that it will gather the correct data. The following questions can be used to guide your feedback:
  • Time taken to complete the questionnaire.
  • Were the instructions easy to follow?
  • Were the questions easy to answer and clear?
  • Testing for personal or inappropriate questions.
  • Any other comments?
If you can do that and email me back with those details I would very much appreciate it. The link to view the questionnaire is: https://www.surveymonkey.com/s/P7N8R3T

Thanks again and If you need to ask any questions please email or call me on 087 9184244.
Regards, Keith.

Email dated 9th January 2014 - From Pilot Recipient

Hi Keith

Had a lovely break, thanks, hope you did too!
Apologies that I didn't get back to you about your questionnaire yet but have now finally had some uninterrupted time to have a look at it properly!

  • Time taken to complete the questionnaire. – 20 minutes
  • Were the instructions easy to follow? - very
  • Were the questions easy to answer and clear? – for the most part yes but I just had queries on:
  • Q20 Opt 4 is unclear
  • Q20 Opt 8, do you mean 'only in classroom'? am unsure about this one

- Testing for personal or inappropriate questions – nothing to report
- Any other comments? – very thorough and comprehensive and really made me think!! Question 20 in particular

If you need any further feedback please don't hesitate to get back to me!

Talk to you soon

[redacted]

Appendix 3D -

Dear School Leader,

Thank you for your interest in participating in a research study as part of my Ph.D. research at the National University of Ireland, Maynooth. I'm writing to you now with full information on the proposed study to allow you to make an informed decision on your school's participation and to allow you to secure final approval from the school's board of management (or other body, as appropriate). This letter will set out the details of the proposed research, the requests that will be made of you and the school and the ethical standards which the research will observe.

At the end of this information letter is a consent form, which includes a summary of the important information about this study, which you should sign and return if you intend to proceed; you should also retain a copy for your records. As this is a relatively complex study, I will be available to provide further explanation or clarification to you or any other school body during the approval process.

Research Title:
An exploration of the effects of mobile learning and access to mobile technology on relationships of learning between students and teachers in post-primary education.

Research Description:
This study views mlearning as more than conjunction of 'mobile' and 'learning', it is viewed as an emerging educational practice built around mobile devices, ubiquitous internet connectivity, socially-connected learning spaces which extend the physical classroom, constructivist pedagogies and a change in the role of the teacher and students. When combined, these forces move formal education from a focus upon teacher-delivered content or instruction to a focus on designing collaborative learning activities or 'what the student does'.

The study aims to explore the effects of mobile learning (mlearning) and access to mobile technology on relationships of learning between students and teachers. The research will take place in three Irish post-primary schools that have adopted mobile learning programmes where each student has a personal device. The purpose of this research is to: (a) identify the changes (if any) in relationships of learning between students and teachers, (b) determine if these changes were brought about solely by the use of mlearning and adoption of mobile devices or if other factors caused or contributed to the changes, (c) establish which theoretical framework(s) underpins the mlearning practice paradigm, and (d) establish whether the mlearning practice paradigm raises students' expectations of teachers to adapt their teaching practice and any resulting tensions from those expectations.

Research format:
The methodology in this research mixed-methods, including qualitative and quantitative data collection methods. The collection of data will take place in two distinct phases: (a) a background and preparatory research phase, and (b) a primary research phase, within each there are a number of data collection methods, which are:

Background phase:
1. Teachers' Initial Questionnaire. A questionnaire will gather information from participating teachers, including demographic information, technology literacy/fluency and beliefs about teaching and learning.
2. School policy and evaluations. An analysis of school policies to examine the school's ethos, policies on teaching and learning strategies and any whole school evaluations (WSE-MLL) from the Department of Education and Skills or school self-evaluations (SSE).
3. Review of continuing professional development (CPD). Statistics on the amount of CPD (of any type) that the school has provided for teachers will be examined.

Primary phase:
4. Participant observation. Three semi-structured observations of classes with each participating teacher will be undertaken over the course of academic year. The purpose will be to video record, examine and classify the interactions between students and teachers.
5. Participant observation. Teachers' and students' use of social networking, virtual learning environments or other online platforms used for teaching and learning will be observed during a fixed period of time to examine the character and quality of online interaction.
6. Focus groups. Focus groups will be held separately with participating teachers, students and school leaders to inform them of the results of the classroom and virtual observation and to gather their feedback on the results and develop further meaning from the data.

Research planning:
If you and the school intend to participate in the research, the following next steps will be a useful summary of actions to help plan the phases of research and fit them around the school calendar:
1. Approval received. Once the school has formally indicated its willingness to proceed the process of data collection, outlined below, can proceed.
2. Policy review. During the policy review the following documents will be requested:

2.1. The school's last WSE-MLL report from the DES Inspectorate or any SSEs carried out in school in relevant areas.

2.2. Policy documents relating to the school's ethos and teaching and learning environment

2.3. Any other document or policy you feel would be useful in this study.

3. Selection of volunteer teachers. A deliberate sampling method will be used to select <u>two</u> teachers to participate; the following points are intended to allow you to identify a small panel of volunteer teachers using your knowledge of the teaching staff who may be selected based on the sampling criteria:

3.1. Teachers who are willing to volunteer and engage in the process and have their classes and online interactions with students observed.

3.2. Teachers who will teach the new Junior Cycle Student Award (JCSA), or for other reasons would have a significant knowledge of it, or would be teaching courses that are similar in nature.

3.3. Teachers who use an online learning environment, examples include: Edmodo, Schoology, Moodle or even Twitter.

3.4. Teachers who have taught students with mobile devices for a numbers of years are preferable. This point does not require teachers with advanced technology literacy or fluency.

3.5. A balance of age and gender in the selection is highly desirable.

4. Scheduling of THREE observed classes. Given the nature of the school timetable, the scheduling of observations will be entirely in line with the school timetable to ensure minimal disruption. In consultation with the researcher, school leaders and teacher it may be decided to schedule a preliminary observation class (unrecorded) to familiarise the teacher and class with the process.

Ethics:

The ethical standards which this research project will observe are based on the British Educational Research Association (BERA). A detailed research plan and ethical statement has been submitted and approved by the NUIM Social Science Ethics Research Subcommittee. The researcher will have obtained Garda vetting before the commencement of data collection and you will be provided a copy of the approval.

As this project will involve the school, teachers and students, it will be necessary to obtain consent from each of these groups.

1. The Principal of each school is being asked to consent in writing with the approval of the board of management (or other body, as appropriate). Each school will receive a written request to participate with study information and a consent form. <u>This letter is performing this function.</u>

2. Once a school has given its consent, the participating teachers will then be invited to provide their consent. Each teacher will receive a written request to participate with study information and a consent form. <u>A copy of this letter is attached for your information.</u>

3. Consent from students in observed classes will be obtained by the teacher with the assistance of the researcher and Principal; each student will bring home a consent form and information

sheet. Once all consent forms have been received the observations can proceed. <u>A copy of this letter is attached for your information.</u>

The standard of confidentiality and anonymity <u>during</u> the research study is as follows:
1. Schools will be referred to by codes A, B & C throughout the research and subsequent outputs.
2. Teachers will be identifiable from video observations, focus group transcripts and questionnaire.
3. Students will be identifiable in the video observations of classes and observations of virtual environments. Video <u>will</u> <u>not</u> be presented in the thesis.

Precautions will be taken to ensure confidentiality <u>during</u> the conduct of the research study.
1. Printed paperwork relating to schools, teachers and students will be filed securely in a locked filing cabinet in the researcher's office in the Education Department in NUIM.
2. Video will be stored in two formats, tape from the camera and digitally. Tapes of raw footage will be returned to the filing cabinet (see above), digital versions of the footage will be stored on an encrypted hard drive; all footage will be retained for the duration of the research project.
3. Transcripts of classroom observations and focus groups, with participant information, will be stored digitally on the researcher's laptop which is encrypted and physically in the research office (see above).
4. The teacher questionnaire will be administered using SurveyMonkey which complies with Data Protection legislation in the EU/EEA via the US Government Safe Harbor programme (http://export.gov/safeharbor/)

At the conclusion of the study, the following steps will be taken to protect confidentiality and anonymity of participants:
1. All video footage will be securely destroyed, both physical and digital.
2. Transcripts of classroom observations and focus groups will be anonymised by removing participant names and identifying characteristics.
3. The teacher questionnaire will have the identity of each respondent removed.
4. All documents provided by the schools will be securely destroyed, both physical and digital.

