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LITERACY AND LEARNING ACROSS PHYSICAL AND DIGITAL SPACES: A CASE STUDY IN A BLENDED PRIMARY CLASSROOM

By

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A thesis submitted in fulfillment
of the requirements for the degree of
Doctor of Philosophy

Faculty of Education and Social Work

University of Sydney

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ABSTRACT

In light of technological innovations, schools are increasingly adopting digital tools and promoting online spaces for learning. Consequently, the shape of teaching and learning is shifting beyond the physical classroom. A blended approach involves face-to-face and online practices, including the mediation of material and digital tools to facilitate learning. Drawing on sociocultural theory, distributed cognition and a networked learning framework, this case study explores how a blended approach shapes teachers' practices and students' learning and literacy processes. The study was situated in a Year Six classroom in an Australian technology-rich independent school, and data was collected over a period of three terms during the 2013 school year and included: 1) observations and field notes; 2) 125 hours of classroom video-recordings; 3) a collection of physical and digital artefacts designed by the students; 4) interviews with four teachers and with students in the classroom; 5) a student survey regarding technology integration in the classroom that included Likert scale items and open-ended questions; 6) entry logs posted by students and the teacher on the Edmodo social network site. Multiple approaches to data analysis were used in order to answer the study's research questions, including: networked learning analysis, thematic analysis, situated discourse analysis, multimodal discourse analysis and a quantitative descriptive analysis. The findings suggest that blended learning spaces support teachers' distributed orchestration of classroom activities across tools and resources while also leveraging students' engagement in reciprocal teaching as well as self-driven and collaborative learning. Digital technologies open space for new ways of communication, interaction and learning in the classroom, yet such affordances are dependent upon teacher's facilitation and expertise. In addition, an interactive pattern of literacy practices was evident in the classroom, where processes of authorship, readership, production, audience, and consumption were established between students. Finally, alignment between teachers' beliefs and the perceived value of technology was a key factor for technology integration in the classroom. This research makes both methodological and theoretical contributions to educational research in primary schools. The multi-method research design applied in this study offers an innovative framework to explore blended learning as well as the role of agents, artefacts, and tools. At a theoretical level, this research helps to identify links between space, interactions and content creation in the primary classroom, therefore contributing to an understanding of the phenomenon of blended learning from an ecological perspective.

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1. INTRODUCTION TO THE STUDY

1.1 Introduction

Technology is pervasive in our modern lives. Research shows that it is integral to content creation, social interaction, information acquisition, collaboration, and communication (Lenhart, Madden, Macgill, Manager, & Smith, 2007; Lenhart, Purcell, Smith, & Zickuhr, 2010). However, the introduction of new technological tools for learning is not a recent phenomenon. For instance, the transition from oral communication to papyrus, and later, to the printing press, shaped not only the patterns of communication of the time but also importantly affected the relation between cognition, information and knowledge (Ong, 1986). Now we are again part of an equally significant change as digital technologies are impacting the relationship between teaching and learning in both formal and informal spaces (Kereluik, Mishra, Fahnoe, & Terry, 2013; Agnes Kukulska-Hulme, 2009; Lai, Khaddage, & Knezek, 2013; Mishra, Fahnoe, Henriksen, Andrews, & Churchill, 2013; Squire, 2009). In this changing scenario, notions of hybrid learning, blended learning, or e-learning have emerged in an attempt to examine the interplay between technology, teaching and learning. Although blended learning has been a growing topic of research in higher education over the last decade (Bliuc, Ellis, Goodyear, & Piggott, 2011; Sharples, 2013), research on blended learning in primary and secondary education has been less studied (Means, Murphy, & Baki, 2013; Picciano & Seaman, 2009; Picciano, 2009). Yet understanding the link between spaces, tools, and learning at the school level is crucial in order to effectively design and use blended spaces and, most importantly, to prepare young people for the challenges of the 21st century.

Research shows that innovations in Information and Communication Technologies (ICTs) are transforming prior models of teaching and learning in the classroom and have called attention to new literacy practices (Coiro, Knobel, Lankshear, & Leu., 2008; Gourlay, Hamilton, & Lea, 2014; Lankshear & Knobel, 2011a; The New London Group, 1996). Teaching and learning in the primary classroom have historically relied on bricks and mortar and have been underpinned by theories of learning and pedagogical practices that accommodate this conventional physical learning context (Kalas, Laval, Laurillard, Lim, Meyer, Musgraves, Senteni, Tokareva, Turcsanyi-Szabo, 2014). Similarly, traditional literacy notions have been situated within a print text model, fostering reading and writing of the print alphabet and character-based text (Lankshear & Knobel, 2006, 2011; Ong, 1986; The New London Group,

1996). New literacies enabled by new technological tools have changed not only the modes for representing and making meaning, but also the relationship between production and consumption (Greenhow, Robelia, & Hughes, 2009; Ito, Horst, Bittanti, Matteo, Boyd, Herr-Stephenson, Lange, Pascoe, Robinson 2008; Halverson, 2012; Lenhart & Madden, 2005). These new literacies are in a constant flux due to the interconnectedness and multilayered relationship between on-line and off-line spaces, materiality, and situated nature of meaning making (Burnett, Merchant, Pahl, & Rowsell, 2014). Consequently, in the classroom teachers need to design for learning literacy practices, not only considering a print-centric approach, but increasingly including a multimodal approach that traverses the physical and the online space (Mills, 2013).

ICTs have evolved rapidly, bringing Web 2.0 applications that are modifying interactions between people online. In particular social media including applications such as Facebook and Twitter are re-configuring the connectivity of users over the Internet (Greenhow & Gleason, 2012; Greenhow & Robelia, 2009) and are enabling learning practices that were previously limited to face-to-face spaces (Jenkins, Purushotma, Clinton, Weigel, & Robison, 2009). However, at the primary school level, research has been slow to respond to the changes of technological tools in the classroom context (Fields & Grimes, 2012). For instance, there is a growing body of literature examining social media in undergraduate and high school contexts (Dunlap & Lowenthal, 2010; Junco, Heiberger, & Loken, 2011; Kilinc, Evans, & Korkmaz, 2012). This study addresses the lack of similar research in primary schools by exploring the use of Edmodo, a social network site with learning purposes in a Year Six classroom.

By drawing on a case study situated in an innovative and technologically rich Australian upper primary classroom, I explore how blended learning shapes literacy practices and learning in a technology saturated classroom environment. As scholars have argued, if we are to advance in models of education, researchers need to construct “critical case studies of possibilities” drawing inspiration from experimental and utopian practice in schools of the past as well as the present (Burke & Grosvenor, 2013). As such, the present study examines patterns of interactions between participants, across spaces, and across tools that may hinder or promote learning and new literacy practices in young adults. In particular, the study explores learning processes and literacy practices through students’ use of technologies such as laptops, free applications from the Web, and Edmodo.

Although this study is situated in a highly technological setting, I acknowledge the fact that access to laptops, tablets, learning management systems, applications, and the Internet is not a reality for every student. As a Chilean doctoral student, I am aware of the inequalities in the distribution of wealth and in particular of the distribution of education and technological resources for education (OECD, 2014). However, it is impossible to ignore the fact that we live in a digitalised world and hence the skills and competences students need to acquire for their future work in the type of society we are living in, will increasingly be digitally mediated. The decrease in the cost of technologies and the comparatively low cost of access to information from the Internet as opposed to books and other print-on-paper resources perhaps signals an avenue for these inequalities to be lessened (Collins & Halverson, 2009).

Underpinned by sociocultural theory, distributed cognition, and the concept of learning networks, this research builds on, rather than displaces, various research perspectives. First, the study takes a sociocultural approach as it firmly values the role that the environment — involving both humans and the tools that populate that environment— has in learning. Second, the study draws on a distributed cognition approach in order to outline the notion of cognition as “out there in the world” in contrast to a view of learning that considers cognitive processes as occurring mostly inside the human brain. This distributed cognition approach allows the role of cooperation and interdependence (among tools, space and agents) for learning to be explored. Previous research on distributed cognition has often focused on informal contexts of learning (Hutchins, 1995, 2000). However, as I will argue, the notion of distributed cognition can also be useful to understand process of learning in formal settings. Finally, in this study I use the notion of learning networks to describe human and material (physically and digitally mediated) connectivity. Although learning networks existed prior to the digital revolution (Knappett, 2013), the usage of the term has found a new outlet of development due to the emergence of new ICT (Goodyear & Carvalho, 2014a). Consequently, here learning networks include learning from and with people via ICT (Goodyear, 2005). By bringing these three perspectives together, this study shed light in the understanding of a multilayered and complex phenomenon such as blended learning in primary schools.

The present study has a situated, ecological, and relational view of literacy and learning. This may disrupt ideas of formal learning based on the four walls space of the classroom and students acquiring learning exclusively from the teacher. In other words, this may disrupt

ideas of who controls the usage of knowledge, where knowledge can be accessed and how knowledge is distributed. Likewise, this may disrupt literacy notions founded on distinctions based on materiality of tools and their affordances; or on canonical conventions of what it means to be literate.

Though the present study focuses on blended learning in the primary classroom, I recognise that new technologies are neither essential, nor sufficient, for learning to occur. I argue that in a digitalised world, the role of the teacher, peers, and social context are equally important in scaffolding, facilitating, and stimulating learning. Likewise, the role of the learner is essential in prompting attention, motivation and effort towards a certain topic of study. Consequently, this study recognises the possibilities and affordances offered by new technologies, including for instance new forms to access information, to establish networks with a wider community and to importantly represent knowledge in novel ways, yet it equally acknowledges the need to move away from reductionist and techno-centric approaches of learning and literacy. Finally, it is important to note that the term affordance is used in this thesis to refer to the qualities that things have in relation to the people who use those things. Hence, analogous or digital tools do not have “affordances per se”, but are dependent upon the use of them, and consequently may varied over time (Dohn, 2009; Goodyear, Carvalho, & Dohn, 2014).

The thesis is organised in the following way:

The first chapter starts with an introduction to the study, setting out the aim and the research questions, along with the significance of the study. Chapter 2 gives an account of the theoretical approaches underlying the research. In particular, I draw on a sociocultural approach, including social learning and tool mediation, and on models of distributed cognition along with the networked learning approach, to support this study.

Chapter 3 provides a literature review on blended learning and new theorisation on teaching and learning triggered by the arrival of ICT. It also covers the current body of research on new literacies and theorisations about meaning making practices, including a discussion of the semiotic resources and the social practices embedded in literacy today. Chapter 4 describes the methodology applied in this study, including the research design, trustworthiness of the data, and ethical considerations.

Chapter 5 discusses the findings based on three dimensions: space and tools; interactions between agents (teacher and students); and artefacts and new literacy practices. Chapter 6

offers a synthesis of the findings discussing, how tools, interactions and learning processes are intertwined in the blended classroom. It also presents implications and suggestions for the design of blended learning in primary environments, as well as the limitations of the study and concluding thoughts.

1.2 Aim and research questions

A review of the literature suggests that research on literacy and learning including an interrelated approach between space, tools, and interactions in primary blended environments has not been widely undertaken (see Chapter 3). While extensive research has focused on separate areas (Boyd & Ellison, 2007; Coiro et al., 2008; Dirkin & Mishra, 2010; Greenhow & Robelia, 2009; Mizuko Ito et al., 2013; Kalantzis & Cope, 2012; Koehler & Mishra, 2009; Resnick, 1987; The New London Group, 1996), there is little research available on the interstices and overlaps of each dimension. Understanding such links better is critical, as students and teachers are increasingly becoming part of blended environments for learning. This gap informs the purpose of this research, which aims to examine students' and teachers' experiences in a primary blended environment. The main question guiding this research is:

- How does blended learning shape teachers' practices and students' literacy and learning processes?

Due to the complexity of this research question, it is broken down into nine sub-questions, grouped according to the following three dimensions: space and tools; interactions; and artefacts and new literacies. The analysis of each sub-question informs the main research question, and together they contribute to examine blended learning at the primary school level. The sub-questions that guide the analysis of the present study are:

Space and tools

- How do the spaces and the tools available in a blended classroom shape teachers' and students' practices?
- What are teachers' perceptions of technology and a social network site in the blended classroom?

- What are students' perceptions of technology and a social network site in the blended classroom?

Interactions

- What are students' and teachers' discursive patterns in the blended classroom?
- Are students' engaging in tutoring roles while interacting on a social network site?

Artefacts and new literacies

- How are primary school teachers using a social network site in their daily activities in the blended classroom?
- What learning and literacy practices can be observed while students interact with their peers and teachers in a social network site?
- How are students engaging in new literacy practices in the blended classroom?
- What are students' and teachers' perceptions on multimodal production in the blended classroom?

For clarity, the sub-questions are included at the beginning of each section of the findings (Chapter 5).

1.3 Significance of the study

Often research has focused on techno-centric models of technology integration in the classroom, hence limiting the results to the analysis of the tool, and missing the contextual, situated and pedagogical aspect of tool-use in the classroom (Cuban, 2001; Ertmer & Ottenbreit-Leftwich, 2010; Stahl, Koschmann, & Suthers, 2006). For instance, research on new literacy practices in the school classroom has been largely focused on single-tool use such as interactive whiteboards, laptops or more recently tablet technologies by young adults (Pegrum, Oakley, & Faulkner, 2013; Walsh & Simpson, 2013). Although this type of research is valuable, it often overlooks the impact that the classroom —understood as a

system (or a whole) where every part, agent, or tool is connected to the other components of the system— has in enabling (or not) literacy practices and consequently the effects that context and the link between elements has in such practices. It seems clear that the boundaries between tool, context, learning and literacy practices are rather blurred in the 21st Century. This study takes a learning ecology perspective (Barron, 2006) that considers learning and meaning making practices not in isolation but as part of a wider learning ecology that includes different technologies and contexts of use. As Barron puts it, young people are “simultaneously involved in many settings and they are active in creating activity contexts for themselves within and across settings” (Barron, 2006, p.199). Each context involves specific arrangements of “activities, material resources, relationships, and the interactions that emerge from them” (Barron, 2006). In particular, the learning ecology of the present case study includes the physical space, the online space (including the home and the school where students interacted online on Edmodo), resources (involving material and digital tools such as pen and paper, whiteboards, applications, the Internet, laptops), and agents (including students and teachers). As such, this study helps to illuminate the debate about blended learning in the primary classroom; thus, advancing the discussion on technology and education in young learners. Moreover, by identifying how blended learning takes place in the primary classroom, this study helps to understand what the commonalities and the differences are with blended learning taking place in other contexts, such as higher education, secondary education or informal blended learning in the workplace.

Second, whereas transmitting, creating, and producing meaning was once linked to print-centric composition, today’s new technologies have expanded the modes for communication. As a consequence, representation and communication are vastly multimodal and conveyed through digital channels (Coiro, Knobel, Lankshear, & Leu, 2008). In this scenario schools are now facing the tension to shift from print-centric to multimodal composition in the primary classroom. Not only this implies new ways to design, teach and assess literacy practices in the classroom, but importantly involves questions regarding control and liberation of multimodal practices across spaces in the digital age (Hamilton, Heydon, Hibbert, & Stooke, 2015). This has opened a stream of research that focuses on the nexus between new literacies and new technological tools. This research contributes to the field of literacy by exploring the types of literacy practices that students can engage in; the ways teachers can model meaning making practices and potentially assess such practices; and by illuminating the possible affordances and constraints that teachers encounter when

implementing new literacy practices in the blended classroom. Through the identification of literacy practices in a blended primary classroom, this research shows how notions of new literacies in the 21st century are related to digital and physical space, analogous and digital tools and to the quality of meaning making practices established across those channels; advancing the discussion about what does it mean to be literate, and more importantly how to teach literacy to young learners. In addition, this research also contributes to connect research in different fields, such as blended learning, literacy and social learning. Consequently, allowing a more holistic understanding of this phenomenon.

Third, this study aims to contribute to an understanding of social media tools in primary contexts. Social media tools are more and more attracting attention of educational researchers (Boyd & Ellison, 2007). The study of the affordances, applicability and potential risks of this emergent phenomenon might impact the way teaching and learning practices take place in formal educational spaces. However, as previously noted, there is a gap in the examination of social media tools in primary school contexts (Fields & Grimes, 2012). The present study addresses this issue by analysing the use of Edmodo at the primary school level, expanding research in this area (Fields & Grimes, 2012; Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013). By identifying the ways in which students engaged in literacy and learning processes on Edmodo, this study contributes to advance the scholarship concerning social media tools and primary education.

2. THEORETICAL FRAMEWORK

This study takes a sociocultural, distributed and networked approach to learning. It aims to explore learning, literacy, technology and the space of the classroom, as relational elements that reciprocally intertwine. I consider the elements (either humans or materials) as related to each other in the process of learning. This chapter first delineates features of the sociocultural approach and its relationship with other theories of learning. Then how such approach can be applied to the concept of literacy is outlined. Next, the notions of social learning and mediation which derivate from a sociocultural approach are examined. Then the notion of distributed cognition and the architecture of productive networked learning approach is described and discussed in relation to blended learning.

2.1 Sociocultural approach to learning and literacy

A sociocultural approach to learning considers the phenomenon of learning as a process that involves both cognitive activities that occur in the human mind along with what surrounds the learner in the environment (Nieto, 2007; Vygotsky, 1978). The environment may include the people and the tools available and is always situated in a particular cultural and historical context. Thus, learning is understood as a complex and relational process where learners' capabilities are being activated by, and intimately entangled with, the social and cultural environment. Consequently a sociocultural approach views learning as an interpersonal process attached to unique relationships established in a given cultural, historical and temporal moment (Vygotsky, 1978).