Outputs
The data collected from this research will only be used for the following purposes:
1. Ph.D. research, thesis and submission for examination by the University.
2. Presentations at academic conferences.
3. Papers to be published in academic journals.

In all of the above cases, the anonymity of the schools, teachers and students will be protected. As a code to connect the data to a subject's identity WILL NOT be retained it will not be possible to identify participants in any subsequent output. No video or photos will have been retained, nor any identifiable information.

The researcher further requests permission for subsequent <u>educational / non-commercial</u> outputs following the conclusion of the Ph.D. thesis. To support this aim, anonymised data will be stored for up to 3 years following the submission of the Ph.D. thesis to allow for further analysis, research, academic writing and conference presentations.

Informed Consent Form

Research Study Title:
An exploration of the effects of mobile learning and access to mobile technology on relationships of learning between students and teachers in post-primary education.

Contact Details:

<u>Researcher:</u>

Mr. Keith Young,
Ph.D. Candidate, Education Department
Room 2.3.1, Education House, NUI Maynooth.
wesley.young.2013@nuim.ie

<u>Academic Supervisor:</u>

Dr. Rose Dolan,
Acting Head of Department, Education Department,
Education House, NUI Maynooth.
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Clarification of the purpose of the research
The purpose of this research is to: (a) identify the changes (if any) in relationships of learning between students and teachers, (b) determine if these changes were brought about solely by the use of mlearning and adoption of mobile devices or if other factors caused or contributed to the changes, (c) establish which theoretical framework(s) underpins the mlearning practice paradigm, and (d) establish whether the mlearning practice paradigm raises students' expectations of teachers to adapt their teaching practice and any resulting tensions from those expectations.

Confirmation of particular requirements.
The research will involve the following elements:
1. A questionnaire for teachers.
2. An evaluations of school policies, inspections, evaluations and CPD provision.
3. Classroom observations of teachers and students.
4. Online observations of teachers and students
5. Focus groups to report on the above observations.

School Principal – please complete the following (Circle Yes or No for each question)
1. Have you read or had read to you the information letter?   Yes / No
2. Do you understand the information provided?   Yes / No
3. Have you had an opportunity to ask questions and discuss this study?   Yes / No
4. Have you received satisfactory answers to all your questions?   Yes / No

Voluntary involvement
Schools and participants may withdraw from the study at any point. An email is sufficient notice of intention to withdraw and the participant's data will be withdrawn from the data set. The cut off point for withdrawal is the data analysis phase and this date will be communicated to participants during the data collection phase.

Protecting confidentiality of data

At the conclusion of data analysis the confidentiality and anonymity of participants will be protected by destroying all video and still footage, anonymising transcripts of classroom observations and focus groups and destroying all physical and digital files provided by the school or participant. The researcher requests permission for subsequent educational / non-commercial outputs following the conclusion of the Ph.D. thesis. To support this aim, anonymised data will be stored for up to three years following the submission of the Ph.D. thesis to allow for further analysis, research, academic writing and conference presentations.

Signature and consent:

I have read and understood the information in this form. My questions and concerns have been answered by the researcher, and I have a copy of this consent form. Therefore, I consent for my school to take part in this research project.

Name: _____ Date: _____

Position & School: _____ Signature: _____

Witness Name & Position: _____ Witness Signature: _____

Statement from the National University of Ireland, Maynooth Ethics Committee

If during your participation in this study you feel the information and guidelines that you were given have been neglected or disregarded in any way, or if you are unhappy about the process, please contact the Secretary of the National University of Ireland Maynooth Ethics Committee at **research.ethics@nuim.ie** or **+353 (0)1 708 6019**. Please be assured that your concerns will be dealt with in a sensitive manner.

Teacher Competence Appraisal Guide

The four broad categories outlined below represent a collation of information from the following documents:

OECD (2009) Teacher Evaluation: A Conceptual Framework

Teaching Council (2011) Initial Teacher Education Criteria and Guidelines for Programme Providers

PDST (2012) School Self-Evaluation Guidelines for Post-Primary Schools

NUIM Teacher Competence Appraisal Guide (and ongoing discussions with staff of the department)

It should also be noted that these categories will be used over the duration of the extended PDE and B Sc Ed / B Sc Maths Ed

Planning and Preparation

- A scheme of work that indicates the sequence of topics to be taught, demonstrating alignment of content, teaching, learning and assessment to the syllabus and the curriculum

- Class plans that

    o contain clear, challenging and achievable learning outcomes

    o describe the modes of assessment of those learning outcomes and appropriate criteria for success

    o utilise a range of methodologies that are appropriate to the age and learning needs of the students and to the subject matter that is to be learned

    o demonstrate a conceptual mastery of the subject matter in a pedagogically appropriate manner

    o are cognisant of the prior knowledge of the pupils, including knowledge from other subject areas, from everyday life and common misconceptions where appropriate

    o have a clear pedagogical beginning, a main body of the lesson that includes appropriate methodological strategies and closure that consolidates learning

- Organisation of all resources and materials for the class

- Provides insightful personal reflections in determining and evaluating objectives

Teaching, Learning and Assessment

Teaching:

- Demonstrating mastery of subject matter

- Implementing and adjusting the lesson plan where necessary in response to the interaction of the pupils

- Engaging pupils in meaningful and engaging learning activities that demonstrate creativity, innovation, resourcefulness and originality

- Using questioning, probing and discussion to develop the pupils' understanding

- Using a variety of resources that are appropriate to the pupils' needs and abilities

- Providing feedback to the pupils that contributes to their understanding

- Clearly and accurately communicating with the pupils at a level that is age and ability appropriate

- Employs gesture, expression, movement and voice variation to enhance the learning experience

- Uses assessment frequently to assess understanding of key concepts and to make adjustments to the planned lesson

- Developing the literacy and numeracy skills of the pupils as appropriate to the subject

Learning:

- Pupils are actively engaged in work that is purposeful

- The learning tasks and activities are appropriately challenging and move pupils towards mastery

- Pupils achieve the learning outcomes

- Pupils progress in their learning

- Pupils take responsibly for their own and others learning

Assessment:

- A range of strategies are used to support, monitor and assess pupil learning, including but not limited to Assessment for, of and as Learning, peer and self-assessment strategies

- Assessment of learning is used to determine the readiness of the pupils to transition to the next learning outcome

- Homework that consolidates the learning outcomes and is appropriate to the pupils' abilities

Classroom Environment

- Develops respect and rapport in both the teacher-pupil and pupil-pupil relationships

- Creates a positive and vibrant learning environment

- Is affirming and positively reinforcing of learning with all learners

- Is welcoming of pupils contributions and questions and exhibits courtesy with all learners

- Supports differentiated learning through the management of classroom procedures

- Manages pupil behaviour and environment to provide productive learning opportunities

- Physically organises the classroom to facilitate learning

- Encourages cooperative learning and peer teaching when possible

- Stimulates pupils' interest in the subject

Professional Responsibilities

- Maintains accurate records of classes taught, assessment results etc in a manner congruent with school policy and procedures

- Engages in both self-evaluation and critical reflection on teaching

- Demonstrates an ability to critically analyse and assess his/her own teaching and to develop strategies to address the areas to be improved

- Engages in professional interactions with the co-operating teacher and with mentor teachers in areas such as planning, reporting and collaboration

- Contributes wherever reasonably possible to the activities of the school

- Committed to an ethical practice in relation to Respect, Care, Integrity and Trust, as indicated in the Teaching Council's Code of Professional Conduct

- Demonstrates professional behaviour in accordance with the Teaching Council's Code of Professional Conduct

- Shows commitment to ongoing development and learning through active `participation in the university component of the programme

Teacher Interviews - Themes and Questions

Themes and questions for teacher interviews. The questions will have specific information from observed classes to provide context and meaning to teachers:

Introduction:

- Let's have a think back to before when all this technology was in your classroom, do you remember a specific incident when a student or students had difficulty with a topic and what you did to help with their understanding? Can you describe that to me please?
- Your school has had devices for students for three years now; did you embrace them immediately when they were introduced? What is your memory of the first class, the first year, etc…

Physical and virtual classrooms:

- Describe your classroom, why is your classroom furniture organised the way it is?
- Were you a regular user of the computer room with any of your classes before, and have you used a computer room since, they got devices? How did you use it?
- How does Edmodo / Schoology relate to your physical classroom?
- Do absent students catch up with work via your online space? What expectations do you set and how do they know them?
- Where do students learn?

Role of the teacher:

- How do you see your role relative to the following:
    - As subject knowledge expert and source of information for the students?
    - As designer of learning activities?
        - Which of the two is more important - does this change depending on the class / year group?
- Thinking over the last few years, do you think your role as teacher is any different? Think about classes before individual devices and then class with them and describe any specific incident that comes to mind.
- In an exam year, how do you use the exam papers? Does technology play a role, has that role changed or is it the same?
- Is an exam year different to other years? If so, how?

Tensions (specific examples):

- Thinking about your classroom management skills, how do you call for attention in class when students are engaged with content that may be more interesting?
- Have you felt a change in students' expectations of you and your teaching?
- Have you received messages from students after school hours, how do you manage them?
- Students have access to vast amounts of information online, has this ever caused a difficult situation?
- Tech support! Where do you get it?

Learning activities:

- I've observed your classroom activities with (1st/2nd/3rd year) students. Think about and describe how the state exams may affect how you use technology with students and contrast with a year that I didn't observe.
- What was your thought process when deciding how to integrate devices into your lessons?
- When students are conducting their own research, how do you direct and support them?
- Is your style of teaching the same as 3/4 years ago? Why is it / isn't it?
- When you think about students learning styles, how do your lessons appeal to those?

Homework:

- Do students make use of their devices and other ICT tools when completing homework? If so, how.
- Have you noticed any impact on homework completion rates and quality of work?

Mobile learning:

- Are you using technology as much as you could or would like? If not, what's holding you back? (Ertmer 2005)
- When you look at this representation of mlearning, do you think it reflects your classroom?

Gender

- When thinking about how boys and girls use technology in your class, can you notice any differences?

The Staff Room and ICT champions

- When you look at (or hear about) your colleagues ICT usage, what do you think about it?
- What do you understand a technology champion to be?
- Who is the right technology champion? The ICT coordinator, a young teacher, an experienced/expert teacher, etc?
- Do you think you've become a champion? Evan an informal one?

Student Interviews - Themes and Questions

Themes and questions for students focus groups. The questions will have specific information from observed classes to provide context and meaning to student participants:

Introduction:

- Who is more eager to use technology, you or your teacher?
- What does technology do for you? (Any sort of awareness about the the role of technology, and can they point to it?)

Student research/work:

- When looking up information, for example on [topic], where do you go to find it?
- Do you prefer to look it up yourself or get it from a textbook?
- Has your teacher worked with you on information sources? If so, please describe what you did?
- Was there ever a situation where either you or your teacher had wrong information? If so, please describe that situation?
- Does homework match what you did in class? Do you find it manageable?
- Can you give me an example of something that the technology has help you learn and how it did so?

Connections:

- Do you move files around to share with each other? If so, how?
- Do you share stuff related to school on Edmodo, Schoology, or anywhere else?
- Your teacher uses Edmodo/Schoology, do you have another place where just students share and chat?
- Where do you connect to the internet from? Thinking about one of the places you connect from, are you in the physical or virtual place more?
- What happens if you send a message to your teacher late at night?
- What happens if your teacher sends a message to the class late at night?

Support:

- Who knows the most about technology?
- What about your teacher?
- Do you help each other with technical problems? If yes, is that help well received?
- Do you help your teacher with technical problems? If yes, is that help well received?

Role of the teacher:

- What do you think your teacher's 'teaching style' is?
- If you think back to a class on [topic], which activities helped you learn most?
  - Thinking about those activities: what did you do and what did your teacher do?
- How does your usage of technology in this class compare to other classes?
- If you get bored, or fall behind, does your teacher find ways to help, encourage or push you on?
- Who is responsible for your learning and how do you know that?

Creative exploration of learning:

- Is your teacher teaching you to understand a topic or to learn it? Explain your answer. (note: examples would be *so that we understand*, or *so we can pass the test*)
- If you are struggling with a topic, can your teacher explain it to you in different ways or give different examples that make it understandable?
- Do you think your teacher likes or loves this subject?

Principals' Interview - Themes and Questions

Themes and questions for semi-structured interviews with school principals.

Introduction:

- What was your rationale for introducing a mobile learning programme in your school?
- How does your school's ethos fit into that vision:
    - School A: as a former vocational school?
    - School B: as a community school?
- How do you see the school's role in the community?
- How do you think the community sees the school's role?

Mobile learning initiative:

- How do you think the initiative has performed since it began?
- Did the school have any strengths or weaknesses when starting the programme?
- How did you prepare staff for it? How are you continuing to develop them?
- You're now three years in to the programme, how do you see it developing in the next three years?

Role of the teacher:

- What do you see the teacher's educational role being?
- Is that view shared by the teaching staff?
- Do you think that role has changed or evolved since the start of the programme? (You can refer to some or all of your teachers.)
- Do you have a policy on student / teacher interaction (similar to the teaching council code of professional practice)? If so, has there ever been any tension between that policy and the mobile learning programme?
- Have other tensions arisen?
- Have students' expectations of teachers risen?

Student learning:

- From a leadership perspective, has student learning changed, and if so, how?

Teachers in this study:

- Can you describe how you selected the teachers that you did for this study?
- How have those teachers contributed to the mobile learning programme? Do you see them as champions?

Conclusion:

- The education sector has faced many challenges over the last few years; the recession and subsequent cuts to funding, the period of industrial relations difficulties and the Croke Park agreement, and the planned introduction of the new Junior Cycle. Can you reflect on some of the impacts of these circumstances on your school, your teachers and the programme over the last three years.

- Are there any other comments you wish to make?

Appendix 3I

Dear X,

Thank you for your interest in participating in a research study as part of my Ph.D. research at the National University of Ireland, Maynooth. I'm writing to you now with full information on the proposed study to allow you to make an informed decision on your participation. This letter will set out the details of the proposed study, the requests that will be made of the you and the ethical standards which the research will observe.

At the end of this information letter is a consent form, which includes a summary of the important information about this project, which you should sign and return if you intend to proceed. You should also retain a copy for your records.

Research Title:
An exploration of the effects of mobile learning and access to mobile technology on relationships of learning between students and teachers in post-primary education.

Research Description:
This study views mlearning as more than conjunction of 'mobile' and 'learning', it is viewed as an emerging educational practice built around mobile devices, ubiquitous internet connectivity, socially-connected learning spaces which extend the physical classroom, constructivist pedagogies and a change in the role of the teacher and students. When combined, these forces move formal education from a focus upon teacher-delivered content or instruction to a focus on designing collaborative learning activities or 'what the student does'.

The study aims to explore the effects of mobile learning (mlearning) and access to mobile technology on relationships of learning between students and teachers. The research will take place in three Irish post-primary schools that have adopted mobile learning programmes where each student has a personal device. The purpose of this research is to: (a) identify the changes (if any) in relationships of learning between students and teachers, (b) determine if these changes were brought about solely by the use of mlearning and adoption of mobile devices or if other factors caused or contributed to the changes, (c) establish which theoretical framework(s) underpins the mlearning practice paradigm, and (d) establish whether the mlearning practice paradigm raises students' expectations of teachers to adapt their teaching practice and any resulting tensions from those expectations.

Research format:
The methodology in this research mixed-methods, including qualitative and quantitative data collection methods. The collection of data will take place in two distinct phases: (a) a background and preparatory research phase, and (b) a primary research phase, within each there are a number of data collection methods, which are:

Background phase:

1. Teachers' Initial Questionnaire. A questionnaire will gather information from you, including demographic information, technology literacy/fluency and your beliefs about teaching and learning.
2. At a school level, there will be a review of policies to examine the school's ethos, policies on teaching and learning strategies and any whole school evaluations (WSE-MLL) from the Department of Education and Skills or school self-evaluations (SSE) as well as a review of the school's CPD programme for teachers.

Primary phase:
3. Participant observation. Semi-structured observations of THREE periods of one of your classes will be undertaken over the course of academic year. The purpose will be to record, examine and classify the interactions between you and your students to evaluate the role of mlearning as described above. It is envisaged that this process will occur in terms 1 & 2 only.
4. Participant observation. The use of social networking, virtual learning environments or other online platforms for teaching and learning will be observed to examine the character and quality of online interaction between and among you and your students.
5. Focus groups. Focus groups will be held separately with participating teachers, students and school leaders to inform them of the results of the classroom and virtual observation and to gather their feedback on the results and develop further meaning from the data.