Given this conceptualisation, the sociocultural approach challenges two key ideas of traditional models of learning: first, that learning happens solely inside the brain; and second, that knowledge is *matter* that can be input into individuals (Siemens, 2005). A sociocultural approach departs from behaviourism perspectives of learning which focus on the manipulation of patterns of behaviour for improving learning (Berridge & Robinson, 2003). In a behaviourist perspective only things that can be observed are considered real phenomena in learning. Behaviourism holds that adding positive or negative reinforcement to learning activities contributes to establishing expected patterns of behaviour. Drills and practice exercises or rote memorization are examples of this approach. Instead, a sociocultural model has a different epistemological and ontological approach to perceive the world and

conceptualise knowledge. Unlike the behavioural perspective that sees the learner as passive and the mind as a “tabula rasa” (Lippman, 2010), the sociocultural approach views individuals as immersed and active in the social and physical environment.

Another accepted model of learning is cognitivism (Dupuy, 2000). This information processing perspective understands “the digital computer as a model of mind and [seeks] to explain cognition by reduction to internal symbolic events” (Hutchins, 2010, p.707). “In-put and out-put processes” of information govern the cognitivism approach which was popular during the ‘70s. Unlike cognitivism, a sociocultural approach conceptualises learning as a relational system, where the “out-puts” derived from the process of information cannot be necessarily predicted (Vygotsky, 1978; Vygotsky, 1997). It holds that learning depends upon, but is not limited, to the social interactions, the tools available and the cultural and historical time and space where such processes take place. It is through this relational focus that the sociocultural approach repositions the role of the learners in the environment. The learner is no longer considered as predictable machine that works in isolation; but in relation to, and being mediated by, the agents and digital and physical resources.

Though Lev Vygotsky’s main manuscripts were written in the early 20th Century, his legacy is not merely of historical interest. Rather, he offers a critical contribution for contemporary analysis of learning and development in the 21st Century. For instance, a sociocultural approach provided the foundation for Cultural Historical Activity Theory (CHAT) and its variations in psychological streams (Cole & Engestrom, 1993; Cole, Gay, Glick, & Sharp, 1971; Cole & Scribner, 1974; Wertsch, 1998). Particularly, in relation to learning, a sociocultural view underpinned the work of Cole and Scribner (1974) on cognition among the Vai community in Liberia, and later, was key in the development of research on teaching and learning (Cole, 1996). Indeed, this approach set the foundations for the growth of research on distributed cognition known as “cognition in the wild” (Hutchins, 1995; Lave & Wenger, 1991; Lave, 1988, 1996; Rogoff & Lave, 1984). Scholars in this area shed light into complex cognitive processes occurring outside formal spaces, in everyday life occurrences, and offer an alternative to research on learning that has been predominantly focused on standardized measurement, un-naturalistic settings, dualistic, experimental and cause-effect approaches (Brown, Collins, & Duguid, 1989; Donald, 1991; Greeno, 1998; Pea, 1993a; Resnick, 1987). Two key approaches rooted in this tradition are social learning and distributed cognition. Both approaches informed the present research and will be discussed later in this chapter.

A widely accepted approach to learning, popularised during the last decades, is the socioconstructivist approach. Sociocultural and socioconstructivist approaches share commonalities in the sense that both emphasize the role of the learner in the environment and the co-construction of knowledge derived from the interactions taking place between people (de Laat, 2006). Learners construct new knowledge based on prior assumptions of knowledge that are discussed, disputed or agreed in active constructions with others (Goldstein, 1999). This is a key element in the context of this thesis. However, at an epistemological level, socioconstructivist theory proposes a distinction between the learner and the environment, whereas a sociocultural perspective states that learning is a joint activity with individuals being part of the environment, not separated from it (Vygotsky, 1978, 1981). Consequently, from a sociocultural approach learners' construction of knowledge cannot be distinguished from the environment, since learner and environment are mutually entangled.

Not only learning, but notions of literacy too have been informed by the sociocultural approach. Researchers from diverse fields, including sociology, psychology, education and linguistics have elaborated on Vygotsky's work to expand on the theorisation of literacy. As Warschauer (1997) explains, there are three main contributions of the sociocultural theory to literacy.

First, a recognition that literacy practices consist of a sequence of events embedded in a social, cultural and temporal context. This has had important implications for the theory and practice of literacy, as researchers and practitioners started to analyse and teach literacy as part of a developmental process where the present ability of a student to read or write, was connected, and consequently examined in light of prior events. Less and less, was literacy proficiency analysed as a single event, or as a sign that may denote the cognitive ability of a student; but as a snapshot taken at a moment in time, that carries the developmental history of any student. It also changes the previous focus on isolated processes, where literacy was understood as comprised of discrete skills such as decoding, comprehension and the production of written text (Kalantzis & Cope, 2012), towards an understanding of literacy as meaning making processes embedded in a cultural and historical context (Kalantzis & Cope, 2012; Lankshear & Knobel, 2011). In addition, the definition of literacy shifted from discrete skills to complex literacy practices that may take place anywhere: in formal spaces of learning, as well as in the informal space of the home or neighbourhood.

A second contribution of sociocultural perspectives to the theorisation of literacy is the shift from the notion of literacy as an individual practice, to literacy understood as a social practice. Because literacy practices are social practices that exist and are indexed to the context where those practices take place, they cannot be detached from particular ways of being in the world (Gee, 2004; Gee, 2008). At a practical level, this meant scholars and practitioners started to recognise the influence of the social context in the mastery of reading and writing. For instance, Gee in his seminal work “Situated learning and language: a critique of traditional schooling” argues that often school teachers have been slow in recognising that the canons from which students are assessed in the classroom carried white-western language-structures; consequently students utilising other language structures such as african-americans or latinos are often invisible or bluntly penalised in schools. This marks the recognition of literacy as a process which is always originated as a social practice, that its mastery is gained as students become acculturated in particular discourses (Lave & Wenger, 1991; Rogoff, 1990) and that as a consequence, different language-structures co-exist. However, the “superiority” of certain discourses over others may still be a factor that affects student achievement in schools.

Third, a sociocultural approach proposes that tools mediate the practice of literacy. The introduction of this idea expanded the traditional use of the written text towards the inclusion of other modes such as audio, visual and multimodal (Coiro et al., 2008; The New London Group, 1996). This implies the recognition that reading, writing and designing are practices situated in a particular historical environment; and consequently the tools used for that are specific to the ones existent in historical time. For instance, previously meaning making practices were limited to the affordances of the printed text. Now the inclusion of ICT can assist language learning in multiple ways, for example, allowing students to represent meaning through video, podcasts, audiocasts, games or simulations, and through the production of digitally mediated texts such as Wikipedia, Twitter, or Wordpress. Implications of the proposition that tools affect the practice of literacy can also be seen at the theoretical level, where the study of multimodality is a clear trend in literacy research (Jewitt, 2005; Kress & Van Leeuwen, 2001). At the practical level, in schools multimodalities are introduced as legitimate mediums to represent knowledge (Hassett & Curwood, 2009) and new technologies are integrated as resources for supporting learning.

The shift from a Cartesian paradigm of learning as a representation of the world in the mind, towards situating the mind in the world has had profound significance. Learning can now be examined integrating (as opposed to displacing) the complexities derived from the particularities of the environment, tools and social interactions involved in the process of learning. Not only has the meaning of literacy changed from one attached to the academic canon and the printed word to an understanding that there are many situated literacies, but also to a notion of literacies happening across formal and informal spaces of learning and through the convergence of both the written text and the multimodal text (Gee, 2008; Mark Warschauer & Matuchniak, 2010). This “new” idea of literacy has been coined in the literature as “new literacies” (see Chapter 3, section 3.2).

Finally, two main ideas from Vygotsky (1978) underlie the theoretical framework of this study. First, knowledge representation exists in conjunction with others. Second, knowledge representation is constructed by mediation between the individual and the object. As a result, in a learning scenario, the processes that constitute learning activities are multidimensional, involving the human mind functioning in relation to, and nurtured by, elements external to the individual. Therefore, both social and material mediation inform this research, and are the lenses through which interactions, occurring in the blended classroom, will be examined. In particular:

- Human mediation (social learning) involves peers and teachers, and also parents and other individuals that might accompany the learner.
- Material mediation (tool mediation) involves the following:
 - symbolic mediation including language and other symbolic references (such as emoticons) used by the participants to convey meaning.
 - material and digital tools, including textbooks, notebooks, pen and paper, personal devices (such as laptops or tablets), the Internet, Edmodo and free applications from the web.
 - the spaces where those mediations take place, including the off-line and the online space of the classroom.

The next sections of this chapter will explain issues connected to these two notions: social and material forms of mediation. First social learning addresses aspects linked to human mediation through social learning linking this with Vygotsky’s work. Second, tool mediation outlines the way learning is mediated by material and symbolic tools. Next, I highlight

aspects of the distributed cognition theory, which together with the networked learning model, constitute the theoretical foundation of the present study.

2.1.1 Social learning

Drawing on Vygotsky's work, the notion of social mediation stresses that mental activities and cognition originate in the social plane. A social learning approach then understands that individual cognition has a social origin and consequently a social nature (Vygotsky, 1978). From early functions in the development of a child to higher psychological functions, such as the formation of concepts and knowledge acquisition, cognitive functions develop through interactions with others (Vygotsky, 1978). Vygotsky elaborated:

Every function in the child's cultural development appears twice: first, on the social level, and later on the individual level; first, between people (interpsychological), and then inside the child (intrapsychological) (p.57).

Consequently, it is through reciprocal interactions that the child internalises what happens at a social level in the individual mind; this process is not exclusive to early child development, but continues during the adult life of a person (Vygotsky, 1978, 1997). Internalisation refers to the internal representation of an external activity. For instance, Vygotsky (1978) illustrated the importance of social interactions by describing a child learning to point at something. He posited that the activity is unsuccessful until the adult understands what the child is pointing at (p.56). It is the reaction of the interlocutor of the child's action (which shapes the process of interaction between two agents) that helps the child in constituting the meaning of that social exchange.

Drawing on the notion of social mediation, in the last decades scholars such as Brown and Adler (2008); Brown, Collins, and Duguid (1989), and more recently Lankshear and Knobel (2011) have developed the notion of social learning. A social learning approach is based on the idea that "content is socially constructed through conversations about that content and through grounded interactions, especially with others, around problems or actions" (Brown & Adler, 2008, p.3). As such, social learning highlights how learning takes place, rather than just what is being learnt (Brown & Adler, 2008). Social learning involves forms of apprenticeship where mentors, teachers or peers scaffold students to advance through their zone of proximal development (Vygotsky, 1978; Warschauer, 1997). The zone of proximal

development is a measurement that accounts for the distance between the actual zone of development of a child and his/her potential zone of development. This latter, in Vygotsky's view, can only be achieved with the scaffold or assistance of a mentor. Van Lier (2002) defines the zone of proximal development as the area 'beyond self-regulation' where people need the guide of another to move that limit further. In addition, Rogoff (1990) coined the concept of *guided participation*, extending the initial focus on didactic, face-to-face discourse and dialogic participations in scaffolding a child's learning (Vygotsky, 1978), towards the inclusion of tacit and asynchronous forms of participation.

The implications of a social learning approach are not just theoretical but also practical. By stating that a learner can achieve better learning outcomes through the mediation or assistance of a mentor, either through face-to-face or asynchronous interaction, a social learning approach suggests that learning is a malleable construct dependant on more factors than the measurement of individual intelligence (Vygotsky, 1978). Learning and cognitive development are therefore not limited by nature. Instead they are strongly dependant on the quality of interactions that might scaffold learners' zone of proximal development. Through scaffolding, mentors and peers facilitate the extension of what an apprentice could not do without help, consequently potentiating a learners' cognitive development and achievement (Rogoff & Lave, 1984; Vygotsky, 1978; Vygotsky, 1997). Vygotsky's view of learning strongly influenced the shift from absolute, to variable measurements to assessing intelligence (Vygotsky, 1978). Interestingly, IQ and strict forms of measuring human intelligence which were popular during the time Vygotsky developed his theory, are still established measurements in education in the 21st Century. They are often used to inform the effectiveness of teacher works and students' capabilities, and to shape high stake standardised tests.

Social learning has been further developed by contemporary researchers who have examined how processes of apprenticeship, enculturation and processes of "becoming" members of communities of practice, affect learning and cognition (Brown et al., 1989; Greeno, 1998; Lave & Wenger, 1991; Resnick, 1987a). These studies suggest that social learning does not apply only to the development of mental activities in children (Wertsch, 1985), but to the development of cognition in adults in formal and informal spaces (Lave & Wenger, 1991; Rogoff, 2003; Wenger, 1998). Social learning entails gaining access to the discourse and to the practices of a community of knowledge. For instance, learning about biological concepts

means understanding the practices of the community of biologists, engaging in the particular discourse of that community and eventually becoming a “member” of that community. This process, also coined as *enculturation* (Brown et al., 1989) is what enables a novice or apprentice to learn. In other words, learning involves being part of a community of practice. As such, learning means participation in processes of inquiry and discourse that includes as a significant component, being able to interact with others (Kozma, 2003) or being able to engage in legitimate peripheral participation (Lave & Wenger, 1991).

Moreover, social learning stresses that learning is always situated, as interactions between student/novice and teacher/mentor are unequivocally indexed to a setting and specific subject-matters. Brown et al., (1989) illustrate this by borrowing from research by Miller and Gildea (1987). The study found that children in schools are frequently taught new words from abstract definitions in dictionaries, yet the outcome of those exercises often leads to failure in the use of those definitions. In contrast, people who learn concepts of words in ordinary communication learn at faster rates and are more successful in applying those concepts. Drawing on the results of this study, Brown et al., (1989) suggest that learning is context-dependant; therefore, real situations indexed in authentic activity are better at enabling meaningful representations. The authors argue that this differs from the type of interactions promoted in schools, where the knowledge is abstract and lacking external cues (Resnick, 1987a).

In addition, further developments on social learning shed light into dialogue formation and interactional aspects of learning, previously overlooked in cognitive and psychological research. Scholars propose that if it is through social interaction that individuals connect their mental representations with the world (Nieto 2007), then activities where social interactions take place such as dialogue are constitutive of learning. Dialogue, defined as “jointly created activities” (Johnson, 2004, p.144), underlies processes of negotiation occurring between mentors and novices in educational contexts. Through dialogue, novices are supported to gain a better understanding of content knowledge formation (Brown et al., 1989; Rogoff, 1990). Currently, dialogue can adopt different shapes such as face-to-face interaction as well as synchronous and asynchronous digital interactions in online spaces.

Some social interactions that are carried through dialogue, such as cooperation and collaboration, are key in knowledge construction (Brown et al., 1989; Dillenbourg, 1999; Wenger, 1998; Wertsch, 1998). In addition, scholars analysing the process of knowledge

development have found that individuals gain understanding of concepts when explaining it to others (Veldhuis-Diermanse, 2002). Patterns of turn-taking during conversation and ways to interact with others in groups are key for these collaborations to succeed (Barron, 2003; Greeno, Collins, & Resnick, 1996). Furthermore, research on student collaboration suggests that engaging in interactions with others involves problem formulation, sharing of information, guiding, questioning, structuring tasks or giving counterarguments, which stimulates learning and the learning of peers (Veldhuis-Diermanse, 2002).

Not only learning is mediated through social interactions, but also the quality of interactions depends on the actors (peers, teachers, mentors) as well as on the context where those interactions take place (Vygotsky, 1978; Wertsch, 1998). For instance, a child might behave differently at home when her interactions are mediated by family members, such as the mother or siblings, than when at school where interactions are mediated by teachers and peers (Vygotsky, 1978). Issues of power between agents; roles and positions of students and teachers in an environment; and the formation of identity in the classroom environment are all elements that might shape the interactions and their quality in any school classroom.

2.1.2 Tool mediation

The notion of mediation is rooted in the sociocultural approach which proposes that any human activity is mediated by both social interactions (and the mediation of people) as well as the mediation of symbolic signs and material tools (Vygotsky, 1978; Wertsch, 2002). Symbolic signs are psychological signs that mediate between the mind and the external world (Nieto, 2007). The most relevant symbolic sign is language, but symbolic signs can also include art, music, and numbers. Unlike symbolic signs, material tools refer to physical matters that mediate action and thought, such as books or computers. Material signs were initially developed to master nature (Vygotsky, 1978). According to Vygotsky (1978) a tool's function is to "serve as the conductor of human influence on the object of activity" (p.55). However, the implications of material tools go beyond the effective completion of a task, as tool mediation affects also mental functions or cognitive processes (Vygotsky, 1981). Through the mediation of tools, human actions are transformed, which at the same time changes the organisation of mental functions.

The concept of tools elaborated by Vygotsky originates in Hegel's idea that tools served humans to fulfil their personal goals. This stresses the role of tools to provide a means for activity development (Vygotsky, 1978). Mechanical tools (also coined analogous tools) were initially used as an extension of human's capabilities. For instance, a fishing rod was conceived as an extension of a human's hand that serves the purpose to facilitate fishing; yet the theorisation of tool-use and its relation to human activities now surpassed the extension of parts of the body. Building on this initial concept, scholars have coined the concepts of *mediation of artefacts* (Cole, 1996) and *mediational means* (Wertsch, 1998, 2003), expanding the initial connections between material tools and nature established by Vygotsky. Such terms allow the current examination of the interplay between cognition and tools. For instance, tools can range from archaic objects such as hammers, knives, wheels to calculators, computers and a variety of digital applications yet to emerge. While writing on a digital interface allows fast dissemination, reproduction, mash up of ideas and broadens the visibility of a text, writing on pen and paper permits a slower pace in the flow of ideas and affords an intimacy imprinted in the materiality of the paper. Thus, tool mediation contributes to changing, broadening or constraining the range of activities of mental functions (Vygotsky, 1978, p.55).