Your selection as a participant in this study was the result of a deliberate sampling method that selected two teachers to participate in each school. The factors that influenced that choice were:
1. Teachers who were willing to volunteer and engage in the process and have their classes and online interactions with students observed.
2. Teachers who use an online learning environment, examples include: Edmodo, Schoology, Moodle or even Twitter.
3. Teachers likely to teach the new Junior Cycle Student Award (JCSA), or for other reasons would have a significant knowledge of it, or would be teaching courses that are similar in nature.
4. Teachers who have taught students with mobile devices for a numbers of years are preferable. This point does not require teachers with advanced technology literacy or fluency.
5. A balance of age and gender in the selection was highly desirable.

Research planning:
If you intend to participate in the research, the following next steps will be a useful summary:
1. Scheduling of observed classes. Given the rigid nature of the school timetable, the scheduling of observations will be entirely in line with your school timetable to ensure minimal disruption.
2. Preparation for observed classes. You should select classes where you have already planned to use technology and integrated it into the lesson, classwork and assigned homework. It is preferable that you do not create a specific lesson plan for observation but conduct a lesson in in the way that you have naturally come to use mobile devices.
3. Your observed classes should also be ones where you use an online learning environment, examples include: Edmodo, Schoology, Moodle or even Twitter.

4. From the selection criteria above you will notice that teachers with experience of the JCSA (or similar) were listed as preferable in the criteria. This preference largely comes from the formal integration of ICT into revised JCSA subjects and the ability to use that technology in the assessment. This criterion and preference could also inform you choice of lessons for observation.

Ethics:

The ethical standards which this research project will observe are based on the British Educational Research Association (BERA). A detailed research plan and ethical statement has been submitted and approved by the NUIM Social Science Ethics Research Subcommittee.

As this project will involve the school, teachers and students, consent is required from each of these groups.

1. The Principal has provided consent in writing with the approval of the board of management.
2. As a (potentially) participating teacher, you are now being invited to provide your consent. Each teacher will receive a written request to participate, containing study information and a consent form. This letter is performing this function.
3. Consent from students in observed classes will be obtained by the teacher with the assistance of the researcher and Principal; each student will bring home a consent form and information sheet. Once all consent forms have been received the observations can proceed. A copy of this letter is attached for your information.

The standard of confidentiality and anonymity during the research study is as follows:

1. Schools will be referred to by codes A, B & C throughout the research.
2. Teachers will be identifiable from video observations, focus group transcripts and questionnaire.
3. Students will be identifiable in the video observations of classes and observations of virtual environments.

Precautions will be taken to ensure confidentiality during the research project.

1. Printed paperwork relating to schools, teachers and students will be filed securely in a locked filing cabinet in the researcher's office in the Education Department in NUIM.
2. Video will be stored in two formats, tape from the camera and digitally. Tapes of raw footage will be returned to the filing cabinet (see above), digital versions of the footage will be stored on an encrypted hard drive; all footage will be retained for the duration of the research project.
3. Transcripts of classroom observations and focus groups, with participant information, will be stored digitally on the researcher's laptop which is encrypted and physically in the research office (see above).
4. The teacher questionnaire will be administered using SurveyMonkey which complies with Data Protection legislation in the EU/EEA via the US Government Safe Harbor programme (http://export.gov/safeharbor/)

At the conclusion of the study, the following steps will be taken to protect confidentiality and anonymity of participants:

1. All video footage will be securely destroyed, both physical and digital.
2. Transcripts of classroom observations and focus groups will be anonymised by removing participant names and identifying characteristics.
3. The teacher questionnaire will have the identity of each respondent removed.
4. All documents provided by the schools will be securely destroyed, both physical and digital.

Outputs

The data collected from this research will be used only for the following purposes:

1. Ph.D. research, thesis and submission for examination by the University.
2. Presentations at academic conferences.
3. Papers to be published in academic journals.

In all of the above cases, the anonymity of the schools, teachers and students will be protected. As a code to connect the data to a subject's identity WILL NOT be retained it will not be possible to identify participants in any subsequent output. No video or photos will have been retained, nor any identifiable information.

The researcher further requests permission for subsequent educational / non-commercial outputs following the conclusion of the Ph.D. thesis. To support this aim, anonymised data will be stored for up to 3 years following the submission of the Ph.D. thesis to allow for further analysis, research, academic writing and conference presentations.

Informed Consent Form

Research Study Title:
Relationships of learning and mlearning

Contact Details:

Researcher:
Mr. Keith Young,
Ph.D. Candidate, Education Department
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Academic Supervisor:
Dr. Rose Dolan,
Acting Head, Education Department,
Education House, NUI Maynooth.
rose.dolan@nuim.ie

Clarification of the purpose of the research

The purpose of this research is to: (a) identify the changes (if any) in relationships of learning between students and teachers, (b) determine if these changes were brought about solely by the use of mlearning and adoption of mobile devices or if other factors caused or contributed to the changes, (c) establish which theoretical framework(s) underpins the mlearning practice paradigm, and (d) establish whether the mlearning practice paradigm raises students' expectations of teachers to adapt their teaching practice and any resulting tensions from those expectations.

Confirmation of particular requirements.

The research will involve the following elements:
1. A questionnaire for teachers.
2. Classroom observations of your class and students.
3. Online observations of your class and students
4. Focus groups to report on the above observations.

Teacher – please complete the following (Circle Yes or No for each question)
1. Have you read or had read to you the information letter?   Yes / No
2. Do you understand the information provided?   Yes / No
3. Have you had an opportunity to ask questions and discuss this study?   Yes / No
4. Have you received satisfactory answers to all your questions?   Yes / No
5. Are you aware that your class will be video recorded?   Yes / No

Voluntary involvement

Participants may withdraw from the study at any point. An email to the researcher is sufficient notice of intention to withdraw and the participant's data will be withdrawn from the data set. The cut off point for withdrawal is the data analysis phase and this date will be communicated to participants during the data collection phase.

Protecting confidentiality of data

At the conclusion of data analysis, the confidentiality and anonymity of participants will be protected by destroying all video and still footage, anonymising transcripts of classroom

observations and focus groups and destroying all physical and digital files provided by the school or participant. The researcher requests permission for subsequent educational / non-commercial outputs following the conclusion of the Ph.D. thesis. To support this aim, anonymised data will be stored for up to three years following the submission of the Ph.D. thesis to allow for further analysis, research, academic writing and conference presentations.

Signature and consent:

I have read and understood the information in this form. My questions and concerns have been answered by the researcher, and I have a copy of this consent form. Therefore, I consent to take part in this research project.

Name: _____   Date: _____

Position & School: _____   Signature: _____

Witness Name & Position: _____   Witness Signature: _____

Statement from the National University of Ireland, Maynooth Ethics Committee

If during your participation in this study you feel the information and guidelines that you were given have been neglected or disregarded in any way, or if you are unhappy about the process, please contact the Secretary of the National University of Ireland Maynooth Ethics Committee at **research.ethics@nuim.ie** or **+353 (0)1 708 6019**. Please be assured that your concerns will be dealt with in a sensitive manner.

The iPad Classroom
Curriculum & Facilitator Guide

'The iPad Classroom' course is designed to enable teachers to deepen their knowledge and skills of using mobile devices for teaching and learning. Participants will develop workflows to allow for assessment and sharing of work between students and teachers. They will explore methods of assessment, both in-class and as homework. Through a group presentation and sharing of work, participants will develop their community of practice with peers.

Learning outcomes for this course are as follows:
- • Review what has been implemented after Learning with iPad.
- • Revisit successful workflow practices for the classroom.
- • Learn how to manipulate PDF's to assess homework.
- • Learn how to create a 'Flipped Classroom' environment.
- • Discover ways to assess your digital classroom.
- • Develop their community of practice within the school.

Audience

This course is designed for teachers who are continuing to develop their practice using mobile devices in the classroom. They should previously have attended Wriggle's 'Learning with iPad' course (or similar).

Agenda & Training Structure

This course is designed to take 3.5 hours in the workshop with approximately 30 minutes preparation and research before the workshop. The agenda and structure of the workshop is set out below. Each workshop has a capacity for 20 participants with 1 facilitator. Where there are more than 20 participants, Wriggle can provide additional facilitators to run additional workshops in parallel.