Technological tools are powerful devices that can provoke changes in knowledge creation and cognition similar to the scales of changes generated by the emergence of the printed text (Harnad, 1991). The term affordance has been widely used in the literature to capture the relationship between the nature of the tool and cognition (Gibson, 1986; Goodyear, Carvalho, & Dohn, 2014; Norman, 1988). Theorists argue that the nature of the tool modifies the nature of the work that can be done and in turn this modify the cognitive processes involved in such work (Hutchins, 1995; Norman, 1988; Wertsch, 2002). The term affordance helps to understand how tools stimulate or prevent specific mental activities given the tools available. For instance, studies on material representations suggest that novices, unlike experts, have a restricted way of expressing and representing content knowledge. However when novices are immersed in a learning environment that promotes the use of a variety of material tools, then novices are able to engage in similar patterns of interactions to experts (Kozma, 2003; Kozulin, 1998). Affordances of digital technologies such as spreadsheets, databases and simulations can also be used to support conceptual understanding and cognition (Jonassen, 2006). Jonasson refers to such tools as "mindtools" as they open possibilities for expanding thinking. In addition, recent studies suggest that interfaces capable of multiple

representations, modalities, and linguistic codes affect human ideation, problem-solving and inferential reasoning (Oviatt, 2013). When the reciprocal bundle between tool and affordance is taken into account, it seems clear that changes may be occurring in blended learning environments. This in turn, evidences the need to explore how those changes are affecting student learning processes and teacher professional practices.

Furthermore, new technologies not only stimulate a broader variety of cognitive operation but also leverage human interactions, dialogue and exchange (Nieto, 2007). In particular, social media and social network sites currently are augmenting the opportunities for interactions anytime and anywhere (Boyd & Ellison, 2007). For instance, social network sites with learning purposes (such as Edmodo), which have been recently incorporated in some classrooms, may offer opportunities to bridge the boundaries between “formal” and “informal” learning; between school and out-of school contexts (see Chapter 3, section 3.1.5, for a detailed explanation of the characteristics of Edmodo).

Up to this point I have discussed the sociocultural approach that underpins the present study, along with the notions of social learning and tool mediation. Next, I connect such ideas with the notion of distributed cognition. I do that as the distributed cognition approach allows an exploration of learning and literacy from a broader view. In so doing, it helps to incorporate notions of systems and to link the micro with the macro, connecting human neurons to classroom settings and to the broader learning ecology.

2.2 Distributed cognition

The notion of distributed cognition is informed by Vygotsky’s book *Mind in Society* (Hutchins, 2000). In his work, Vygotsky (1978) suggested that cultural settings are essential for cognitive development because they help to shape people’s thoughts (Vygotsky, 1978). Drawing on this principle, Hutchins (2010) points out that the human mind does not work in isolation, but it involves interaction and evolves with the interactions of systems in the environment (Hutchins, 2010). As such, a distributed approach of learning posits that all elements in the environment play a role in the construction of meaning (Hutchins, 1995, 2000). The environment is not seen as a canvas where cognitive processes take place but as a constitutive element that strongly influences (yet not determines) cognitive processes. As Hutchins notes:

There might be something special happening in systems of distributed processing, whether the processors are neurons, connectionist nodes, areas of brain, whole persons, group of persons, or groups of groups of persons (Hutchins, 2000, p.20).

After studying the navigation of navy ships and airline cockpits over long periods of time, Hutchins observed that in order to effectively coordinate navigation, pilots in the system could not rely only on their personal knowledge. Instead they had to use the knowledge of other individuals who might be inside or outside the ships (such as cartographers, meteorologists or coastal reporters) as well as knowledge distributed in tools, in order to successfully navigate these systems. As a result of his observations, Hutchins concluded that any human endeavour depends, to a smaller or larger extent, on elements of the environment, where knowledge is located (Hutchins, 1995, 2000). Thus, knowledge is not located solely in the human mind, but distributed across tools, people, time and the rest of the elements in the environment. Similarly, Salomon argues that cognition is distributed, yet his perspective differs from Hutchins as he understands individual cognition separated from the system in which the individual mind operates (Salomon, 1993). The shift in understanding cognition as a whole as opposed to discrete parts is also acknowledged by Pea (1993) who asserts that “the mind rarely works alone” (p.47). In Pea’s view, the implications of this approach are not trivial as external resources and interactions change the possibilities of activities and expected goals available at an historical time.

By positioning the mind out there in the world, rather than the world in the mind, a distributed cognition approach suggests that individuals engage in cognitive processes through networks of interactions involving tools and individuals, jointly working on solving problems or achieving outcomes indexed in time and space. For example, research on informal learning has examined how individuals are able to solve mathematical and logical problems drawing on tools from the environment (Resnick, 1987a). These studies have addressed differences in the way problem solving is delineated in schools and in out-of-school contexts. While out-of-school “problems” are contextualised, unconstrained and practical, schools tend to formulate “problems” in a contextualized, constrained and abstract way (Resnick, 1987a; Scribner, 1984). This latter formulation of problems echoes an epistemological view of learning that perceives the role of space, matter and tools as a background for cognitive thinking and where learning practices are focused on individual achievement and assessment rather than on cooperative work (Squire, 2009). Consequently, learning in formal contexts has few connections between agents, tools and spaces; and as a

result such elements have little visibility and no apparent relevance for the process of learning. Instead, from a distributed approach, the visibility of the background acquires an important role, as it encapsulates critical knowledge for thinking and problem solving.

One advantage of looking at a cognitive phenomenon, including the articulation of the environment in its distributed and situated shape, is that it underlies a cooperative structure of learning processes. As Hutchins (1995) stresses “the cognitive properties of groups can be quite different from the cognitive properties of any individual in the group”. Echoing Hutchins’ words, the patterns, connectivity and configuration of groups affect their potential power as a group. From an educational perspective, numerous studies have suggested that positive learning circles occur when people collaborate, share and participate towards common interests or expected goals (de Laat, Lally, Lipponen, & Simons, 2007; Lave & Wenger, 1991; Wenger, Trayner, & de Laat, 2011). In addition, research on literacy has used a social theory of distributed cognition to highlight the relational aspect of reading and texts (Smagorinsky, 2001). In Smagorinsky's (2001) view, “meaning is a function of work conducted among readers and texts rather than between reader and text” (p.141). Consequently, the mediational function of culture is central to literacy practices. Similarly Lewis (2007) points out that rather than a focus on new tools, the stress should be on the new connections that can be built in the classroom with these new tools. In Lewis’s view (2007) the situated nature of literacy can be explored not only interacting with the local space (e.g classroom, city), but also with the global space by engaging in interactions that traverse the borders of nations and cultures.

In alignment with studies done in out-of-school contexts, studies on interest driven communities among young people and adults evidence the benefits of communication, sharing and collaboration among people (Black, 2009; Jenkins et al., 2009; Lammers, 2013; Steinkuehler & King, 2009). Studies on new literacies in out-of-school contexts have also documented the role of peers in scaffolding young adults to write (Lammers et al., 2012). Studies on literacy teaching and learning in school settings are also starting to address this issue. For instance, Gomez, Schieble, Scott Curwood, and Hassett (2010) investigated an English language classroom and found how learning was distributed across various tools, technologies and students. The authors observed that a distributed schema for teaching literacy, which includes analogous and virtual tools, helped to engage students in learning. As this research showcases, currently, new opportunities for augmenting these types of

experiences may be created, due to the facilitation of digital technologies in building networks and communities across the world.

In schools, researchers particularly in the area of the learning sciences have over the last two decades examined the attributes of collaboration in small groups among students (Sawyer, 2006). Those studies have primarily focused attention on pre-designed ways of collaboration. In general, those studies have given an account on how groups interact towards the completion of a task and what are the characteristics of successful groups. Recognising the importance of this type of research, here I am interested to look at cooperation among students in a different way. Not as cooperation as defined by the “researcher”, but to explore how naturally students cooperate with each other in the community constituted by the class. Drawing on Hutchins’ ideas, in this study I look at the distribution of cognition in what could be called the classroom in “the wild”. As such, I observe those interactions in the natural shape and pace of the classroom in relation to learning and literacy practices. This means that the approach of interactions (and the cooperation generated from there) shares similarities with ethnographic perspectives (although I am not implying for a moment that this research is an ethnography). As previously discussed, this perspective is interwoven with a view of knowledge-construction that draws on a sociocultural approach, hence is firmly grounded in knowledge-construction as a dialectic process (Sfard, 1998), whether those processes occur with other subjects or/and with tools available in the environment.

Distributed, social and tool mediated learning underpins the foundations of the analysis of blended learning in the primary classroom. Finally, the last part of this section is dedicated to explain the architecture of productive learning networks, proposed by Goodyear and Carvalho (2013, 2014). This learning network approach will be used to examine the connections between space and tools in the blended environment of the classroom (Chapter 5, section 5.1.1).

2.2.1 Architectures of productive learning networks

As previously discussed, a distributed cognition approach suggests that individuals engage in cognitive processes through networks of interactions involving tools and individuals, jointly working on solving problems, achieving outcomes, or just interacting, indexed in time and space. In order to see how issues of matter and materiality, agent and tools underpin the

network of the classroom I draw on a networked learning approach (Goodyear, 2005) and on the framework developed by Goodyear and Carvalho (Goodyear & Carvalho, 2013; Carvalho & Goodyear, 2014) namely the *architectures of productive learning networks*. Consequently, the concepts of social learning, mediation and distributed cognition will be used in combination with a rather material or socio-material perspective in which the set design or space is illuminated.

The decision to combine sociocultural and socio-material approaches of learning allows me to examine the agents and the matter in the process of learning and literacy in the upper primary classroom. This is relevant as, from a sociocultural approach, the primacy of the unit of analysis is the agent, therefore the way learning is examined has a strong anthropocentric focus (Shaffer & Clinton, 2006). In this case, the agents that are participating in the study are the students and the teachers in the physical and virtual classroom. The activities of agents in the environment will be primarily analysed through the constructs developed and rooted in sociocultural theory. However, examining issues related to digital and physical spaces and the ubiquity of technological tools calls for the inclusion of other lenses that may better capture this phenomenon. In other words, understanding the matter and spatial dimension of learning and their potential influence on activity, requires that both agent and space are taken into account, becoming equally visible as a unit of study.

The *architectures of productive learning networks* is an analytical framework composed of three main elements: 1) physical architecture (set design), including both physical and virtual spaces along with physical and digital tools, involving resources such as pens, notebooks, computers, tablets.; 2) epistemic architecture (epistemic design) which refers to two dimensions: a macro level related to knowledge, ways of knowing and types of knowledge, along with a micro level including the design of tasks and subtasks; 3) social architecture (social design) which relates to social interactions and division of labour (Goodyear & Carvalho, 2013). Figure 1 illustrates the connections between set, epistemic, and social architectures and their influence on learning activities.

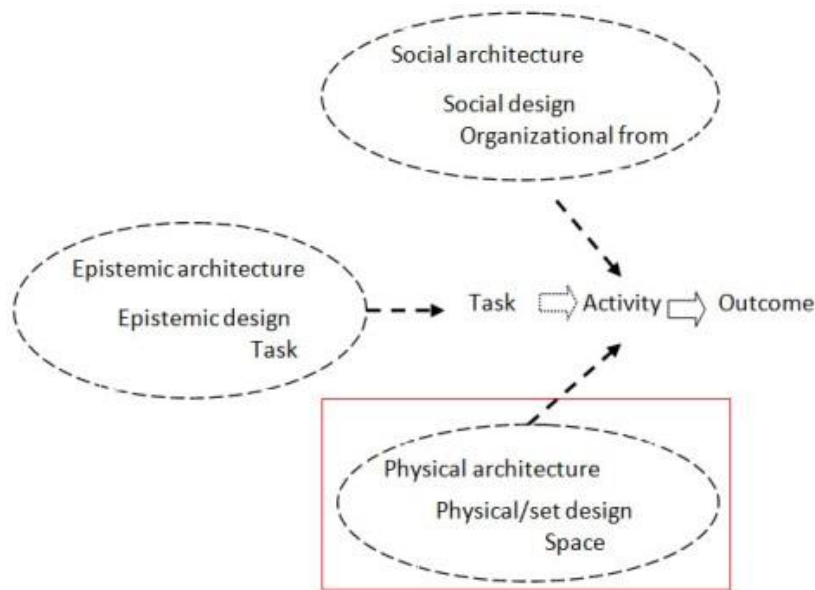


Figure 1. Set, epistemic and social co-creation and co-configuration activities. Source: Modified from Goodyear and Carvalho (2014)

When applying this notion to the upper primary classroom it is clear that the setting consists of a network dependent upon, and constituted by, the activities of the agents (de Laat et al., 2007). Consequently, from this perspective learning happens in a network. Networked learning can be defined as “learning in which ICT is used to promote connections: between one learner and other learners; between learners and tutors; between a learning community and its learning resources” (Goodyear, Banks, Hodgson, and McConnell (2004, p.83). In addition the notion of networked learning acknowledges the influence of information and communication technologies in leveraging connections between agents and stresses the relational nature of the activities among agents, across face-to-face and online spaces.

The present study applies the architectural framework placing a focus on the set design of the classroom (see Chapter 5, section 5.1.1). The set design of the blended classroom involves physical and online spaces along with physical and digital tools, including pens, notebooks, computers iPads, and other resources as part of the *physical architecture*. The set design is also constituted by the activities that these tools afford. An important aspect of the activities students engage in, relates to the design of proposed tasks by the teacher. Finally, it is important to note that this framework makes a distinction between tasks and activities. So, a task is what the teacher designs and expects students to do, whereas an activity refers to what students do in practice. Consequently, the enactment of the task by learners may differ widely from the initial task designed by the teacher (Goodyear, 2005).

A network perspective supports the investigation on how space and elements in a classroom may shape students' learning activities and teachers' instructional practices. I focus on the concept of activity as it relates to elements in the set design. That is, students' activities are explored in relation to the digital and physical elements of the classroom, rather than in relation to tasks or what teachers have designed for learning. Despite the relevance of the design aspect in instructional activities, the inclusion of that aspect is beyond the limit of this thesis. Accordingly, I take the view that teaching and learning are situated and indexed in activities (Brown et al., 1989), and consequently activities represent ways of teaching and learning in the space of the classroom.

By drawing on a networked learning model, I attempt to diminish the risk of a unidirectional analysis where particular tools, sets, or pedagogies are considered in isolation and where affordances or limitations of tools are mistakenly attributed to discrete elements in the environment. Likewise I acknowledge that tools, activities and pedagogies co-exist in a multidimensional *habitat* or learning space, therefore it is essential in educational research to take advantage of an analytical tool that supports the examination of the learning environment, understood as "the shared habitat of a collection of learners" (Goodyear, 2000, p.2). Such networked learning perspective supports the articulation of elements in the classroom and allows the analysis of the set design as an entanglement of tools, agents and activities, illuminating their relations to students' learning and literacy practices.

2.3 Synthesis of the theoretical framework

In sum, the learning approaches and theoretical perspectives discussed in this chapter are understood as complementary. The study draws on a sociocultural theory and a distributed cognition approach, as these provide a social, cultural, distributed, material and mediational framework from which to understand the interplay between students, tools, learning and literacy in a classroom environment. The concepts proposed above shed light in understanding social and material elements in a learning environment not only as context in which cognitive processes take place, but as constitutive elements of those processes. As Greeno (1998) posits, scholars have advocated towards interactive and relational processes of learning over many years, and yet

... 20th century psychologists have focused theoretical attention on the behaviour and cognitive processes of individual people and animals and have treated the rest of the social, material and informational environment as contexts in which individual behaviour occurs (p.6).

Almost two decades after the publication of Greeno's article, these words still resonate clearly in the educational field. Although the analysis of discrete mental functions and cognitive processes provide important knowledge, the perspective of this thesis is different. I argue that looking at learning and literacy practices from a relational perspective provides profound insights for understanding these phenomena. The fast pace of technological innovation has pushed the boundaries of research in education, stimulating more research that integrates learning in relational ways. This echoes Wellman's (2001) work who posits that when computers and technological tools are used to connect people, these ICT tools stop being independent and alien machines, but become instruments for social network creation. It is here where lies the need to generate research able to explain the complexity of learning, through an account that views learning as situated in a natural environment yet mediated by advanced technological tools.

To sum up, the theoretical framework of this study combines a sociocultural approach with a *socio-material* perspective (this latter provided by the architecture of productive learning networks) which allows the examination of entanglements between physical, digital and human interactions occurring in the blended school classroom.

3. LITERATURE REVIEW

This chapter reviews the literature related to the scope of this investigation which is to give an account of learning in a blended environment of a primary classroom. The review first considers the theoretical nature of blended learning, and the evidence reported by scholars on this topic. Special attention is then given to current developments of models of learning with technology (section 3.1.3) and models of teaching with technology (section 3.1.4). The last section is dedicated to an examination of social network sites, and to a learning technology that mimics such applications called Edmodo. The learning technology Edmodo is included in the literature, as students in this case study used this application in the classroom. Although this literature review is focused on blended learning in primary settings, studies

coming from secondary and tertiary education are also discussed when relevant to describe research trends. This is particularly significant in the teaching with technology section and to a lesser degree, the section on a conceptualisation of blended learning.

3.1 Blended learning

In the present study I consider blended learning as a synonym of e-learning and hybrid learning. Acknowledging the variety of definitions of blended learning I use the term as an amalgam of face-to-face and online practices that involve the mediation of material and digital tools to facilitate learning (see section 3.1.1 for a discussion on this topic).

The notion of blended learning and research on blended learning arose due to the increasing ubiquity of technology in the classroom. Although initially blended learning as a focus of study started in tertiary education, it is now occurring in many schools; yet is considerably less researched there (Barbour et al., 2011; Means et al., 2013). Despite this misbalance between research and practice, the availability of blended learning opportunities in schools has increased dramatically since late '90s. For instance, it was estimated that in 2008 over one million students in K-12 enrolled in an online course in the U.S (Picciano & Seaman, 2009). Similarly, in 2011, Watson, Murin, Vashaw, Gemin, and Rapp (2010) reported that 50 states in addition to the District of Columbia were offering online and blended courses in K-12. A study conducted by the International Association for Online Learning K-12 (iNACOL) across 60 countries found that in the U.S alone, blended learning has grown at an average of 30% each year over the last 10 years (Barbour et al., 2011). In addition the report documents that “opportunities for blended and online learning are found around the world, but elementary and secondary-level students living in North America, Western Europe, Asia, and Oceania (Australia and New Zealand) have the most access to those choices” (p.5).

The incorporation of blended learning at the school level is due to technology access in the classroom. As the European Commission suggests, schools are reaching a level of maturity in relation to technology acquisition (European Commission, 2013). For instance, a survey conducted over two years in 27 European countries shows that the number of computers per 100 students in secondary school has doubled compared to data from the same survey conducted in 2006. In addition, whereas in 2006 the focus of equipment in schools was on desktop computers, in 2013 schools are investing in laptops, interactive whiteboards and the

inclusion of mobile phones. The shift is moving from desktop to more personalised devices such as laptops and mobile technology. Another important change is related to the access of broadband in schools. Whereas in 2006 less than three quarters of schools reported having broadband, in 2013 almost all schools were connected to the broadband. In addition, the survey shows that the number of schools with websites and emails for teachers and students has augmented in primary and secondary education. Similarly, a survey run by The British Educational Communications and Technology Agency revealed that laptops, broadband connection and emails are now common features in primary and high schools. As the authors stress, primary schools in the British countries have “caught up with secondary schools” (Becta, 2008). However, not all digital tools have been implemented equally in the classroom. As the EU School survey 2011-2012 reports, there is a high misbalance between countries regarding the provision of virtual learning environments (VLE) (European-Comission, 2013).

In the Australian context, data derived from governmental reports suggest that access and connectivity of technologies in schools have been supported by major governmental initiatives. Examples of this are the Digital Education Revolution (now discontinued) that provided students in years 9-12 with laptops and high speed broadband in all Australian schools along with supporting teachers training in ICT, and that the Australian National Curriculum (implemented in 2014) has a major emphasis on digital literacies and technology integration across subjects (DEER, 2008). Furthermore, the Department of Education and Early Childhood Development (DEECD) has equipped schools with iPad technology and has been exploring the use of such digital technologies in the classroom. For instance, in 2011 the DEECD conducted research on the use of iPads in ten primary, secondary and special school settings, reporting positive results in students’ engagement, multimodal awareness and self-initiated learning. However, the findings also showed that the use of technology has more benefits for students in primary and special schools, than for students in secondary schools (DEECD, 2011).

In sum, the data suggest “a level of maturity” regarding technology access in many schools across countries, yet also indicate the urgent need to understand how technological tools can be used effectively to leverage students’ learning and achievement. In other words, how blended learning can be designed and implemented in the classroom. This question is significant because despite the increased equipment of devices and technological systems in

schools, the implementation of technology in the classroom has been slow and often taught separately from content knowledge (Ertmer & Ottenbreit-Leftwich, 2010; Underwood et al., 2010).

3.1.1 Toward a conceptualisation of blended learning

The study of teaching and learning practices considering a blended approach is important given that technologies are becoming more prevalent in the school classroom. Students and teachers are in the present time often engaging in both types of work: online and offline. As a consequence of the inclusion of technologies in formal learning spaces, the shape of teaching and learning is changing. Blended learning has been a matter of scholarly research for over ten years. One of the seminal works that addresses the need to conceptualise blended learning is by Whitelock and Jelfs (2003, p.99) published in a dedicated special issue in the *Journal of Educational Media*. Three main definitions were identified as blended learning:

1. The integrated combination of traditional learning with web-based online approaches; including face-to-face with online learning (Harrison, 2006);
2. The combination of media and tools employed in an e-learning environment where individual and group study can be supported by online tools;
3. The combination of a number of pedagogic approaches, non-dependant on learning technology use (Driscoll, 2002)

As the editorial of this special issue evidenced, the notion of blended learning encompasses a variety of meanings which calls for the need to have a theoretical framework to design for and assess blended learning environments (Whitelock & Jelfs, 2003). As a response to this lack of conceptual clarity Oliver & Trigwell (2005) published their journal article “Can blended learning be redeemed” arguing that “the term blended learning is ill defined and inconsistently used. Whilst its popularity is increasing, its clarity is not. Under any current definition, it is either incoherent or redundant as a concept” (Oliver & Trigwell, 2005, p.24).

More recent definitions still lack clarity. For instance, Laurillard (2006) states that a student who learns through any form of ICT is using e-learning. In addition, Means, Murphy, and Baki (2013) address that blended learning involves the inclusion of technologies in a way that surpass the casual use of a specific device. So, in this case the notion of blended learning is

attached to a systematic use of technology. Furthermore, Barbour et al., (2011), suggest that while conventional instruction or bricks and mortar instruction refers to traditional school instruction, blended learning refers to a combination of “bricks and mortar” learning supervised by a teacher along with at least some part of that learning in an online mode (Horn & Staker, 2011).

To add to the complexity of this discussion, the literature addresses a distinction between blended learning and online learning. So, unlike blended learning, online learning refers to learning activities that are developed exclusively through ICT (Watson & Kalmon, 2005). Finally, blended learning has also been coined in the literature as e-learning or hybrid learning (González, 2010; Olapiriyakul & Scher, 2006; Sharpe, Benfield, & Roberts, 2006).

Whilst a lot of effort has been put in understanding the nature of blended learning, including the material and digital elements involved, the networks that may support it (Goodyear et al., 2004; Goodyear, 2005) and the type of instruction that such amalgam requires (González, 2010), less attention has been paid to the inclusion of the perspective of the learner in such a context (Oliver & Trigwell, 2005). As a way to solve this problem Oliver and Trigwell (2005) propose to ground the discussion of blended learning in the notion of learning theories and variation. By doing so, the authors highlight “the potential of designing around varied experiences that may lead to learning. This subversive (but logical) reinterpretation shifts the emphasis dramatically, from teacher to learner, from content to experience and from naively conceptualised technologies to pedagogy” (p.24). In this sense, the actual potential of blended learning is that it “would involve students learning through experiencing variation in aspects of what it is that they are studying (their object of study)” (Oliver & Trigwell, 2005, p.22). From this derives the need to review relations between learning theories and blended learning and to be aware that students may experience the learning environment in different ways, some of them unexpected or intended by the design of the space (Oliver & Trigwell, 2005). This is in alignment with Goodyear and Carvalho’s work that highlights the need to understand the relation between spaces, tools and learning in order to understand blended environments; and at the same time to be aware that tasks can be designed to support learning, yet learning experiences (or activities) are individual, unique and therefore cannot be transferred (Goodyear & Carvalho, 2014a). These latter ideas were firmly considered in the analysis of the learning environment of the primary classroom.

3.1.2 Research on blended learning

According to the literature, blended learning may impact students as it allows a) more flexibility, metacognition and self-reflection; b) broader opportunities to connect and to engage in dialogue with others, c) yet at the same time it provides support for individual work, through for instance access to resources and support through digital software or people. Some key studies that report on blended learning are described below.

Research on blended learning has reported positive results in course outcomes. In particular, research highlights collaboration as an outcome that can be enhanced with blended learning (Jefferies, Grodzinsky, & Griffin, 2003; Schweizer, Paechter, & Weidenmann, 2003). In addition, self- reflection and metacognitive skills are also elements reported by the literature as positive outcomes resulting from a blended learning design, in particular when digitally mediated personalised environments, such as blogs can be added to the interface (Oravec, 2003). Moreover, Salmon (2003) who developed an eModerating 5-stage framework, argues that blended learning, and particularly online channels of communications in classes, promotes knowledge-construction. Through dialogue, students are able to exchange knowledge in meaningful ways, which results in collaboration and eventually in learning. Also, Salmon, stresses that students are able to engage in high levels of critical thinking and to become more independent of their own learning. Salmon (2006) found that a central element in pedagogical development in blended learning was to support students with recognition and reward when moderating interactions online. Furthermore, the role of the teacher in blended learning design has been reported as central for the success of blended learning. This includes the prior expertise of the teacher in the subject-knowledge, but also his or her expertise in facilitating interactions among students.

Studies have highlighted that blended learning enables flexibility, allowing students to be more autonomous and independent in relation to their learning activities (Codone, 2004; Olapiriyakul & Scher, 2006). This flexibility encompasses students making everyday decisions in relation to where, when and how they will approach a task and of course involves navigation from in-class activities to out-of-class activities (Moe & Rye, 2011; Rye, 2008). As a result, the flexibility that blended learning may support brings notions of learning as an in-class activity but also as a social practice that is continued once students leave the school space. In a sense this can be paralleled with the conventional notion of “homework” (Horsley & Walker, 2013), yet the difference here lies in the autonomy that students have to

accomplish a given task or alternatively to pursue independent learning (hence with a less scripted task) as the access of information is no longer scarce with Internet connectivity.

A recent meta-study on blended learning is in agreement with the above described findings (Means, 2013). This meta-study included 45 studies, which contrasted a fully or partially online condition with a fully face-to-face instructional condition. The meta-analysis consisted of (1) experimental studies using random assignment and (2) quasi-experiments with statistical control for pre-existing group differences. Means et al. found that while face-to-face (traditional) and online learning modes (exclusively online modes) show no statistical difference in students' performance, blended learning outweighs both face-to-face and online learning. According to the authors, the positive impact on blended learning may be explained because in a blended learning mode students tend to spend more time on task, engage more in individual research, yet at the same time, tend to work more in collaborative/peer discussion, hence students are able to interact more. The authors conclude that positive outcomes might be closely related to variables such as additional learning time, more variety of instructional resources, and course elements that encourage interactions among learners (p.2). Any such variables or a combination of them might lead to a contribution to positive outcomes for blended learning. Echoing the call for further research and development on different blended learning models by Means et al., the findings of the present study will shortly reveal the similarities or dissonances with Means et al.'s meta-findings.

3.1.3 Models of learning with technology

In this section, I underline models that illuminate the process of learning with technology and hence are relevant to understand the configuration of the blended classroom. This is important given that technological tools and the blended classroom underlie processes of learning that need to be understood if we want to effectively cater for students' learning in the 21st century (Harris, Mishra, & Koehler, 2009; Koehler & Mishra, 2009). As Goodyear suggests, what the learner enacts in a blended environment involves a combination of activities that are technology-mediated and others that are not; hence, the relevance of bringing back notions of learning and linking those with digitally-tool mediation.

Different perspectives on student learning have been outlined in the literature. Such models provide a background for the analysis of the present case study. Again, it is important to

remind the reader that the blended classroom is understood in the present study as an ecology in which teaching and learning is dependent on the other agents in the network along with the tools that are available for engaging in those activities. For starting this discussion, I would first mention the notable journal article “On two metaphors on learning and the dangers of choosing just one”. Here, Sfard (1998) argues that there are two major metaphors in the current discussion on learning: acquisition and participation. In relation to the acquisition metaphor she suggests:

Eventually, they envisioned learning as a never-ending, self-regulating process of emergence in a continuing interaction with peers, teachers, and texts. As long as they investigated learning by focusing on the “development of concepts” and on “acquisition of knowledge”, however, they implicitly agreed that this process can be conceptualised in terms of the acquisition metaphor (p.6).

The participation metaphor, on the other hand, radically changed the acquisition paradigm as the notion of concept development moved towards “being”, “becoming” and “knowing” (Cobb, 1995; Smith, 1995). Learning as a legitimate peripheral participation (Lave & Wenger, 1991) as an apprenticeship in thinking (Rogoff, 1990), or as a community of practice moved away from the conceptual change paradigm. This in turn was only possible as the notion of context became acknowledged as part of any learning activity (Greeno et al., 1996; Greeno, 1998). As Sfard enumerates various terms were coined to refer to this idea including situatedness, contextuality, cultural embeddedness, and social mediation (p.6). Sfard concludes that both metaphors are needed in order to account for learning, and thus, rather than rivals, they are complementary in understanding cognitive processes of learners.

Acquisition metaphor		Participation metaphor
Individual enrichment	Goal of learning	Community building
Acquisition of something	Learning	Becoming a participant
Recipient (consumer), (re-)constructor	Student	Peripheral participant, apprentice
Provider, facilitator, mediator	Teacher	Expert participant, preserver of practice/discourse
Property, possession, commodity	Knowledge, concept	Aspect of

(individual, public)		practice/discourse/activity
Having, possessing	Knowing	Knowing Belonging, participating, communicating

Table 1. Sfard: The Metaphorical Mappings

Interestingly, even though Sfard did not include technology in the description of metaphors for learning, similarities can be found between the models that Laurillard (2012) and Luckin et al., (2012) use to identify activities that can be enhanced by technology (Table 2 illustrates the models included in this review).

Drawing on Sfard's two-sided conceptualisation of learning, Paavola, Lipponen, & Hakkarainen (2004) argue that another variant of learning needs to be added: the knowledge-creation model of learning. The authors posit that one element that has not been acknowledged in either of the two metaphors of acquisition and participation is the aspect of "collective knowledge creation for developing shared objects of activity" (p.559). These concepts build on the commonalities of the following models: model of knowledge creation (Nonaka & Takeuchi, 1995); model of expansive learning (Cole & Engestrom, 1993; Engeström, 1999); and model of knowledge building (Bereiter, 2002; Scardamalia & Bereiter, 1994). Knowledge-creation is characterised by cyclical and iterative processes which shift from individual to social and collaborative aspects of knowledge. It shifts from the Cartesian dichotomy "object-subject" towards an epistemology that integrates knowledge and rationality with emotion, symbolic speech and action. Finally, knowledge-creation highlights the development of shared objects which are conceived as key elements in mediating the link between people and artefacts. The reconfiguration of learning models by Paavola, Lipponen, & Hakkarainen (2004) adds to the metaphor model configured by Sfard. Together these models help to illustrate the development of learning models over the last century and the beginning of the 21st century.

It is interesting to see how the notion of learning as knowledge-creation has been captured by later models that try to understand the link between technological tools and learning. For instance, the idea of artefact creation is considered in Laurillard (2012) model of learning with technology as "production". Similarly, Luckin et al., (2012) considered learning through making as another way in which technology can enhance learning. Of course the implications of a continuity and change between learning theories and models of "learning and

technology” are broader, yet due to the limits of this thesis I could only highlight here some connection between learning and learning with technology.

Sfard (1997)	Paavola, Lipponen, & Hakkarainen (2004)	Laurillard (2012)	Luckin et al.,(2012)	Ruben-Puente (2012)	
Learning as:	Learning as:	Learning through the integration of:	Learning:	Learning as:	
Acquisition		Acquisition	From experts	Redefinition	Transformation
Participation		Discussion	With others		
		Investigation	Through making	Modification	
		Collaboration	Through exploring		
		Practice	Through inquiry		Enhancement
	Knowledge-creation	Production	Through practising	Augmentation	
			From assessment		
			Learning in and across settings	Substitution	

Table 2. Models of learning and models of learning with technology

Recently Laurillard (2012, p.258) proposed five approaches of learning with technology: acquisition, discussion, investigation, collaboration practice and production. She states that each way of learning with technology is complementary to each other, consequently there is no hierarchy established between each other. For instance, learning through acquisition involves the delivery of information through the use of technological tools. Technology affordances may include listening to a podcast, reading from books or online, or watching videos. Second, learning through discussion involves extending students’ conceptual understanding of a topic or “story lines” through face-to-face, synchronous and asynchronous interactions. Digital chats, mobile technology, applications of social media (such as Twitter or Facebook) are able to scaffold teaching and learning through discussion. Third, learning through investigation involves exploring, comparing and critiquing information about a topic of inquiry. Technology can be useful in this case for instance by allowing students to search information in various academic repositories or to learn from experts’ resources online. Fourth, learning through practice stems from an activity that requires students to reflect on the goal they are aiming to achieve, including the feedback for improvement in the next action. Technological tools may enhance learning through practice in activities such as

simulation, games or programming. Fifth, collaboration involves team-work activities in which students work together towards the completion of a task. Learning through collaboration involves also discussion, practice and production. Wikis are a good example of how technology may enhance learning in this case. Finally learning through production is described as the generation of the student's own conceptual knowledge and its expression in a tangible way. Technology may help students to learn through production in varied ways. For instance through fan-fiction writing, video-production, the design and development of blogs, mash-up of audio and images.

Similar to Laurillard, Luckin et al., (2012) argue that in order to understand the ways in which technology may enhance learning the focus needs to be on the types of learning that technology may enable, rather than in the analysis of specific technologies. In particular, Luckin et al. argue that any technology by itself is unable to impact learning. Rather, the underlying key is teachers' effective use of those tools to support teaching and learning practices. The authors emphasise that many of the current policies have failed to achieve effective changes in learning because of the device-driven model of implementing policies in technology. In their meta-analysis that included over 1000 articles and that was refined to 210 cases retrieved from countries all over the world, the authors report best practices in innovation with technology in the classroom based on experts and the use of the Adaptive Comparative Method (p.11). Based on this technique, Luckin et al. (2012) propose eight learning themes where technology offers potential to enhance learning, including learning: from experts, with others, through making, through exploring, through inquiry, through rehearsing, from assessment, along with learning in and across settings. In this meta-analysis, the authors found that existing technology does support a range of learning activities across subjects and learning environments and that such technology can be used individually or combined to cater for different forms of learning.