10 Minutes	Welcome & Introduction
30 minutes	Workshop 1 - Review of Learning with iPad
30 minutes	Workshop 2 - Successful Workflows
30 minutes	Workshop 3 - Brainstorming / Mind-mapping
15 minutes	Break & Refreshments
60 minutes	Workshop 4 - Participant Presentations (rotational seminar)
35 minutes	Workshop 5 - Flipped Classroom
10 Minutes	Reflections & Questions

Appendix 4A - Coding Of Teachers' Virtual Classrooms

Table 1.1

Initial coding of interactions on Tanya's Edmodo group, showing student-initiated requests

	Responded to by:	
Student-initiated requests	Students	Teacher
Student-initiated requests		
- Requesting course content	0	1
- Querying if or what homework has been set	5	1
- Requesting assistance with work	3	2

Notes: The period of observation was September 1st 2015 to March 5th 2015 (when the teacher took a leave of absence), during which there were 32 posts in the group. At the end of the period of observation, there were no folders in the content library.

Table 1.2

Initial coding of interactions on Tanya's Edmodo group, showing notifications and announcements

	Initiated by:	
Notifications and announcements	Students	Teacher
- Setting (or stating) homework	3	1
- Distributing course content	0	4
- Notification of absence	4	1
- Relating to extra-curricular activities	1	5
- Sharing examples of class or homework	0	0

Notes: The period of observation was September 1st 2015 to March 5th 2015 (when the teacher took a leave of absence), during which there were 32 posts in the group. At the end of the period of observation, there were no folders in the content library.

Table 2.1

Initial coding of interactions on Amy's Edmodo group, showing student-initiated requests

	Responded to by:	
Student-initiated requests	Students	Teacher
- Requesting course content	0	2
- Querying if or what homework has been set	7	1
- Requesting assistance with work	0	0

Notes: The period of observation was September 1st 2015 to June 19th 2015, during which there were 28 posts in the group. At the end of the period of observation, there were 3 folders containing 5 resources in the content library.

Table 2.1

Initial coding of interactions on Amy's Edmodo group, showing notifications and announcements

	Initiated by:	
Notifications and announcements	Students	Teacher
- Setting (or stating) homework	0	16
- Distributing course content	0	3
- Notification of absence	0	0
- Relating to extra-curricular activities	0	0
- Sharing examples of class or homework	0	0

Notes: The period of observation was September 1st 2015 to June 19th 2015, during which there were 28 posts in the group. At the end of the period of observation, there were 3 folders containing 5 resources in the content library.

Table 3.1

Initial coding of interactions on Martin's Edmodo group, showing student-initiated requests

	Responded to by:	
Student-initiated requests	Students	Teacher
- Requesting course content	0	0
- Querying if or what homework has been set	4	0
- Requesting assistance with work	0	0

Notes: The period of observation was September 1st 2015 to June 19th 2015, during which there were 28 posts in the group. At the end of the period of observation, there were no folders in the content library.

Table 3.2

Initial coding of interactions on Martin's Edmodo group, showing notifications and announcements

	Initiated by:	
Notifications and announcements	Students	Teacher
- Setting (or stating) homework	4	42
- Distributing course content	0	10
- Notification of absence	0	4
- Relating to extra-curricular activities	0	0
- Sharing examples of class or homework	74	0

Notes: The period of observation was September 1st 2015 to June 19th 2015, during which there were 28 posts in the group. At the end of the period of observation, there were no folders in the content library.

Table 4.1

Initial coding of interactions on Olive's Edmodo group, showing student-initiated requests

	Responded to by:	
Student-initiated requests	Students	Teacher
- Requesting course content	0	0
- Querying if or what homework has been set	5	0
- Requesting assistance with work	3	2

Notes: The period of observation was September 1st 2015 to June 19th 2015, during which there were 28 posts in the group. At the end of the period of observation, there were three screenshots of exemplar work in the content library.

Table 4.2

Initial coding of interactions on Olive's Edmodo group, showing notifications and announcements

	Initiated by:	
Notifications and announcements	Students	Teacher
- Setting (or stating) homework	0	34
- Distributing course content	0	22
- Notification of absence	0	6
- Relating to extra-curricular activities	0	0
- Sharing examples of class or homework	73	0

Notes: The period of observation was September 1st 2015 to June 19th 2015, during which there were 28 posts in the group. At the end of the period of observation, there were three screenshots of exemplar work in the content library.

Table 5.1

Initial coding of interactions on for all teachers's Edmodo group in Hillview School, showing student-initiated requests

	Responded to by:	
Student-initiated requests	Students	Teacher
- Requesting course content	0	3
- Querying if or what homework has been set	21	2
- Requesting assistance with work	6	4

Table 5.2

Initial coding of interactions on for all teachers's Edmodo group in Hillview School, showing notifications and announcements

	Initiated by:	
Notifications and announcements	Students	Teacher
- Setting (or stating) homework	7	93
- Distributing course content	0	43
- Notification of absence	4	11
- Relating to extra-curricular activities	1	5
- Sharing examples of class or homework	147	3

Table 6

Initial coding of materials and updates on all Schoology courses in Seafront School.

	Dan	Martha	Beverly
Materials			
- Assignments	8	25	10
- Documents (Word and PDF)	-	28	10
- PowerPoints	49	3	1
- Internet Links	-	7	13
- Quizzes	-	-	5
- Discussions	-	-	4
Updates			
- Homework reminders	-	2	-
- Questions from students	-	-	2

Notes: Analysis of the materials and updates in the Schoology courses tool place on June 19th 2015, and generally amounted to one year's worth of course content (coinciding with the adoption of Schoology).

Appendix 4B: Initial Coding Of Video Recordings And Classroom Observations

Tables 1 to 7 below show the initial coding of video recordings and classroom observations using a task-by-task coding approach. The tables should be read in conjunction with the glossary of Apps shown in Table 4.9.

Table 1

Initial coding of video observations of classes for Tanya from Hillview School; coded by educational task with examination of technology use.

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Observation 1: 1st year Music - practical class (32 minutes)			
Apps & tools: QuickVoice, Skitch, Edmodo and BookCreator			
Set homework for the following week; including a mix of theory and practical work *Whole-class activity* (4 minutes)	Distributed musical scores via Edmodo	Researched musical instruments online and found factual information and diagrams, then recorded using BookCreator App	PDFs of the musical scores were posted to the Edmodo feed
Recorded attendance (<1 minute)	iPad-based attendance tool	n/a	n/a
Practised the recorder (instrument) *Whole-class activity* (27 minutes)	Projected musical score for the class Recorded backing track for absent students using QuickVoice	Read musical score from iPad or projector Recorded backing track for later practise using QuickVoice	*- musical scores were previously posted on Edmodo feed*
Observation 2: 1st year Music - teaching class on *instruments of the orchestra* (42 minutes)			
Apps & tools: Skitch and BookCreator			
Set homework for the following week; including a mix of theory and practical work (3 minutes)	None	Found recordings of instruments online and saved to playlist Labelled a diagram of the instrument using Skitch	None

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Recorded attendance (<1 minute)	iPad-based attendance tool	n/a	n/a
Reviewed homework *Whole-class activity* (38 minutes)	Inspected students' research as recorded in the Book Creator App Co-created course reference material on musical instruments using the Book Creator App	Researched the french horn (instrument) online; created new page in BookCreator App with facts and image Identified key words, annotated diagram and recorded in the Book Creator App to create revision resource Collaboratively wrote a paragraph summary of key words to augment previous tasks and create course and revision content	None

Observation 3:   1ˢᵗ year Music - practical class (32 minutes)

Apps & tools: Edmodo and QuickVoice

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Recorded attendance (<1 minute)	iPad-based attendance tool	n/a	n/a
Reviewed students' preparation and planning for upcoming examination *Whole-class activity* (4 minutes)	Encouraged students to contact her via Edmodo with questions	Invited to communicate with teacher	Students invited to communicate with teacher via Edmodo
Practised the recorder (instrument) *Whole-class activity* (13 minutes)	Projected musical score for the class Recorded backing track for absent students using QuickVoice	Read musical score from iPad Recorded backing track for later practise using QuickVoice	*- musical scores were previously posted on Edmodo feed*
Practised singing *Whole-class activity* (14 minutes)	Projected musical score for the class	Read musical score from iPad Recorded singing of *arpeggio* scales for later independent practise Used front-facing camera to observe and correct 'mouth work' for singing	*- musical scores were previously posted on Edmodo feed*

Table 2

Initial coding of video observations of classes for Amy in Hillview School; coded by educational task with examination of technology use.