Finally, Puenteadura (2012) proposes a model to understand technology integration in the classroom defining four levels of education and technology integration that are organised hierarchically from low to high integration. He argues that technology can be used in both ways: as an innovative tool or as a tool that only reproduces traditional tasks. In his view, the major benefits of technology integration in education are located in the actions involving modification and redefinition. This includes transformation of activities, rather than just enhancement of prior tasks. Such actions would not be possible to achieve without the use of

technology. According to this model, substitution stems for a type of technology integration where a tool replaces the use of a prior tool, yet there is no functional change. Augmentation occurs when technology allows for a functional improvement of prior activities, and as a “direct tools substitute”. For modification to happen, technology needs to offer a significant task redesign. Finally, redefinition refers to the creation of a completely new task due to the affordances of technology.

I will return to the notion of models of learning with technology later in this thesis. Then, the models from Sfard (1997), Paavola, Lipponen, & Hakkarainen (2004), Laurillard (2012), Luckin et al.,(2012), and Puentedura will serve as lenses to see how students are using technology. Whether using technology for learning through inquiry, or collaboration, or using it for innovation or just acquisition, these models show similarities in the approach to understanding technologies for learning. I purposefully included in this section models that focus first on the process of learning and then on the technologies. By avoiding technocentric approaches of learning the present study aligns with scholars who suggest focusing on activities rather than on tools. As Luckin et al., (2012) put it:

The only answer to questions such as “Do games help learning?” is to say, “It depends”. Instead we argue that more progress comes from thinking about the types of learning activities that we know to be effective, such as practising key skills, and exploring the ways that technology can support and develop these effective learning (p.8).

Similarly, Perkins (1993), more than two decades ago, acknowledges that although technological tools might offer opportunities for accessing, acquiring, representing and producing knowledge, tools alone do not necessarily lead to such functions. In order for learning to occur, some sort of “executive function” is needed, to orient the meaning making process (Perkins, 1993). The continuity between past and current research will help to illuminate how students are learning in the blended learning space, and to understand how students may be experiencing variations in their processes of learning (Trigwell, 2006), due to their heavy use of technology across subjects in this learning space.

3.1.4 Teaching with technology

To understand blended learning, both processes of learning and processes of teaching need to be addressed. As documented in the literature, the incorporation of technological tools in the classroom has been often a complex and problematic transition (Ertmer & Ottenbreit-Leftwich, 2010; Harris et al., 2009; Howard, Chan, & Caputi, 2014; Howard, 2013). In this section I expand on these ideas by first underlining notions of pedagogies and teachers conceptions on teaching. Next I address how such notions are being challenged with the pervasiveness of technology in the classroom space. In addition, insights on how some teachers have been successfully integrating technology in the classroom are provided. This examination of the literature review is relevant as it helps to understand the role of teaching practices for blended learning and so adds another layer of analysis to the understanding of this phenomenon.

Pedagogies can be defined as multifaceted processes that teachers engage in, including designing, planning, managing the classroom, teaching lessons and assessing students' learning (Shulman, 1986). The notion of pedagogy has moved beyond Shulman's conceptualisation underpinned in static and personal knowledge located in the figure of the teacher, towards the understanding of teacher knowledge as relational, distributed, design-based and shaped by dialogue (Loveless, 2011). In other words teaching "is about helping to make the learning of something possible" (Trigwell, 2011, p.6). Those practices involve numerous decisions that teachers make on a daily basis and that depend on tangible factors such as number of students, classroom space, and resources in the classroom as well as less tangible factors such as teachers' values and beliefs and students' dispositions to learning (Ertmer & Ottenbreit-Leftwich, 2010; Ertmer, 2005). As Trigwell (2011) puts it, pedagogy includes:

Teachers' knowledge of the most useful forms of knowledge representation for learning, the most powerful analogies, examples, illustrations, demonstrations and explanations that make subject matter comprehensible to others; an understanding of what makes learning of some topics difficult or easy, the sorts of understandings students have intuitively and what they bring from prior studies (p.1)

How teachers enable learning is closely linked to how teachers approach or think about their practices. For instance, Kember (1997) conducted a meta-analysis on teaching including 13 large independent studies. Based on this meta-analysis he observed that teaching practices can be broadly categorised in two main dimensions: teacher-centred/content-oriented or student centred/learning oriented. The teacher-centred/content-oriented model is grounded in a conceptualisation of teaching as delivering information and transmitting discrete knowledge. On the other hand, the student centred/learning oriented model is based on teaching as facilitating learning processes and knowledge as conceptual change. Table 3 shows Kember's work.

Dimension	Imparting information	Transmitting structured knowledge	Teacher student interaction	Facilitating understanding	Conceptual change
Teacher	Presenter	Presenter	Presenter and tutor	Facilitator	Change agent/developer
Teaching	Transfer of information	Transfer of well structured information	Interactive process	Process of helping students to learn	Development of person and conceptions
Student	Passive recipients	Recipient	Participant	Lecturer responsible for students' learning	Lecturer responsible for student development
Content	Defined by curriculum	Lecturer needs to order and structure material	Defined by teacher	Constructed by students within teacher's framework	Constructed by students but conceptions can be changed
Knowledge	Possessed by lecturer	Possessed by lecturer	Discovered by students but within lecturer's framework	Constructed by students	Socially constructed

Table 3. Dimensions used to delimit conceptions on teaching, Kember, 1997, p. 262

Recent studies have expanded this area of analysis (Åkerlind, 2004; Carnell, 2007; Trigwell, 2011). For instance, Åkerlind (2004) suggests that teachers' ideas about their practices may include a broad spectrum from teacher-transmission focus to student-relations focus. According to Åkerlind (2004) such categories impact in the following concepts: role of student, benefits for students, benefits for teacher and breath of benefits. In addition, Carnell (2007) suggests that effective teaching occurs as a co-construction of knowledge. In Carnell's work (2007) key elements emerged as effective teaching such as belonging to a community of practice, learning through dialogue and learning with transparent outcomes. Moreover, teachers who understand learning as a process of knowledge construction rather than information transmission would be more likely to promote reflection in the classroom

(Carnell & Gold, 2009; Curwood, 2011; Shipton, 2011; Schön, 1983). By allowing reflection about both actions in practice (reflection in-action) and reflection once the activity has finished (reflection on-action) teachers are able to engage students in deeper conceptual understanding between theory and practice (Schön, 1983). Consequently, allowing reflection through pedagogy permits students to think about their own thinking and actions, enabling meta-cognitive processes and the construction of students' own knowledge (Schön, 1983).

According to the literature, different teachers' conceptions on teaching and the enactment of pedagogies in the classroom currently co-exist. For example, countries in the European Union report that student-centred activities are more frequent than teacher-centred activities (European Commission, 2013). Interestingly, in the same survey, students' perceptions on teachers' activities differ as students report that teacher-centred activities were more frequent than student-centred activities. In addition, Hayes, Johnston, & King (2009) in a three year project in four High Schools in Australia located in culturally diverse and disadvantaged communities, observed that teachers practices were strongly based on teacher-focussed activities. This includes students paying attention to the teacher, answering questions prompted by the teacher, receiving work to be completed (usually worksheets), listening to instruction, working individually, and presenting work to the teacher for inspection (p.114). The authors argue that this approach to teaching resulted in low intellectual demands for students and undermined opportunities to learn.

This review is in no way intended as a criticism or to portray a confronting dichotomy between teachers that practice a student-centred/content knowledge approach against teachers that practice a teacher-centred/transmission approach. Rather it is conceived as a showcase of the complexity of teaching practices and the slow pace in which teaching practices change. In this respect, one could consider for instance Dewey's call for a pedagogical change early in the last century (Dewey, 1910, 1916). This call gives some perspective on the longevity of the need for revisiting pedagogies in the classroom.

Over the last two decades one element that has impacted on the understanding and conceptualisation of teaching has been the inclusion of technology. The arrival of the digitalisation process added another layer to the already intrinsic complex nature of teaching. Teaching in learning environments that involve physical and digital tools, physical and online spaces, face-to-face, synchronous and asynchronous interactions carried complexities (Goodyear et al., 2014). Teachers now need to be aware of all those elements and the

relations between such elements to enable learning. Koehler and Mishra (2009) argue that teaching with technology may require rethinking teacher education and teacher professional development. The authors posit that at the core of teaching with technology lie three components: content, pedagogy and technology along with the relationship among and between these components. Building on Shulman's model of "content, knowledge and pedagogy" Koehler and Mishra argue that the distinction between the three components serves an analytical purpose, yet in fact teaching with technology exists in a dynamic and transactional relationship (Dewey & Bentley, 1949). In any teaching and learning activity the three components co-exist, consequently the aim of teaching with technology is to re-balance these three components enabling the teaching of content in meaningful ways. The analytical benefit of this model is allowing the examination of what teachers know, along with the examination on how teachers put that knowledge into practice in the learning environment. The impact of these technological changes is not trivial for education as current technologies afford cognitive process development such as representation and manipulation of data. This in turn is impacting innovation across disciplines as different as archaeology, medicine and design (Koehler & Mishra, 2009).

Research over the last 15 years on teaching with technology suggests a strong relationship between teachers' effective ability, value and confidence to use technologies and the acquisition of students' digital competences (Koehler & Mishra, 2009; OECD, 2010a, 2010b). However, the literature also shows that the inclusion of such tools is complex, and often problematic. For instance, studies report that technology integration in the classroom is often rooted in techno-centric approaches, covers low order thinking skills or is barely used for content-development (Curwood, 2011; Ertmer & Ottenbreit-Leftwich, 2010; Ertmer, 2005; Laurillard, 2009). In particular, across European countries, the frequency of use of a variety of digital resources and tools in the classroom showed that 35% at all grades never use multimedia tools and between 50% and 80% of students never use digital textbooks, softwares, broadcast/podcast, data-logging tools, simulations or learning games/video games (European Commission, 2013, p.85). In addition, schools are rarely using technology to support links between home and school (European Commission, 2013, p.80). For instance, between 60% and 80% of teachers declared that they do not use technology to send homework for students or to assess students' digital outputs or to communicate online with parents (European Commission, 2013, p.80).

In Australia, the report on the implications of the Digital Education Revolution (see section 3.1) suggests an increase in technology use in the classroom over four years, particularly laptops and ICT-related activities, as well as more student-centred practices (Howard & Mozejko, 2013). However, such changes have been more effective for younger students (years 9 and 10) than for senior school students (years 11 and 12). The report also suggests that such reform has impacted on teachers' perception of the importance of technology integration in the classroom, and their actual competence and confidence in technological usage in the classroom (Howard & Mozejko, 2013). However, this evidence contradicts research conducted in primary schools in Australia, which found that even though teachers were "skilled pedagogues, experienced literacy teachers and keen users of technology, students literacy practices prompted by the teachers were traditional, routine based and attached to the 'logic of practice' associated with teaching in the classroom" (Honan 2012, p. 87).

The evidence of the literature makes it clear that access to technology is only one aspect of teaching and learning with technology. As a recent report on technology integration in the classroom suggests "supporting and developing teachers could be as important as providing technology" (Kalas et al., 2014, p.33). In addition, research reports that pre-service teachers have frequently not been adequately prepared in the pedagogical use of ICT (Starkey, 2010). These ideas are in alignment with a survey conducted across countries in Europe, reporting that on average teachers not confident with technology constitute a majority. The survey shows that 75% of teachers reported not feeling confident with the use of ICT in the classroom (European Commission, 2013). These findings seem paradoxical given that currently teachers perceived less obstacles to using ICT and are being offered more professional development than in the past (European Commission, 2013). Again the irony is that the percentage of teachers using ICT in more than 25% of lessons is either stable or declining in all grades since 2006 (p.129).

Studies have also suggested that low integration of technology in the classroom is related to teachers' cultural values and everyday beliefs (Curwood, 2012; Harris, Mishra, & Koehler, 2009). When these are dissonant with notions of technology integration, pedagogies are affected (Curwood, 2014). In addition, scholars have documented that even though pre-service teachers may have expertise in technology-use, this knowledge is often not translated into teaching practices in the classroom (Swain, 2006).

According to Ertmer and Ottenbreit-Leftwich (2010) teachers adopt and use technology depending on their past experiences. Therefore, although pre-service teachers are more likely to be knowledgeable users of technology, their beliefs about teaching and learning were formed in a cultural model that had absence of digital technologies, thus affecting teachers' current practices (Ertmer & Ottenbreit-Leftwich, 2010). In order to challenge these models, scholars suggest the need for pre-service teachers and teachers to engage in vicarious experiences of effective technology integration in the classroom and the need to provide opportunities for them to develop their skills by participating for instance in micro-classes or real classroom settings (Ertmer, 2005; Bandura, 1997). Finally, the nature of professional development may also affect how teachers implement technology in the classroom (Watson, Murin, Vashaw, Gemin, & Rapp 2010; Curwood). As Barbour et al., (2011) suggest, if professional development keeps focusing on infrastructure, tools and resources, then it is likely that the dissonance between teachers' everyday practices and beliefs will continue. Instead, Barbour et al., (2011) call for professional development with a focus on students' outcomes, pedagogies and learning skills.

In sum, the review of the literature established links between notions and conceptions of teaching and teaching with technology. It also made clear how technology integration in the classroom is not a straight forward issue, as it involves not just access to technologies, but importantly other interacting factors such as teachers' subject-knowledge, self-efficacy, pedagogical beliefs, school culture, and feelings of competence (Ertmer & Ottenbreit-Leftwich, 2010). This review also signals the critical role that teachers and their pedagogies play in designing effective blended environments.

3.1.5 Edmodo: A social network site with learning purposes

Learning technologies such as Edmodo mimicking popular social media features from social network sites seem to have the potential to expand teaching and learning practices and repertoires in the primary classroom. Blended learning defined as a combination of face-to-face and online practices is enacted by the use of material and digital tools. Edmodo was part of the digital resources that the students in the present study used and as such, it was a constituent part of this Year 6 blended environment. As I will shortly examine, Edmodo in this classroom space allowed students to interact online outside the school hours. Hence it

enabled the formation of a digitally mediated learning network that was intimately related to the classroom activities, yet functioned at a different space and time from the school. As Edmodo was a tool actively used by the teacher in the classroom, a special focus was given to this social media tool. Thus, the decision to examine Edmodo, as opposed to other social network sites, was not tied to any specific preferences towards this application. In this section, I will first contextualise the use of social media tools in out-of-school contexts. Next I will describe the features of social network sites (SNSs) and social network sites with learning purposes such as Edmodo and give an account of current literature about SNS for learning.

Technologies like Edmodo build on Web 2.0 tools or social media tools (both concepts are often used interchangeably) (Greenhow & Gleason, 2012). Web 2.0 applications such as blogs, microblogs, wikis or social network sites allow people to use, consume and remix data from multiple sources and, at the same time, produce their own data; which, in turn, can be used by others (Partnership for 21st Century, 2007). Research in the United States, Canada, Australia, and the European Union countries have suggested that digitally mediated out-of-school settings are providing rich spaces for learning. This is possible due to the increasingly easy access to technology in such informal spaces (Madden et al., 2013). For instance, recent findings from the Pew Research and the Berkman Center for Internet and Society at Harvard University including a nationally representative survey of teenagers (between 12-17 years old) show that:

- 93% teens have a computer or have access to one at home;
- 71% teens with home computer access reported that the laptop or desktop they use most often is one they share with other family members;
- 78% of teens now have a cell phone, and almost half (47%) of those own smartphones.

In addition, as shown in Figure 2, while in 2011 only 23% had smartphones, in 2013 37% of all teens have such technology (Madden et al., 2013). Young people are also increasingly engaging in social media. For instance, based on the data of the Pew Report (2013) 81% of online teens use some kind of social media with a major participation of teens in Facebook and an increased use of Twitter (from 16% in 2011 to 24% in 2013).

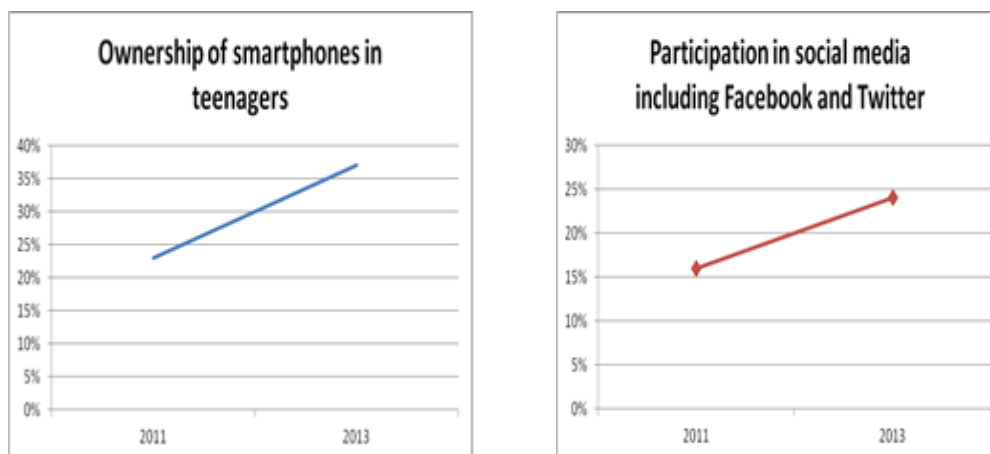


Figure 2. Access and participation in social media, Pew Report (2013)

This is consistent with data from the EU countries (European Commission, 2013). According to this report, students spend less hours working on their computers at school than at home. Understanding the use of digital technologies and particularly how young learners are engaging in “social networking” activities in the school context is essential. As a recent report from the Joan Ganz Cooney Center (Fields & Grimes, 2012) argues, there is little or no research dedicated to this topic in young age groups.

SNSs emerged in 2004 along with the arrival of the Web 2.0. SNSs can be defined as Web 2.0 tools that encourage people’s interactions, identity construction through profile formation, media sharing and networking (Ellison & Boyd, 2013). Social media tools have reached popularity with sites such as Facebook, Twitter, YouTube or LinkedIn, although its origin can be found in the development of online dating sites during the mid-nineties (Boyd & Ellison, 2007). Since then, the shape of these online tools has evolved from an emphasis on profile formation to a focus on communication and media sharing (Ellison & Boyd, 2013). Three main features currently characterise SNSs: profiles, contacts, and media content exchange. As Ellison and Boyd (2013) define:

A social network site is a networked communication platform in which participants

- 1) have uniquely identifiable profiles that consist of user-supplied content, content provided by other users, and/or system-provided data;
- 2) can publicly articulate connections that can be viewed and traversed by others and;
- 3) can consume, produce, and/or interact with streams of user-generated content provided by their connections on the site (p.6)

SNSs allow interaction through a range of semiotic resources and types of interactions; hence synchronous, asynchronous, print-based, audio, visual and multimodal modes can be displayed using this tool. Unlike the fixation on paper for written modes of communication, SNSs expand the choices one can make for meaning making production.

Though SNSs emerged as out-of-school tools with the purpose of allowing connection, communication, and processes of sharing and media production where people are able to design their own profiles (Boyd & Ellison, 2007), currently social network sites have also targeted educational spaces by developing specific features for learning. Such richness in the affordances that social media tools have enabled have triggered the study of these tools not only in areas of cultural studies or technological design, but recently in the educational field (Greenhow & Gleason, 2012; Greenhow et al., 2009; Greenhow & Robelia, 2009; Greenhow, 2011; Kilinc et al., 2012).

One example of a SNS with learning purposes is Edmodo. According to Evans and Klilincm (2013), Edmodo “offers teachers a collegial classroom management toolkit to use across their class periods”. As public data retrieved from the Edmodo website stated, currently over 34 million teachers and students are connecting in this form of online classroom. Figures 3 and 4 shows the interface of Edmodo:



Figure 3. Edmodo screenshot



Figure 4. Example of students' interactions on the Edmodo interface

Due to its aim at enhancing learning, Edmodo presents some specific features that differ from mainstream SNSs. For instance Edmodo allows teachers to record grades, notify students' homework through posting on the wall, or keep calendars throughout the learning period. In addition, Edmodo allows users to submit their homework either privately or publicly; create alerts for deadlines of task submission, and provide with the number of contributions and other statistical data summarised in users' profiles. Furthermore, Edmodo differs from mainstream SNSs as the network created in this digital environment is bounded. Consequently, only people with a unique six code digit can access the platform. With this code students create their profile and are able to interact and navigate across the network. This feature permits teachers to be in control of the participants of the network, allowing teachers to design and cater for their unique classroom audience. This feature also protects students regarding issues of privacy, security risks, and abuse that have been reported as major threats on SNSs (Boyd & Ellison, 2007; Boyd & Marwick, 2011; Ellison & Boyd, 2013). Whereas both public SNSs and SNSs with learning purposes can foster communication, profile formation and traverse of content within users, the latter has an added layer in its learning design related to security and surveillance (Foucault, 1975); and to some extent to formality as interactions are limited to school activities. Acknowledging the

differences, at the core of their design both can enable social networking as defined by Wenger et al., (2011) and open parallel spaces for interactions and learning to occur.

Research on literacy practices regarding social network applications reports positive outcomes of students' interactions online. For instance, a study done by Davies (2012) explores young people literacy practices using Facebook. By using interviews, think-aloud and snapshots of students' profiles online, the researchers report that teenagers are engaging in new dimensions of literacy practices as students learn to navigate their profile, and create a social presence built on visual images and digital text. Another study by Kilinc et al. (2012) that analyses the impact on Facebook and Twitter in the context of social media studies documents that the use of social networking in the classroom promotes global interactions along with students' independent knowledge formation. In addition Thibaut (n.d.) suggests that through the use of Edmodo students in the upper-primary classroom were able to engage in multimodal literacy practices with an awareness of audience and authorship.

Studies on asynchronous communication using the social media tool Edmodo reported that the social interactions that students constructed in this platform allowed students to acquire knowledge while developing 21st century skills (Hayes, Ruschman, & Walker, 2009). In addition, studies run on asynchronous learning environments such as Blackboard have reported that students feel a difference between the way they interact on a face-to-face basis and the way they are able to communicate mediated by asynchronous learning platforms. For instance students reported that they could develop their ideas further because they have more time to elaborate on their arguments, have more opportunities to contribute to discussions, and experience less anxiety and public pressure (Warschauer, 1996). Similarly, studies suggest that combining turn-taking models of interaction in face-to-face environments with digital interactions have positive impacts on students, such as students perceiving that they do not have to compete for attention, and they can develop longer contributions with a strong component of self-expression (Lazonder, Wilhelm, & Ootes, 2003).

Learning environments where communication is mediated by technological tools open opportunities, but also present risks for teaching compared to the traditional face-to-face classroom (Ludvigsen, Lund, Rasmussen, & Säljö, 2011). Hence, a social platform like Edmodo has the potential to perpetuate negative social patterns of interaction among students occurring face-to-face in the classroom. For example, Vines and Dysthe (2009) examine law students interacting in an asynchronous blended environment. The scholars found that

knowledge and authority are factors that do prevent students to interact productively and share their opinion in an asynchronous environment. They argue that despite the increased amount of writing and the improvement of students' writing skills "the fact that 80% of the written comments are from group leaders indicates the same asymmetric pattern as observed in oral communication" (p.189).

As the literature shows, the design features of social media tools and in particular of Edmodo, provide opportunities, but also risks, for students to interact and engage in social networking in a safe environment. The implications of such features for teaching and learning are not trivial as the use of Edmodo potentially expands the time and space where learning may take place. The design features of this tool might also have implications for learning as the dialogue produced between students of the classroom network generates an archive of information over time. In addition the design features of Edmodo support written along with multimodal text which is of special interest for the present study given the focus on literacy practices. Interestingly, what differentiates Edmodo's dialogue formation from design features such as Blackboard or other virtual learning management systems (VLE) is that, as do popular social network sites, Edmodo allows identity formation through profile construction and the generation of streams of content that are built upon and traversed by other users (students in this case). Such design specificities are tied to identity construction and they may have an effect on the significance that users attribute to their participation in the network. As previous studies on Twitter or Facebook reported, students seemed to engage in more self-driven and independent knowledge formation in such social media platforms than in other virtual learning environments.

Understanding how social media tools such as Edmodo, models of learning and approaches to teaching are related is core to understanding blended learning in the primary classroom. This is key to examine how concepts such as distributed cognition, affordances and social learning are entangled in the primary classroom. As observed, the arrival of new technologies has not only modified the tools, but importantly has expanded the possibilities of activities, social interactions and perhaps the cognitive stimulation that students receive for acquiring new skills in the classroom. As with learning, the introduction of technology in the classroom has also strongly challenged conceptions of teaching, teachers' identity and pedagogies. Teachers are now challenged to design tasks for learning that move across spaces, choose relevant tools and identify areas where the interactions can be expanded towards experts and peers

outside of the formal learning space. Of course this has changed the rules of the game of teachers' profession. The amount of research on this topic signals the preoccupation at both theoretical and practical levels in understanding the phenomenon of blended learning in order to capitalise on its benefits and minimise its risks. The incorporation of technologies that mimic social media features of SNS in school contexts, is a clear example of how technologies are trespassing borders between formal and informal learning. As I will shortly reveal, the notion of literacy has also been challenged by technologies. How people communicate and make meaning is changing due to the affordances of digital tools. Next I will connect conceptualisations of literacy, new literacies and multimodality along with empirical evidence that attempts to give an overview about the stage of the art in this area.

3.2 Literacy and blended learning

Literacy practices are constitutive of any human endeavour. Since thoughts are represented and communicated through meaning making practices, an understanding of learning underlies an examination of modes of representation, either linguistic or visual, gestural, aural and multimodal. What is new about this relation is that blended learning environments are offering other tools for meaning making and representation than traditional face-to-face learning environments. Consequently, it is essential to examine the connection between literacy and learning in blended settings.

Literacy in schools has historically been based on linguistic accomplishment, both oral and written. Particular emphasis in school has been given to reading and writing text, often put in terms of mastery of discrete skills such as phonemic, spelling, punctuation, decoding and comprehension (Kalantzis & Cope, 2012). Such skills have often been rehearsed by students from a teacher-centred perspective in decontextualised exercises (Luke, Freebody, & Land, 2000). Now such practices are being challenged by new conceptualisations of notions of literacy and as a result approaches on how to teach literacy in the classroom are changing. For instance, the Department of Education and Early Childhood Development explicitly established the inclusion of new technologies as integral for students to develop literacy skills and capabilities they will need for economic, social and cultural success in the 21st Century (DEECD, 2011). Similarly, scholars in the context of Australia have advocated for student-centred, situated, multimodal and whole-language approaches (Luke et al., 2000). Wider signs

can also be seen for instance in “The Programme for International Student Assessment” PISA (OECD, 2011) that includes in their last versions an assessment of digital reading and collaborative working.

However, as evidenced previously while many schools now have access to technological tools in the classroom, the practices with digital tools and the use of such technologies for teaching new literacies vary. As Luke et al. (2000) argue, “schools and school systems create particular texts for study and particular kinds of literacy events and practices” (p.11). Scholars argue that literacy practices are often based on technocentric approaches to technology integration in the classroom (Curwood, 2014; Kereluik et al., 2013; Voogt et al., 2013). As a result literacy practices in the classroom, though they might be drawing on new technologies are often still attached to print-centric models. In addition, research on literacy evidences that school practices are “still dominated by conventional literacies” (Lankshear & Knobel 2006). Consequently, rote memorisation, the dominance of the alphabetic print, decontextualized teaching and learning, and standardized assessment are still core engines of school practices (Gee, 2004; Honan, 2012; Wenger, 1998).

In sum, the literature shows that blended learning and literacy practices are intertwined. However this relation may or may not have implications for literacy practices and learning as this link is strongly dependant on how new tools are integrated in the classroom. In order to unwind this entanglement, I will offer current theorisations on literacy and new literacy practices followed by an account of notions on multimodality and social semiotics. Next I will discuss research on literacy practices in schools and in out-of-school contexts; then I will finalise with a description of measurements about new literacy practices.

3.2.1 Toward a theorisation of new literacies

New conceptualisations around the nature of literacy, semiotics, and multimodality have been challenged by the emergence of new communication technologies (Bezemer & Kress, 2014; Kress, 2013; Luke et al., 2000; The New London Group, 1996). The emergence of digital platforms has allowed for communication and meaning making practices to take place with a different structure, pace, and time than the printed word and across formal and informal settings. In particular the publication of the seminal work of The New London Group “Pedagogies of multiliteracies” (The New London Group, 1996) in the Harvard Educational

Review, marked the need for re-thinking the meaning of literacy in a technology-driven society. So what it means to be literate in the 21st Century has changed from what it meant to be literate just two decades ago. Whereas until the early '90s literacy was generally associated with reading and writing of print-based text, now literacy also involves the reading and writing of digital text along with communicating and representing meaning through still image, video, audio and gestures (Kalantzis and Cope, 2012). The traditional and dominant literacy model is defined as the correct use of formal language as prescribed by the high cultural text of the literary canon (Kalantzis and Cope, 2012, p.63). This canon has still a wide use in schools today.

New technologies not only have expanded the means for meaning making but have also affected the relationship between the writer (or author) and the text, allowing the meaning-maker —previously recognised as the “writer” (or author)— to also become a designer and producer of the text. This in turn, has affected the nature of the notion of authorship, shifting from a static text-author process to a more dynamic and dialectic process. Such changes in tools, modes and relationship between agents and tools are also reshaping traditional ways of communicating and representing meaning (Jewitt, 2005). Consequently, it is important to consider that new models of literacy are not replacing “old models” of literacy; instead together they are changing the notions of literacy as both are intrinsically related and consequently both need to be taken into account in order to understand ways of teaching and learning literacy.

The dialectical swing between theory and practice is overt in the current discussion of literacy. As Spencer (2011) argues, global shifts at a broad social level involving the change from a “logocentric” to a “ocularcentric” focus, have also impacted on the discussion about the nature of literacy at a theoretical and practical level. In other words, the transition from a print-centric to the inclusion of other modes of communication that draw on visual representations is overt in meaning making production such as videos, audiocast, games, blogs or digital images. Given that literacy and new literacies are notions that are entangled, in order to become literate in society, students need to be able to master oral and written texts, yet also multimodal texts (Luke et al., 2000). As Luke and Freebody posit, literacy can be defined as: “the flexible and sustainable mastery of a repertoire of practices with the texts of traditional and new communications technologies via spoken language, print, and multimedia” (Luke, Freebody, & Land, 2000, p.3). This definition encompasses a dynamic,

multimodal, social, and technologically mediated understanding of literacy practices (Coiro, Knobel, Lankshear, & Leu., 2008). In addition, according to Curwood and Cowell (2011) a focus on literacy practices emphasizes a new set of skills, such as:

- the awareness of audience
- a critical and collaborative engagement with content and text production
- and the promotion of multiple modalities

Furthermore theoretical discussion of new literacies involves the consideration of new “ethos stuff” and new “technological stuff” (Lankshear & Knobel, 2011). Whilst, the former refers to the social aspect involved in new literacies, the latter stems from the mediation of technological tools that enable new ways of inscribing meaning. Consequently, from this perspective, writing an academic essay, participating in a discussion on a social network thread, creating online fan-fiction, playing videogames, producing a video and sharing it on YouTube, collaborative writing on Wikipedia, or programming on Scratch can all be considered literacy practices. What differs between the first example and the rest has to do importantly with the nature of the text. As Curwood and Cowell (2011) argue, whereas one has a fixed, linear, and print-based form, the latter have a rather dynamic, non-linear, and multimodal form.

The revision about the theorisation of literacy has given new modes and digital tools for meaning making production, evidenced by the arrival of new concepts that show an attempt to capture the radical changes precipitated by technologies in this area. Unlike the previous consensus of a single literacy definition —as based on the high cultural printed text of the literary canon— (Kalantzis & Cope, 2012), now it is unclear whether concepts such as “new literacies”, “multiliteracies”, “literacy practices” “critical literacy” can be encapsulated and hierarchically ordered for better representing current transformations of meaning making practices. Instead, what is clear is the plurality and broader nature of the current notions of literacy. Now the line dividing what can be considered as literacy or not is yet to be drawn (Kress, 2010). The present research considers new literacies, acknowledging that is an unfixed and evolving term.

3.2.2 Multimodality and social semiotics

As previously mentioned, new technologies have expanded the means for meaning making giving shape to the notion of new literacies. New literacies are characterised by multiple and multilayered modes. Modes are “socially and culturally shaped resources for making meaning” imprinted in text. Texts are the canvas where modes are represented and they have been defined as “the material form in which rhetorical purposes and the process of design are given realisation through the modes and modal resources available to the designer” (Bezemer and Kress, 2009 p.250). New modes stem from audio, visual, kineikonic and multimodal. In addition, recently scholars investigating new literacies have been discussing the inclusion of *touch* as a mode (see for instance Bezemer and Kress, 2014 or Walsh and Simpson, 2014); this discussion has been prompted by the rise of touch screen technologies and the increase in interest about embodied ways of communication (Bezemer and Kress, 2014).

Different modes offer different potentials for meaning making (Kress, 1997). The question that has arisen, given that “new technological stuff” (Lankshear & Knobel, 2011) allows both the rejuvenation of traditional ways of communicating and representing meaning and offers new ways of making meaning, is how these modes are entangled and the various relationships that can be acquired in a multimodal composition. Notably, multimodality does not only refer to emergent ways of meaning making, but also refer to the interplay between technology, education and identity, as well as the role of literacy education in a digital age (Hamilton et al., 2015). Areas of research in linguistic semiotics and visual semiotics have tried to answer these questions by drawing on signs and the alphabetic print, and images in the case of the latter. However, although relevant, separated efforts have been proved to be insufficient to provide an account on multimodal text. Attempts to combine both approaches draw on social semiotics and visual semiotics, and although there is no consensus in the terminology, they are often called intersemiotics (Royce, 2007).

Halliday’s work on social semiotics or Systemic Functional Linguistics (SFL) laid the foundation for current intersemiotic analysis. According to Halliday, any mode has the following semiotic functions (Kalantzis & Cope, 2012; Kress, 2013): 1) interpersonal; 2) ideational; and 3) textual. In other words, a mode needs to be able to represent and communicate meaning in relation to the people interacting; in relation to ideas that want to be represented and communicated; and in relation to the coherence of the form adopted for communication such as internal and external coherence of the sentence (Kress, 2014).

Interpersonal, ideational and textual are meta-functions that can be extrapolated to visual semiotics (or grammar). So for instance, the gaze of the actor in a photo, the angle from which a photo or footage is taken, are all visual clues related to the interpersonal function of the text. Likewise, the representation of participants, objects or the inexistence of objects and participants in a composition are related to the ideational function of the text. Textual functions can be associated with visual elements, for instance: the use of focus, the position of the object/subject within the frame, the connection disconnection between elements, the use of real or ideal visual clues to represent meaning (Kress & Leeuwen, 2006).

As with writing or visual design, the use of meta-functions in a multimodal text can result in better or worse outcomes. Put simply, what scholars in intersemiotics argue is that depending on the coherence and the relationships formed within modes, a text can be more or less effective in conveying meaning. Multimodal approaches are key for understanding new literacy practices in current blended spaces for learning and will be applied in the analysis of video production in this classroom environment.