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Observation 1: 3rd year Business Studies - revision class on *marketing* (30 minutes)			
Apps & tools: SimpleMind+, Keynote, PowerPoint, PicCollage and Digital Textbooks			
Reviewed the topic *marketing* *Whole-class activity* (20 minutes)	Projected PowerPoint with revision notes on the topic Quizzed students on market segmentation activity, where students previously created PicCollages	Revised materials created with SimpleMind+ (mind maps) Viewed digital textbook	None
Practised applying the *marketing mix* theory to a new product *Individual activity* (7 minutes)	Projected a template of the *marketing mix*	Created *marketing mix* in Keynote Researched using Google to find relevant information Searched e-commerce sites for pricing information Types additional notes on the topic	None
Set homework *Whole-class activity* (3 minutes)	None	Researched online for information about a new product to apply the *marketing mix* theory Directed to create *marketing mix* for additional product using PicCollage (or paper)	None
Observation 2: 3rd year Business Studies - revision class on *marketing* (29 minutes)			
Apps & tools: SimpleMind+, PowerPoint, PicCollage and Edmodo			
Reviewed students' preparation and planning for upcoming examination *Whole-class activity* (1 minute)	Projected PowerPoint with directions and information	Directed to review materials previously created, including mind maps and PicCollages	None

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Reviewed the topic *marketing* *Whole-class activity* (21 minutes)	Demonstrated how to create revision mind maps with SimpleMind+ Presented completed mind maps as discussion / revision prompts for class	Skimmed chapter on *marketing* to identify key words and created a mind map using SimpleMind+	None
Set expectations for students' use of Schoology *Whole-class activity* (concurrent with activity below)	Reminded students to join Edmodo, planned to use extensively in future	Invited to Join Edmodo	Students invited to connect to teacher's Edmodo class
Set homework for the following week *Whole-class activity* (7 minutes)	Distributed homework questions via Edmodo	Received homework on Edmodo	Home submitted to teach via Edmodo

Observation 3:   3rd year Business Studies Exam preparation class (28 minutes)

Apps & tools: Edmodo

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Reviewed previous homework *Whole-class activity* (11 minutes)	None	Accessed homework content from Edmodo and physical copy book	Homework task and questions were posted on Edmodo feed
Reviewed past examination questions *Whole-class activity* (15 minutes)	Projected marking scheme	Accessed homework task on Edmodo Accessed exam questions online (examinations.ie)	Link to exam questions previously posted on Edmodo feed
Set homework *Whole-class activity* (2 minutes)	Posted homework task and link to set questions on Edmodo feed	Accessed homework task and materials on Edmodo	Homework task and questions were posted on Edmodo feed

Table 3

Initial coding of video observations of classes for Martin in Hillview School; coded by educational task with examination of technology use.

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space / teacher's website
Observation 1: 3rd year History - teaching class on *The Irish War of Independence* (31 minutes)			
Apps & tools: PicCollage, Digital Textbooks and Edmodo			
Reviewed previous lesson Set objectives for current lesson *Whole-class activity* (6 minutes)	Projected two PicCollages from students which were completed previously and shared on Edmodo Invited paired and plenary feedback on PicCollages	Students reviewed projected PicCollages in pairs, followed by plenary discussion Revised their own PicCollages on the topic to incorporate feedback from discussion	Previous work was submitted to the teacher via Edmodo
Researched the topic *The Irish War of Independence* *Jigsaw group-work activity* (22 minutes)	Projected research topics/ terms for students Directed students to research online, then verify facts using a trusted source, in this case the digital textbook	Conducted individual research online using Safari and Google Created PicCollage with terms and researched answers Amended researched answers after verification	None
Recorded attendance (<1 minute - concurrent with activity above)	iPad-based attendance tool	n/a	n/a
Set homework *Whole-class activity* (3 mins)	Projected homework task and discussed Uploaded resource to teacher's website Posted homework task to Edmodo feed	Directed to research the participants in *The War Of Independence* by picking 1 person and looking up 10 facts. Directed to record facts on iPad and prepare to share with their groups in the following class	Homework task and link to resource posted on Edmodo feed
Observation 2: 3rd year History - teaching class on *The Emergency* (31 minutes)			
Apps & tools: Edmodo			
Taught the topic *The Emergency* *Whole-class activity* (26 minutes)	Projected questions Showed video on *The Emergency* as direct instruction Repeated video to allow students develop their answers further	Accessed topic summary and questions on teacher's website Used questions to guide viewing of the video, noting answers to 18 questions on paper	Resources shared on teacher's website

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space / teacher's website
Set homework (1 min)	Posted homework task to Edmodo feed	Conduct research online to answer set questions	Homework task posted on Edmodo feed
Consolidated the lesson *Individual activity* (4 minutes)	Administered online quiz to students to conclude the topic	Answered online quiz using iPad and Safari web browser	Online quiz was hyperlinked from the topic page on the teacher's website

Observation 3:   3rd year History - teaching class on *Ireland 1950 to 1966* (31 minutes)

Apps & tools: Edmodo, PicCollage, Padlet and Digital Textbooks

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space / teacher's website
Set objectives for current lesson and lesson setup. (4 minutes)	Projected the task for students	None	None
Recorded attendance (<1 minute - concurrent with activity above)	iPad-based attendance tool	n/a	n/a
Continued research on the topic *Ireland 1950 to 1966* *Jigsaw group-work activity (in expert groups)* (5 minute5)	Projected research topics Divided students into expert groups to present research on their topic. Research was recorded using PicCollage	Researched designated topic online and verified their research using course materials (digital textbooks on iPads) Created PicCollage with information from their research Updated their own PicCollages with further information from classmates after group feedback	None
Presented researched information *Jigsaw group-work activity (in base groups), followed by whole-class activity* (17 minutes)	Projected research topics Directed students to present their research, recorded in PicCollage, to their base group. Led plenary discussion	Read and projected from their PicCollages in sequence of topics Discussed research in plenary	No

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space / teacher's website
Consolidated the lesson and setting homework *Whole-class activity* (5 minutes)	Created Padlet per topic to host all student research, intending to use it as a revision resource Directed to continue contributing to Padlet for homework	Directed to share their research on a Padlet page per topic	Linked to the Padlet pages from Edmodo

Table 4

Initial coding of video observations of classes for Olive in Hillview School; coded by educational task with examination of technology use.

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Observation 1: 3rd year Maths - teaching class on the topic *Geometry* (31 minutes) Apps & tools: Edmodo and Camera (for video)			
Introduced the topic *Geometry: triangles and rectangles* *Whole-class activity* (6 minutes)	Projected instructions for practise activities	Viewed class activity notes/handout on Edmodo	Class activity notes/ handout posted to Edmodo feed
Practised *construction of triangles* *Paired activity* (7 minutes)	Projected instructions for practise activities Projected a demonstration of the construction of a triangle with a video animation	Followed instructions downloaded from Edmodo Practised their triangles on paper	Class activity notes/ handout posted to Edmodo feed
Created recording of students narrating the construction process for the first type of triangle *Paired activity* (10 minutes)	Directed students to work in pairs, one constructing the triangle while the other makes a video recording	Recorded and narrated the construction of a triangle using using an iPad Swapped roles and repeated	Students posted samples of each type of triangle construction to Edmodo feed for peer feedback and as a revision resource
Created recording of students narrating the construction process for the second type of triangle *Paired activity* (6 minutes)	Directed students to work in pairs, one constructing the triangle while the other makes a video recording	Recorded and narrated the construction of a triangle using an iPad Swapped roles and repeated	Uploaded samples of each type of triangle construction to Edmodo for peer feedback and as a revision resource
Set homework *Whole-class activity* (<1 minute)	Directed students to complete homework section of class notes/ handout	Followed instructions downloaded from Edmodo	The class activity notes/ handout posted to Edmodo feed also included the home for the lesson
Observation 2: 3rd year Maths - revision class on the topic *Coordinate Geometry of the Line* (33 minutes) Apps & tools: Edmodo and EduCreations			