3.2.3 Research on literacy practices in schools and in out-of-school spaces

Changes in the nature of interactions and communication in the 21st Century present challenges to the literacy skills that young learners need to develop in an increasingly participatory culture (Jenkins et al., 2009). Such changes are currently linked not just to computer technologies and the Internet, but also to social media tools and Web 2.0 applications, such as blogs, social network sites. However these latter technologies are often not allowed in the classroom preventing students and teachers from accessing social networking technologies (Boyd, 2008). This is problematic given the learning potential that digital technologies are evidencing in out-of-school spaces (Selwyn, 2009). For instance, the ability to read and write on digital platforms, the capacity to engage in multi-modal production in collaborative, distributed and sharing ways; the ability to critically analyse information online, the opportunities to learn about the boundaries between private and public sphere, the awareness of digital footprint; as well as the ability to manage privacy issues and learn to deal with copyright issues, are important skills mediated by the Web 2.0.

In out-of-school spaces, the ubiquity of technologies, social media and online mediated participation has prompted the study of literacy learning in settings that traditionally have not

been associated with literacy acquisition (e.g Black, 2009; Lammers, Curwood, & Magnifico, 2012; Squire, 2006; Steinkuehler, Compton-Lilly, & King, 2010). The following sample of studies suggests how out-of-school-spaces have impacted on young students' literacy skills development, and informs the present study. For instance, the Pew Internet & American Life Project has found that 64% of young people ages 12-17 are participating in content-creating activities on the internet, including artwork, photos, stories, videos, blogs, maintaining their own personal webpage or remixing content (Lenhart et al., 2007).

In a seminal work about out-of school practices, Ito and colleagues (2008) conducted a three-year ethnographic study to explore how young people participate in the new media ecology. The authors suggest that current practices “change the dynamics of youth-adult negotiations over literacy, learning, and authoritative knowledge” (Ito et al., 2008, p.5). As implications for policymakers, educators and students, the authors argue that online activity, both interest driven and friendship driven, enables self-directed and peer based learning; the authors also conclude that embedded in the normally associated “hanging around” time young people are acquiring relevant social and technological skills for their future.

Similarly, Halverson (2012) explores the interplay between art-making and new literacies analysing young artists' representations in informal spaces of learning. Utilizing a comparative method across case studies that were examined for more than one year and using a distributed cognition approach, Halverson investigates how learning occurs in diverse youth art organisations mapped across digital media representations. The author concludes that new media-based informal learning environments are powerful tools for learning art and new literacy representations. Similarly, Black (2009) examines literacy and social activities outside school spaces through a three year ethnographic study exploring online fan fiction. The author found that all participants in the study developed multimodal literacies and technological proficiency (Black, 2009, p.693). In addition, Lammers, Curwood, and Magnifico (2012) investigate literacy practices in young adults. By using an online ethnographic methodology, the authors examine how adolescent literacies can be driven by fan culture, online games, and video games, suggesting that online contents are useful tools for engaging young learners in literacy development.

Scholars have also found that in this context, young people's use of technology mediated communication is driven to a large extent by social interactions (Black, 2009; Nilson, 2010; Bers 2012) which has the potential to impact text production, involving processes where

students experience a sense of ownership, authoring and identity formation (Magnifico, 2010b). In addition, Greenhow and colleagues (2009) discuss how the significant changes in the Web from the 1990s until now have affected learning and how the unique affordances of the Web 2.0 today prompt two major topics: (a) learner participation and creativity and (b) online identity formation. The authors describe various platforms that support participation and how they are targeted for different purposes, for instance:

- Social networking, (*e.g. MySpace, Facebook, and Ning*); media sharing (*e.g. YouTube and Flickr*);
- Social bookmarkings (*e.g. Delicious and CiteULike*); collaborative knowledge development (*e.g. Wikipedia*);
- Creative works (*e.g. podcasts, videocasts, blogs and microblogs, such as Blogger or Twitter*);
- Content aggregation and organization, such as RSS (*Really Simple Syndication*);
- Feeds and tagging tools; and remixing or mash-ups of content from different content providers into new forms (p.247).

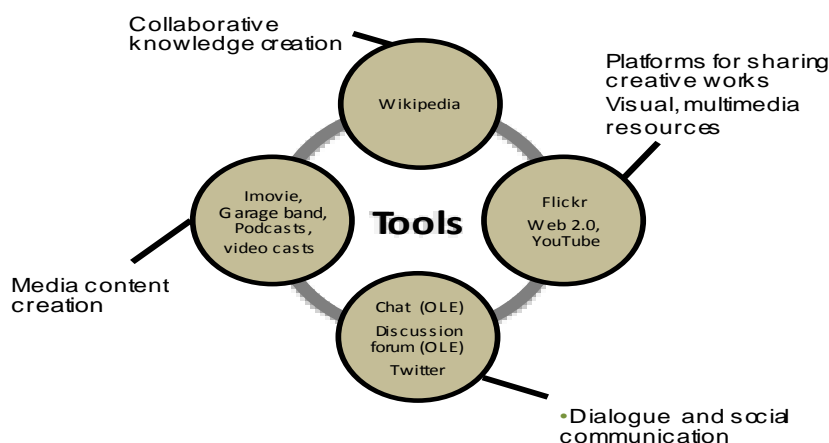


Figure 5. Example of technological platforms and literacy and learning practices

Recently, Greenhow and colleagues examined social media tools such as Facebook or Twitter. The authors posit the need to understand the interplay between social media applications and literacy practices in a wider view; hence including the use of such technologies and the interactions that they enable in young learners' everyday lives and their practices in schools (Greenhow & Gleason, 2012; Greenhow, 2011).

Popular out-of-school activities such as playing games are essentially multimodal texts and have been examined by educational scholars in order to see how they use might relate to learning and literacy. For instance, Steinkuehler and King (2009) explored multimodal text in massive multiplayer online video games targeting disengaged and low-achiever 15 year old boys. Through an ethnographic study the researcher suggested that students were developing key digital literacy practices such as researching, assembling, and synthesizing information, leveraging complex problem solving skills. Similarly, Steinkuehler, Compton-Lilly and King (2010) provide a rich insight to add to the discussion about games and literacy practices. In their research about reading in the context of online games, the authors assess youth reading performance. Their empirical evidence shows that reading texts is a regular aspect of playing videogames. Second, that in these contexts, 20% of the text types use academic language which require an average reading level. And, third, when difficulty and topic are controlled, reading performance in video games contexts does not differ from school. The researchers concluded that when “struggling readers were allowed to choose the topic, they strikingly increased the performance 7-8 grades above” (p.228). This is in line with Gee, who states that “many children are exposed to language and other symbols connected to modern technologies and media (e.g Internet, video games, text messaging) that seem more compelling and motivating than the school language” (Gee, 2004, p.38).

Current research on new literacies in the classroom shows positive incorporation of new ways of meaning making by teachers. For instance, Ho, Nelson and Mueller-Wittig (2011) investigate the affordances of a technology-mediated project on language curriculum, multimodal making and expression with year 7 students. Data from the intervention were gathered by using interviews and surveys. The researchers report that students gained in collaborative learning skills and motivation in language learning, along with awareness and development of multimodal communication. Similarly, Walsh and Simpson (2014) conducted a two-year research with students in year 5 (primary school) in the Australian context. The researchers examined students’ reading and other literacy practices with the use of iPads in the classroom. The findings of this study suggest that interactions and representation in this classroom context were complex and expanded the acquisition of reading and writing, as it involved the use of physical and digital text along with the manipulation of *touch* mode to convey meaning. In another study, Curwood and Cowell, (2011) implemented a digital poetry curriculum over three years in the secondary English classroom. The authors reported positive results in students’ critical engagement with poetry texts, the integration of students’

awareness of audience while engaging in literacy activities, and the practices of text composition that involve multiple modalities. A study of mobile learning and multimodal literacy in young learners in primary school examined the use of mobile devices for composition and storytelling (Fails, 2009). In particular the scholar analysed how the affordance of such technology that allows splitting and sharing content between devices, might enable or prevent reading and writing. The findings of this study suggested that students were more active and social, and engaged in more collaborative activities when writing this way than with regular pen and paper in the classroom.

Mobile applications such as laptops, tablets or smartphones, and initiatives such as Bring Your Own Device in schools are showing that the distinction between online and offline , and between print and screen reading and writing, along with multimodal texts is blurring. For instance Leu et al. (2007) studied online reading comprehension and offline reading comprehension suggesting that the skills and behaviours of students were related to, rather than separated from, each other. Mobile technologies that enable access to the Web anytime anywhere are also challenging previous research in school classroom where literacies were studied with the presupposition of desktop technologies (Kukulska-Hulme, 2010; Kukulska-Hulme, 2009). This signals how technologies such as desktop computers have inevitably bounded the type of work of students in the classroom and consequently the type of findings reported by scholarly studies. For instance, findings derived in a desktop-based study concluded that desktop technologies for literacy learning were diminishing social interactions and decreasing young students' physical mobility (Wolfe and Flewitt, 2010). Such findings can be argued against given the shift towards mobile technologies, reported previously in this literature review.

The frequent lack of connection between literacy practices taught at school and the informal literacy practices being acquired by some young people is problematic at different levels. Although I have so far documented positive examples of new literacies' integration in the classroom, the review of the literature equally illustrates a delay in the use of technologies for learning. The lack of connection can be illustrated as follows. First, it makes overt the urgent need for understanding ways in which pedagogies can support literacy practices given a scenario of constant technological flux, risky-job structures and emergent ways of meaning-making (Freebody, 2007; Fullan, 2011). Second, changes in society have opened up new possibilities for unconventional careers that require skills often detached from preparation

based on traditional education. These career pathways are associated with individual self-training and network building, often related to online platforms and out-of-school spaces (Black, 2009; Ito et al., 2013; Jenkins et al., 2009). Third, while currently in out-of-school spaces some young learners are getting exposure to the use of digitally mediated skills, often this participation masks an equity issue, as privileged young people are the ones who are often supported with access, information connectivity, and online resources at home (Ito et al., 2013). Consequently, if schools fail to teach students about how to navigate the information society through digital literacies, a hidden curriculum might emerge (Bernstein, 1995) where the most advantaged members of society —those who are able to learn key skills for participating in a digital landscape outside school— will have more chances to succeed in the future (Jenkins et al., 2009). This is critical as inequality in literacy education affects both students' opportunities of development and structural imbalance in society as a whole (Freebody, 2007).

In sum, the review of the literature suggests the need to move beyond the discussion on online and offline, screen and print and potentially the divide between school and out-of-school spaces towards an ecological approach to look at literacy practices. The evidence outlines how technologically-mediated-tools for communication and representation have challenged notions of literacy and actual practices of literacy in the classroom. It also signals how young adults are engaging in literacy practices across formal and informal spaces, yet the lack of a firm implementation of new literacies that secures such types of learning for everyone is opening a new type of inequality in the education system.

3.2.4 Approaches to practice-based measurement of new literacies

Conventional approaches to literacy have been re-shaped in recent times due to the ubiquity of technology. Learning literacy in blended environments involves not only a different materiality, but also, importantly, different ways to engage in literacy practices. There is consensus among scholars that new communicative practices have emerged due to technological tools which have brought new mediums and material means and consequently new meaning making practices (Coiro. et al., 2008; Lankshear & Knobel, 2006). However there is no agreement on how to classify and measure new literacies yet. Various examples can be observed in the literature attempting to generate taxonomies that reflect to some extent

the range of literacy practices and skills today. For instance, Beetham, McGill, and Littlejohn (2009) in their work “Thriving in the 21st Century: Learning Literacies for a Digital Age” established a series of discrete competences associated with literacy. These involved keyboard skills, use of capture technologies, use of analysis tools, use of presentation skills, navigation skills, along with adaptability, confidence and exploration. Similarly, Jenkins et al. (2009) proposed that in order to face the challenges of the 21st century, media education needs to prepare students to play, perform, network, negotiate, navigate across medias and tools, judge, multitask and work using a distributed cognition perspective.

Belshaw (2012) in his work “The Essential Elements of Digital Literacies” proposes that literacies involve cultural, cognitive, constructive, communicative, confident, creative, critical and civic elements. Additionally, in a recent work by Hamilton about literacy practices online (2013), she argues that digital literacy is characterised by the following elements: having various reading paths; the composition of multimodal text; the ability to multitask; new forms of authoring, interacting, participating and collaboration; new audiences, and new nature of feedback. Hamilton argues that such online spaces allow also for new visual modes of communication such as emoticons. Moreover, in a recent survey across European Union countries, digital literacies were measured as the ability to manage a digital identity, netiquette, interact, share and collaborate through digital channels (European Commission, 2013). Table 4 illustrates some different approaches to “measure” new literacy skills.

Beetham, McGill, and Littlejohn (2009)	Jenkins (2009)	Belshaw (2012)	Hamilton (2013)	EU description of digital literacies (2013)
Keyboard skills	Play	Cultural	Various reading paths	Interacting through
Use of capture technologies	Performance	Cognitive	Multimodal text	technologies
Use of analysis tools	Simulation	Constructive	Multitasking	Sharing information
Use of presentation skills	Appropriation	Communicate	New forms of authoring	and content
Use of	Multitasking	Confident	New forms of interacting	Engaging in online
Adaptivity	-Distributed	Creative	interacting	citizenship
Confidence	Cognition	Critical	New forms of participating	Collaborating through
Exploration	-Collective	Civic	participating	digital channels
	Intelligence		New forms of collaboration	Netiquette
	Judgment		collaboration	Managing digital
	-Transmedia		New audiences	identity

navigation	New nature of feedback
Networking	Creation of new
Negotiation	communication forms

Table 4. Literacy practices, various authors

In light of the different ways that scholars have developed to “measure” new literacy practices, it is clear that popular measures of literacy skills today often fail to account for the nature of change that is occurring in the notion of new literacies. Therefore, the ways students are currently being assessed, often privileges a decontextualised understanding of learning over a situated practice rooted in practice (Gee, 2008; Resnick, 1987; Warschauer, 2006). As the review of the literature suggests often out-of-school literacy practices are invisible in the classroom. Thus, students’ literacy capital absorbed in other settings is often not capitalised in the classroom. Instead, this research drew on a sociocultural approach and as such it considers that people learn communicative practices from the settings in which they are immersed, involving family, school, group of friends, etc. (Gee, 2008; Resnick, 1987; Warschauer, 2006). Such an approach connects the richness of language and communicative practices with today’s technologies in out-of-school practices and the literacy practices in the classroom.

A sociocultural approach offers opportunities to examine how the pervasiveness of technology in the 21st century is currently transforming literacy practices underlying three key notions. First literacy has a social nature, consequently literacy changes as society changes (Gee, 2008; Lankshear & Knobel, 2003). Second, literacy is not a personal possession whose acquisition can be proved only by the ability to read and write, but it is a process that is co-constructed in a relational form with social actors and the environment; as such, literacy is shaped by economic, cultural, historical and social factors capturing the shift from a static to a dynamic conceptualisation of literacy (Gee, 2008; The New London Group, 1996). Third, there is an intimate relationship between literacy and processes of identity formation and forms of being in the world (Wenger, 1998). These notions were considered, and thus guided the analysis on literacy in the present case study.

3.3 Synthesis of the literature review

The literature review documented how the explosion of technological tools, the transition from desktop to mobile devices and the ubiquitous presence of digital technologies have challenged previous notions of learning and teaching in the classroom. According to the review of the literature, and although strongly criticised, the concept of blended learning provides a useful umbrella from which to examine the process of learning with technology in the primary classroom. A review of models of learning and ways of teaching in blended spaces was provided in order to explain the shift in these notions, at both practical and theoretical levels. In addition, a link between blended learning and literacy practices was offered by reviewing how technology has impacted on traditional ways of communication, in this process rejuvenating older ways of representing and communicating meaning. New mediums (such as portable devices based on touch or linguistic symbols, and new platforms such as blogs or social network sites) have allowed the emergence of new modes of communication and learning, expanding the discussion on multimodality and semiotic practices. Also, an account of literacy practices in out-of-school spaces was provided, in order to showcase the use of technology by young people in informal spaces and the conventional use of technology in formal spaces of learning.

As evidenced in this review of the literature, it is clear that everyday practices in the classroom are changing. This again brings back the question of how blended learning shapes teachers' practices and students' literacy and learning processes. Through the literature review, current challenges on educational and literacy research such as, What does it mean to be literate in the current context? or, How does learning and teaching takes place when mediated by technology? and, How to capitalise on blended environments to support learning? were outlined in preparation for the documentation of the findings in this study.

4. METHODOLOGY

4.1 Research design

The present study draws on research in teaching and learning that have focused on naturalistic settings, and in particular, on case studies (Burke, Cunningham, & Grosvenor, 2010; Burke & Grosvenor, 2013; Burke, 2014; Harste, Woodward, & Burke, 1984). Such

research approach aligns with an epistemological view of contemporary qualitative inquiry that acknowledge that the social world cannot be studied in the same way as the natural world (Mertens, 2005). Instead a qualitative approach highlights the need of observing subjects in “their own territory and interacting with them in their own language, on their own terms” (Kirk & Miller, 1986, p.9). Consequently in this study I aimed at allowing the participants, their interactions, activities and the artefacts they produced to reveal the ways in which teaching and learning takes place in this blended space.

Combining data gathered through different sources enriches and provides insight for understanding a complex and emerging phenomenon (Patton, 2002). However, traditionally quantitative and qualitative approaches to research underlie not only different techniques of gathering data and consequently different data analysis techniques, but also reflect particular philosophical and epistemological worldviews (Babbie, 2009). While a quantitative research approach stems from notions of objectivity and reality of the phenomenon that can be understood through the scientific method, a qualitative research approach considers reality as an intrinsically subjective phenomenon that lies in interpretive, naturalistic and constructivist paradigms of knowledge (Migiro & Magangi, 2011). Furthermore, whereas a quantitative approach understands reality from a reductionist perspective, where ideas can be synthesized and reduced to variables that can be later tested against observation, a qualitative approach considers reality as subjective and dependent on interpretation and construction of people’s own worldviews (Babbie, 2009). Following this reasoning, I acknowledge that as the researcher, I reconstructed and interpreted the data, and in so doing I modified the reality.