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Set objectives for current lesson *Whole-class activity* (2 minutes)	Directed students to have 1 iPad between 2 for this class	Use 1 iPad between 2 students	None
Revised the topic *coordinate geometry of the line* *Individual activity* (21 minutes)	Directed to revise key terms using EduCreations Questioned students on key terms Directed to revise formulae using EduCreations Questioned students on formulae	Listed 8 key terms from the topic on a slide in EduCreations Wrote 4 formulae on a new slide in EduCreations	None
Practised of examination questions *Individual activity* (10 minutes)	Directed to import examination questions from Edmodo into EduCreations and solve them	Worked on the 2014 examination questions in pairs	Questions were posted to the Edmodo feed
Set homework *Whole-class activity* (<1 minute)	Directed to complete task and share completed examples of exam questions	Uploaded samples of completed exam questions to small groups on Edmodo Saved their EduCreations file as a revision resource	Uploaded samples of question to Edmodo small groups

Observation 3:   3rd year Maths - revision class on the topic *Coordinate Geometry of the Line* (32 minutes)

Apps & tools: Edmodo and Geogebra

Reviewed prior class on *linear graphs and quadratic equations* Set class objectives *Whole-class activity* (5 minutes)	None	None	None

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Practised of *coordinate geometry of the line* *Individual activity* (27 minutes)	Directed to note the questions in a copy book Directed students to use GeoGebra to verify first attempt at a line Demonstrated finding solution in GeoGebra Directed to write full answer on paper	Note four questions in copy book with draft attempt Use GeoGebra to plot lines and verify draft Transferred from GeoGebra to hard-back notebook	Video tutorial of solving equations using geoGebra previously posted on Edmodo feed
Set homework *Whole-class activity* (<1 minute)	Directed to complete 1 more example for homework, following the same steps in class	Followed procedure from class to complete one more example for homework Review peers' examples and prepare to critique in class.	Completed homework to be uploaded to Edmodo

Table 5

Initial coding of video observations of classes for Dan in Seafront School; coded by educational task with examination of technology use.

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Observation 1: 3rd year Geography - teaching class covering *cartography* and *human geography* (40 minutes) Apps & tools: Schoology, AirPlay, Google Maps and screenshots			
Reviewed homework *Whole-class activity* (4 minutes)	None	None	None
Recorded attendance (<1 minute - concurrent with activity above)	iPad-based attendance tool	n/a	n/a
Taught the topic *Traffic Management* *Whole-class activity, followed by paired activity* (17 minutes)	Reminded students to access course content on Schoology Projected teaching materials from iPad via AirPlay Directed students to work in pairs and apply theory to exam questions Shared students' discovery of using Google Maps	Transcribed traffic management methods from the projector Retrieved map from examinations.ie and applied theories Projected their iPads and discussed their work with the class Use Google Maps to verify one-way street	Course content uploaded to Schoology resources
Practised developing a traffic management plan for their town *Paired activity* (15 minutes)	Directed to use Google Maps to develop a traffic plan for the local	Use Google Maps to develop traffic management plan *Access to Google Maps was hampered by poor Wi-Fi*	None
Set homework *Whole-class activity* (1 minute)	Asked students to screenshot maps from Google Earth / Maps to have to work on in the next class Directed to complete class activity	*As above*	None
Observation 2: 3rd year Geography - teaching class covering *cartography* and practicing map skills (41 minutes) Apps & tools: Schoology and the camera			

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Reviewed homework (*issued during last observation)* *Whole-class activity* (17 minutes)	Invited students to present their traffic management plan *Repeated for three groups*	Presented from iPad and discussed traffic management plan. Projected over the whiteboard and annotated with markers	None
Recorded attendance (<1 minute - concurrent with activity above)	iPad-based attendance tool	n/a	n/a
Practised map reading skills *Individual activity* (24 minutes, but interrupted by school announcements for 2.5 mins)	Projected task instructions on determining map perspective from exam question Asked students to complete task without instructions Repeated task with instructions Assigned further practise question	Complete task on papers Consulted reference materials on Schoology Work on second example from exam papers on examinations.ie	Task instructions and references materials uploaded to Schoology assignments (setting homework)
Set homework *Whole-class activity* (1 minute)	None	Photograph the instructions from the board	None

Observation 3: 3rd year Geography - exam preparation class focusing on the *Greenhouse Effect* (34 minutes)

Apps and tools: none

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Revised the topic *Greenhouse Effect* *Whole-class activity* (10 minutes)	Displayed video summary of the topic Guided students' use of internet sources	*Some students had researched online and found incorrect information*	None
Recorded attendance (<1 minute - concurrent with activity above)	iPad-based attendance tool	n/a	n/a
Practised completing examination questions *Individual and paired activity* (12 minutes)	Directed to complete questions and peer mark	Accessed exam questions from examinations.ie	None

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Set homework (1 minute)	Directed to finish examination questions for homework	None	None
Reviewed past examination questions *Whole-class activity* (11 minutes)	None	None	None

Table 6

Initial coding of video observations of classes for Martha in Seafront School; coded by educational task with examination of technology use.

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Observation 1: 2nd year Geography - teaching class covering *economic activity* (35 minutes)			
Apps & tools: Digital Textbooks and Schoology			
Reviewed the topic *economic activity*, introducing *tertiary activity* *Whole-class activity* (14 minutes)	Questioned students to assess prior learning Projected definition and materials for topic Projected exam questions from Schoology to orient students to the topic	Read from the digital textbook for the topic Read aloud from the digital textbook and highlighted key terms	Materials uploaded to Schoology resources Examples of exam questions uploaded to Schoology resources
Recorded attendance (<1 minute - concurrent with activity above)	iPad-based attendance tool	n/a	n/a
Consolidated teaching on the topic *tertiary activity* *Whole-class activity* (8 minutes)	Administered quiz on Schoology followed by discussion	Completed topic quiz	Quiz hosted on Schoology
Practised *map work* skills and set homework *Individual activity* (8 minutes)	Projected task instruction; to find examples of cultural activities on the maps Directed to complete for homework with extension activity	Accessed task resources on Schoology Continued task for homework	Uploaded material to Schoology Map coordinates submitted by students on Schoology assignment (setting homework)
Observation 2: 2nd year Geography - teaching class covering *human geography* (36 minutes)			
Apps & tools: Schoology and AirPlay			
Reviewed homework, Set expectations for students' use of Schoology *Whole-class activity* (9 minutes)	Projected homework task for review Determined who had not viewed the activity via Schoology analytics and questioned them Introduced students to Schoology analytics and grade book Explained expectations around absence and lack of wifi	None	Homework exercise submitted via Schoology assignment Schoology established as part of the class routine

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Recorded attendance (<1 minute - concurrent with activity above)	iPad-based attendance tool	n/a	n/a
Reviewed homework *Whole-class activity* (4 minutes)	Projected task to review Projected examples of student's work via AirPlay and discussed	Compared own work to the examples projected	Displayed work which had been submitted via Schoology assignment
Researched the topic *Culture* *Individual activity* (23 minutes)	Directed students to find a definition of culture online Projected video on the topic from YouTube and watched as a whole class Directed to re-watch on their iPad and to classify cultural activities shown and upload that classification list	Googled definition of culture Watched linked video on their own iPads with headphones to classify cultural activities	Video resource linked from Schoology resources Classification of cultural activities submitted via Schoology assignment
Set homework *Individual activity* (1 minute)	Directed to complete task for homework	*As above*	*As above*

Observation 3:   2nd year Geography - exam preparation class covering *Tourism* (32 minutes)

Apps & tools: Digital Textbooks and Schoology

Reviewed of homework *Whole-class activity* (11 minutes)	Viewed homework submissions on Schoology	Read digital textbook on the topic	Homework had previously been submitted via Schoology assignment
Recorded attendance (<1 minute - concurrent with activity above)	iPad-based attendance tool	n/a	n/a
Introduced the topic of a case study on *tourism and transport in Spain* *Individual activity* (13 minutes)	Directed students to complete activity on the topic	Reading from the digital textbook, identifying key points and highlighting Completed activity on paper, photographed and submitted via Schoology	Class activity submitted via Schoology assignment

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Set homework (8 minutes)	Projected video excerpt on transport and tourism Issued questions to be answered Directed students to watch the full video for homework	Watched projected video Answer questions in Notes	Video resource linked from Schoology resources Answers to set questions submitted via Schoology assignment

Table 7

Initial coding of video observations of classes for Beverly in Seafront School; coded by educational task with examination of technology use.

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Observation 1: 3rd year History - teaching class covering *The Cold War* (30 minutes)			
Apps & tools: Schoology, AirPlay and PowerPoint			
Shared and discussed an article on an archaeological find which was relevant to revision of first year topic *Individual and whole-class activity* (4 minutes)	Directed student to open Schoology and read a recent newspaper article	Viewed and read the linked article	Newspaper article shared via Schoology resources
Reviewed homework on *Cuban Missile Crisis* *Group-work activity* (18 minutes)	Projected students' homework via AirPlay for discussion	One student per group opened their notes on the topic for reference	Consulted notes previously uploaded to Schoology resources
Revised the topic *The Cold War* and set homework *Individual activity* (8 minutes)	Directed students to open Schoology and view a PowerPoint Directed to review the PowerPoint for homework	Accessed PowerPoint file from Schoology using their iPad	PowerPoint shared via Schoology resources
Observation 2: 3rd year History - revision class revising *The Middle Ages* (30 minutes)			
Apps & tools: Schoology			
Revised the topic *The Middle Ages* *Individual activity* (10 minutes)	Directed students to open the class activity quiz on Schoology	Took the revision quiz on their iPads	Class activity linked from Schoology
Reviewed homework and self-corrected *Individual activity* (8 minutes)	Directed to open homework (exam question completed in copybook) and to open the solution on Schoology Gave further work to complete during the Christmas holidays	Accessed solution from Schoology for self-correction of work	Solutions for homework previously uploaded to Schoology resources

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Engaged in concluding 'fun' activity at the end of the term *Whole-class activity* (12 minutes)	Projected questions	None	None

Observation 3:   3rd year History - teaching class covering *Social History of Ireland* (26 minutes)

Apps and tools: Digital Textbooks

Task, Format & Duration	Teacher's Technology Use	Students' Technology Use	Links to online space
Reviewed the last class and homework *Paired activity* (11 minutes)	Projected pages from digital textbook	None	None
Taught *Social History of Ireland* *Whole-class activity* (9 minutes)	Projected pages from digital textbook Directed students to read the topic	Read content from the digital textbook	None
Completed activity on *changes in rural life*; class activity and set homework *Individual and whole-class activity* (6 minutes)	Projected pages from the digital textbook Directed to complete activity for homework	Read content from the digital textbook	None

Planning to introduce mobile devices

Vision for Teaching and Learning

In both Hillview and Seafront schools the principals articulated a vision for teaching and learning that underpins their mobile device initiatives, although each expressed that vision in different ways. In Seafront, the principal clearly aligns herself with the principles of the Junior Cycle reform, where students combine knowledge and skills, and demonstrate their learning through diverse means:

> that's the basis of the new Junior Cycle, you know: students' self-directed learning and also the five key skills that, the development technology in learning and encouraging students to take on the learning themselves. That's what the new junior curriculum is all about. (Principal A)

Indeed she states that these principals were a long-standing educational aspiration for her: *"25 years I've been thinking this way. So, you just have to be patient"*. These comments are echoed in Hillview, where the vision for teaching and learning was:

> to get students to be more responsible for their own learning and to evaluate how we were teaching our students, whether we were spoon-feeding them or whether they were able to learn on their own, whether they were producing the goods themselves or whether they were relying on notes or whether they were just learning off and regurgitating again.

The vision is largely student-centered, with teaching taking a more facilitative role. IT does not come at the expense of quality teaching as it is recognised that *"It won't replace good teaching, it won't replace good teachers"* (Principal, Seafront School). The aims is to give students ownership and responsibility for their learning processes by developing their ability to leave, collaborate or work autonomously. The principal in Hillview School emphasis that these were not buzzwords being 'thrown around', but there was a meaningful engagement with the process and rationale for it. Both principals give a nod to a more holistic education, with students developing an awareness of self and environment.

The vision and rationale for the use of mobile device in both schools is evidently an educational one rather than a technical one. The language used emphasises teaching and learning by describing, amongst other things, access to a world of information, to new sources of new educational content and to develop a sense of responsibility of learning. While the vision in ambitious, both schools recognise practical constraints in time and focus and an unwillingness to compromise on current standards. Both schools see the opportunity to invoke, but employ different strategies in use their finite capacity to change.

The term 'capacity to change' comes form the coding process and was defined in an early memo which encompassed remarks from both principals about new curriculum initiatives, availability of time, teachers technological skills, teachers' desire to change their practices, and a limit to how much disruption of current practices can take place before quality suffers. In Hillview School for

example, there was a high capacity to change reported by the principal. She described the schools' involvement in the TL 21 programme and a recent staff visit to New Zealand giving the outlook, skills and inspiration for a renewal of their educational practices. In the year before this study, two teachers were sent on a research trip to New Zealand to explore approaches taken in a similar system. Inspired by their visit, the teachers and staff as a whole adopted a theme for the year: *less teaching, more learning*. In Seafront School, the principal describes their focus on pedagogy in anticipation of the June Junior Cycle, acknowledging the delays, she says: "we've been working ahead on pedagogy, right, we've been doing a lot of work there so whatever comes down the line I think we'll be ready for it." The preparation extended to the teaching staff with a voluntary 'teaching and learning' club run by Beverly (Teacher in Seafront School), as a space for teachers to share experiences and reflections on their practice. The principal of Hillview School recognised that undertaking two large initiatives was not possible: "we felt we couldn't be a network [pilot] school and introduce a device, that we would do the technology first and then we would come online with the new junior curriculum at that stage" (Principal , Hillview School). Both schools introduced mobile devices a year ahead of the anticipated mainstream start of the new Junior Cycle, intending to have he technology 'bedded down'. With the industrial relations difficulties, resulting from Ireland's financial crisis '*things changed dramatically since that, there was a lot of stalling on the new junior curriculum.*" (Principal , Hillview School). With the strong linked between the aims of the schools' own mobile device initiatives and the new Junior Cycle, the principals felt it logical to have a linked and sequential introduction of both. Despite the delays, the sting rationale and vision allowed the mobile device initiatives to proceed principal of Hillview School indicated that it was the right choice: *"But we've forged ahead with our IT and things and I'm really, really glad that we took that road."*

Appendix 4D: Glossary Of Apps And IPad Features

Table 1

Glossary of Apps and iPad features, showing which schools and teachers used them and grouped by classification of ability / use case.

Apps / Feature	Ability / Use	Hillview School				Seafront School		
		Tanya	Amy	Martin	Olive	Dan	Martha	Beverly
Virtual Classroom Apps								
Schoology						x	x	x
Edmodo		x	x	x	x			
Reference / Sources of Educational Content								
Digital Textbooks			x	x			x	x
Teacher's Website				x				
PowerPoint			x			x	x	x
Safari		x	x	x				x
Google		x	x	x			x	
Creative Apps								
QuickVoice		x						
BookCreator		x						
Skitch		x						
SimpleMind+			x					
Keynote			x					
PicCollage			x	x				x
EduCreations					x			
GoogleMaps						x		
Subject-specific Apps								
GeoGebra	*Maths*				x			
Sharing & Collaboration								
Padlet				x				
AirPlay						x	x	x
Recording features								
Camera		x	x		x	x	x	
Screenshots						x		

While in some cases Apps are self-explanatory, for example digital textbook Apps, in other cases features like AirPlay (the ability to wirelessly project from an iPad to a projector screen) need an explanation. The glossary provided an insight into how and for what purpose some Apps and features were being used by teachers and it allowed me to ask further questions during interviews to determine a teacher's beliefs and intentions, it therefore provided some insight into the observed tasks and had an impact on coding and further data collection. The uses can generally be classified as:

- Teachers' virtual classrooms. Which will be discussed in depth in Chapter 6, including their patterns of use based on observations.
- Sources of Educational Content. These Apps included digital textbooks, teachers' PowerPoints, a teacher's website (access via browser app), web browsers, YouTube, and Google for web searches.
- Creative Apps. Creative Apps generally allowed students to create some product, and ranged from mind-maps, to annotated diagrams, annotated amps, narrated videos, musical recordings, and collages of images.
- Subject specific. GeoGebra was an app for mathematics that allowed students to create geometric constructions (amongst many other features)
- Sharing & Collaborations. These apps generally allowed students to see each other's work, either online or by projecting it onto a screen in call. Padlet, in addition, allow for asynchronous interactivity.
- Recording. These apps (or features) allowed students to take photos or screenshots.

Given the limited nature of how the data were collected, no generalised findings can be drawn; therefore it is appropriate at this point that it fulfils its original purpose and informs the reader of the purposes of the Apps and features observed.