While the differences between quantitative and qualitative approaches have been recognised, they are not mutually exclusive. As the description of case studies illustrates (see section 4.1.1), the body of literature in methodology has evolved towards less categorical and limited approaches; consequently, currently more pragmatic views on methodological decisions can be adopted (Merriam, 1998). Current trends in methodology recognise that a combination of qualitative and quantitative approaches often is beneficial for better understanding a phenomenon. According to the literature, a combination of approaches is better suited for analysing exploratory questions as such a blend can produce more comprehensive findings (Punch, 2005). In light of the literature review on research undertaken in blended learning, social media analysis and new literacies, and acknowledging sociocultural, distributed and network theory as underlying the present, I take a qualitative approach to study the

phenomenon of the blended classroom, yet I also consider a survey method to complement the exploratory analysis.

The next section details the research design of the study. The study design was guided by the use of a case study which was bounded by the Year 6 classroom composed by 30 students and their teachers. This bounded system was analysed by using various forms of data collection and multi-method approaches aiming at understanding the data from various perspectives (Marten de Laat, Lally, Lipponen, & Simons, 2007; Weinberger & Fischer, 2006). The present chapter is organised in the following way: description of the case study, study context, participants, data collection and data analysis. Then a discussion of the trustworthiness of the data and ethical issues of the research are considered.

4.1.1 Case study

The present study employed a case study research methodology. As Stake (1994) explains, “case study is not a methodological choice, but a choice of object to be studied. We choose to study the case. We could study it in many ways” (p.236). Thus, what leads a case study endeavour is the interest in the case, which could involve both qualitative and quantitative inquiry. Likewise, Creswell (2013) defines case study as a “bounded system”. According to Bromley, a case study is a “systematic inquiry into an event or a set of related events which aims to describe and explain the phenomenon of interest” (Bromley, 1990, p.302). In addition, Yin (2009) points out that a case study can be defined as “an empirical inquiry about a contemporary phenomenon (e.g., a ‘case’), set within its real world context especially when the boundaries between phenomenon and context are not clearly evident” (p.18).

Consequently, according to the previous definitions a case study is, first, defined by the selection of an object of interest. Second, a case study approach attempts to understand a case as a unique natural phenomenon and as bounded in the real world. Third, this methodology allows the study of a phenomenon beyond the isolation of variables as it includes the context as part of the research (Yin, 2012). As a consequence a case study underlies a holistic approach to examine the phenomenon of study which leads to the fourth element: a case study “produces a wide range of topics to be covered (Yin, 2012, p.4). Finally, given the complexity produced by the range of topics covered, a case study requires research to be

undertaken over time in a natural setting to produce a satisfactory, explanatory and comprehensive understanding of a phenomenon (Neuman, 2006).

What distinguishes a case study from other methodologies is that it looks at phenomenon in depth with the aim of understanding and providing insightful data about a single or small number of cases set in the real-world context (Bromley, 1986, p.1). Case studies have been applied across disciplines such as sociology (Creswell, 2013), psychology (Bromley, 1986, 1990) and education (Merriam, 1998; Stake, 1978, 1994, 1995) and have included, but are not limited to, the analysis of a person, an organisation, an event, or a company. For instance, case studies of blended learning have been used recently to explore health education and blended learning designs in higher education (De George-Walker & Keefe, 2010; de Jong, Savin-Baden, Cunningham, & Verstegen, 2014).

Although classrooms, a group of doctors or a child may be a case, not all classrooms, children or groups of doctors are case studies. Unlike the generality of many classrooms, what distinguishes a case from say all the classrooms in Australia is the specificity of the classroom selected. Consequently, as Stake (1994) argues, the notion of case study draws attention to what specifically can be learned from the selected case. In addition, elements in the system of the case and the case itself are mutually entangled. As Stake (1988) defines “it is not always easy for the researcher to say where the child ends and where the environment begins, but the boundedness and the behaviour pattern of the system are key factors in understanding the case” (p. 237 as cited in Stake 1994). As a result, certain features are part of the bounded system, others are in the interstices and other features are significant as a context (Stake, 1994, p.237).

Case studies have been classified as intrinsic, instrumental or collective (Stake, 1995). While an intrinsic case often has an exploratory purpose, the aim of an instrumental case is to expand theory and build knowledge across cases. Finally a collective case study includes the examination of multiple instrumental case studies that aim to explain a phenomenon or situation. Case studies have also been classified as exploratory, explanatory and descriptive (Yin, 2009). Yin further elaborates his taxonomy according to four combinations observed in the following quadrant:

	<i>Single-case design</i>	<i>Multiple-case design</i>
<i>Holistic (single unit of analysis)</i>		
<i>Embedded (multiple units of analysis)</i>		

Figure 6. Case study (Yin, 2012, p.8)

The holistic approach focuses on the whole and therefore ensures a rounded perspective of the data. However the downside of this approach is that it may miss fine grained data happening at the level of the unit of analysis. Thus an embedded single-case design is recommended when aiming to illuminate sub-units within a single case. If this focus is selected, caution needs to be considered in order not lose attention to the case as a whole (Yin, 2009). As already stated, uniqueness is a constitutive feature of case studies. According to Stake (1994), the unique characteristic of a case study can be found in the nature of the case; its historical background; the physical setting; other contexts, including economic, political, legal and aesthetic; other cases through which this case is recognised; or those informants through whom the cases can be known. Consequently, attention needs to be paid to what is common and what is particular about the case (Stake, 1994).

The present case study adopts the shape of an *embedded single-case* study design. In other words, the case study consists of the classroom along with embedded subunits involving the students and the teachers of the classroom. As stated by Stake (1994) the case is singular but it has subsections such as students, teachers, and parents (p.239). The case study is unique as the integration of technology across spaces is not only innovative given the type of tool used, but also given the organisation and type of interactions occurring. This type of case study can be represented as follows:

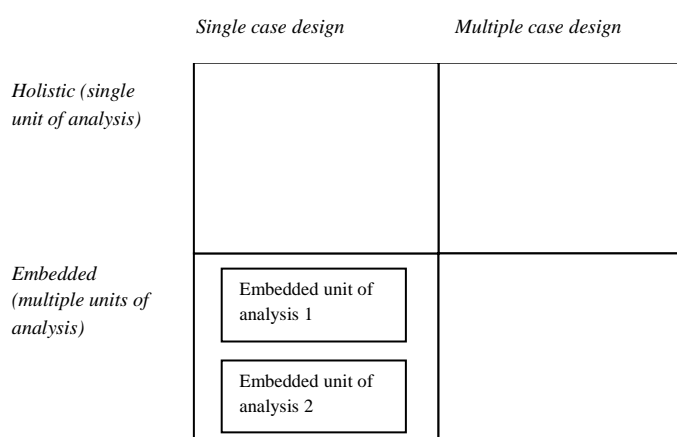


Figure 7. Case study and the application of the present study (Yin 2012, p.8)

The embedded design allows a thick description (Geertz, 1973) of the phenomenon of blended learning in the primary class, as well as an in-depth observation across subunits of analysis —teachers and students— within the single case. Such a configuration permits an analysis of the data in different ways, including an analysis within the units, between the different units, or across all of the units (Baxter & Jack, 2008). As discussed earlier, the aim of this study is to explore blended learning considering the interplay between technology, learning and literacy in a primary classroom. Consequently, the selection of an *embedded single-case study* allows examining the phenomenon of teaching and learning in the interstices of space, tools and agents, building connections between the literature of learning and literacy and the literature on computer supported learning; and therefore allows the exploration of the research questions proposed in this study.

Case study research is not limited to one source of data and one type of data analysis. Instead, a variety of sources and analysis is recommended; and may include quantitative and qualitative data (Yin, 2012). Whereas research on literacy has frequently used a qualitative approach (Coiro et al., 2008; Palincsar & Ladewski, 2006), research on technology-enhanced-learning has often applied a quantitative, causal and aprioristic approach (Stahl et al., 2006). Acknowledging this gap, I attempt to contribute to the literature by utilising a case study approach with a focus on qualitative methods to examine the blended classroom (Yin, 2012). Thus, the present study utilised primarily qualitative data, yet it also includes a survey as part of a quantitative data source. The instruments applied in the present case study include interviews, observations, video recordings, collection of digital and physical artefacts, entry

logs and a survey. Such instruments will be described in detail in the section of data collection 4.1.4.

Case study research design however, has limitations. It has been criticised because of the limited transferability of the findings (Merriam, 1998) and the lack of objectivity involved in the process of data collection and analysis (Duff, 2008). Other critiques reported are the singularity and the consequent non-replicability of the results (Denzin, 1989; Glaser & Strauss, 1967). Although important, generalisation should not be the only aim privileged in social research (Burke & Grosvenor, 2013; Fielding & Moss, 2011; Stake, 1994, 1995). For instance Fielding and Moss (2011) argue that:

Education today needs fewer large-scale quantitative studies comparing performance on predetermined outcomes, and more critical case studies of possibility, opportunities to enrich our imagination and vocabulary and to explore the potential (p.16).

Together, large scale quantitative and small qualitative studies are needed as they serve different purposes and contribute differently to the understanding of a given phenomenon. Contrasted to other approaches such as phenomenography, which has been widely utilised to examine teaching and learning in blended contexts (González, 2010; Kember, 1997; Trigwell, 2011), a case study perspective relies not only on testimonies of the participants, but also on the observations and products of actual classroom practices. In this way, it minimises issues such as *social desirability bias* defined as the likelihood of participants in a research to respond as socially expected (Stoeber, 2001). For instance the examination of blended learning carries the risk of participants over-reporting desirable activities in the classroom such as active learning or student-centred learning. This risk is minimised by triangulating data gathered from various types of data.

4.1.2 Study context

The study sample was purposively selected (Merriam, 1998; Patton, 2002). This decision was made because currently there is a wide diversity of technology integration in primary classrooms in Australia (Kervin, Verenikina, Jones, & Beath, 2013). While some schools have high-level of usage of technology, often others do not. Selecting a school with a high

level of technology integration in the classroom supports the collection of data aligned with the purpose of study which is to examine blended learning. As Haywood et al., (2004) state, purposive sampling can be an effective way of addressing specific topics of analysis as it allows an in-depth examination of the phenomenon of study.

The study was conducted in a K-12 independent faith-based school in Sydney, Australia, with a total enrolment of 1267 students. Approximately three-quarters of the students in this school continue on to tertiary education (www.myschool.com.au). According to the last report of The Australian Curriculum, Assessment and Reporting Authority (ACARA), the school is slightly above the average ICSEA value, with most students coming from middle-quarter socioeconomic background. Currently the school has a total of 705 boys and 562 girls; and 9% of students with a language background other than English. Table 5 summarises this data.

Student background 2013

[Index of Community Socio-Educational Advantage \(ICSEA\)](#)

School ICSEA value	1133
Average ICSEA value	1000
Data source	Parent information

Distribution of students ²

	Bottom quarter	Middle quarters		Top quarter
School Distribution	2%	9%	31%	59%
Australian Distribution	25%	25%	25%	25%

Percentages are rounded and may not add to 100

Students 2013

Total enrolments	1267
Girls	562
Boys	705
Full-time equivalent enrolments [?]	1265
Indigenous students	0%
Language background other than English ³	9%
Student attendance rate	93%

Table 5. School demographics according to ACARA (www.myschool)

Over the last decade, the school has gained a marked reputation for technology integration in the classroom, innovative professional development for teachers, and redesigning learning spaces. The learning space in this study is not conventional. It is comprised of a large open

plan environment that accommodates six combined classes from years five and six, with a total of approximately 180 students and six to eight teachers working in the space. Originally the space was structured as six conventional classroom settings, each with their own respective walls and fixed white boards, yet as part of recent infrastructural and pedagogical reforms, the layout of the school shifted from isolated classrooms with closed boundaries to an open plan with collaborative spaces (the current layout of the classroom with a detailed analysis of the learning space is provided in the findings, section 5.1.1).

Students in this learning environment are expected to be equipped with their own laptops and personal devices as the school operates a Bring Your Own Personal Device policy (BYOD). The online space of this learning environment consists of a Wi-Fi network, a learning management system and the free social network site Edmodo.

Regarding the curriculum organisation of the classes, the timetable is organised into blocks of time to incorporate four learning lessons: literacy, numeracy, project-based work; and a final lesson that accommodates sports, visual arts, a second language, assembly meetings or complements hours to project-based work or independent work.

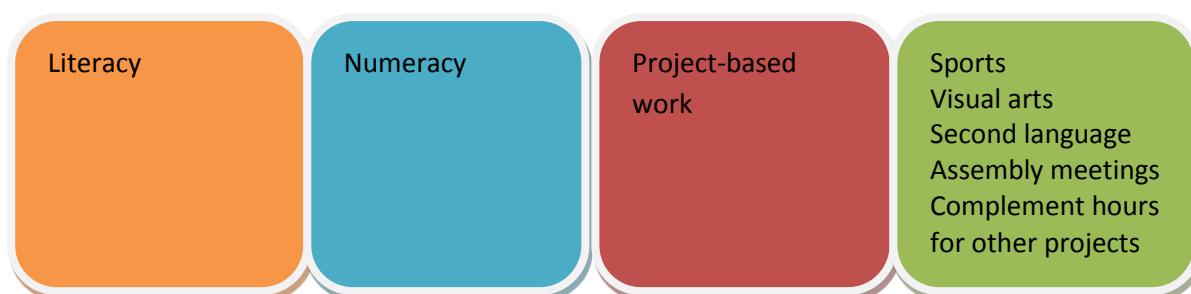


Figure 8. Daily curriculum organisation distributed on learning lessons

4.1.3 Participants

Participants in the study were a class of 30 students in Year 6 and their teachers, as teachers work collaboratively and often teach in pairs in the large open learning space. All the six teachers working in the classroom space agreed to participate in the study. However, only four teachers participated in the in-depth interviews. Table 6 shows a summary of the teachers interviewed in this study.

In the present study I offer a more detailed description of the head teacher of the Year 6 class, Claire (a pseudonym) than the other teachers; as she was the main designer of students' tasks, and the main facilitator of students' learning during lessons. Claire was also the online moderator of Edmodo. At the time of the study, Claire had 11 years of teaching experience. She described herself as a tech-savvy teacher who was passionate about exploring new forms of instruction with the use of technology. She pointed out that by using social media tools such as Twitter and blogs, she stayed current with the use of technology in the classroom. Claire also emphasised that professional development in her school has played an important role in her understanding and application of technology in the classroom. In addition to Claire, Mrs. Kate, Mr. Robert, Mrs. Melinda and the principal Mr. Cruice were interviewed. A detailed analysis of the data about teachers is provided in section 5.1.3. Table 6 describes teachers' profiles.

Name	Role	Age (range)	Years of teaching experience
Miss Claire	English teacher	30-40	11
Mrs Kate	English teacher	25-30	4
Mr Robert	Math teacher	50-60	25
Mrs Melinda	English teacher	40-50	15
Mr Cruice	English teacher/principal	50-60	n/a

Table 6. Characteristics of teachers in the study

Students participating in the study were all in the same class and were aged between 11 and 12 years old, and included 10 girls and 20 boys. In relation to technology, each student had their own personal digital device (PDD) in accordance to the school's Bring Your Own Device policy. Students reported high levels of technology competence and were skilful in navigating various interfaces required for class activities.

Learning Task: The theme park project

The theme park project was a four-week long project designed by Claire as part of a term's work activity that involved an integrated inquiry approach that supplemented and connected

literacy and numeracy content. I provided a detailed description of this task, as students were working on this project for a month during the data collection process. The theme park project involved two phases. The first phase involved students investigating the history and development of theme parks around the world. In the second phase, students were asked to prepare three main outputs: a) a PowerPoint or Prezi presentation about a specific theme park that had shut down operation, displaying some of the major attractions, explaining the reasons for closure and three lessons learned from the park's closure; b) a scaled theme park design using digital applications such as Google SketchUp or physical materials such as cardboard and paint; and c) an "Australiana" themed park concept website. The rubric given to the students as a guide to develop their project included the following elements: 1. Theme park name; 2. Logo; 3. Catch Phrase; 4. Vision Statement; 5. Indigenous considerations; 6. Inclusive considerations; 7. Christianity in action.

4.1.4 Data collection

The data was collected in the field over a period of three terms during the 2013 school year. Data collected in the classroom included: a) observations and field notes; b) 125 hours of classroom video-recordings; c) a collection of physical and digital artefacts designed by the students such as sketches of theme parks, notes, drawings, websites, online games, videos related to task activities; d) interviews including eight in-depth interviews with students and four interviews with teachers regarding technology and literacy; one interview with the principal of the school about school culture, technology and literacy; e) a survey that examined students' school motivation and technology usage. The sixth and final form of data was collected by retrieving entry logs posted by students and the teacher on the Edmodo thread (further referred as the Edmodo wall). It is important to note that data from the entry logs on the Edmodo wall was collected over four months including June, July, August and September. This allowed a better perspective of the interactions occurring in the online space over time.

In addition, it is important to note that entries on the Edmodo wall were used as a way to complement the interactions between students and the teacher beyond the fixed space and time of the classroom based learning session. During direct instruction of literacy and numeracy, students were generally asked to close their personal devices (PDD), consequently

lessons privileged off-line modes including the use of analogous tools such as pen and paper, a whiteboard and a big screen. Over the lessons that accommodated project-based work and visual arts, second language, and so on, the use of PDD was more prominent, and here students were sometimes allowed to access Edmodo. Thus, it is important to note that over a regular school day, students did not access Edmodo, unless specifically directed by the teacher.

As stated above, the present study involved various data sources. A brief description of each of them is provided:

- a) **Observation:** Conducting observation in “natural settings” such as a real classroom environment allows the researcher not only to contrast and triangulate information gathered from interviews, but gives context to the activities and the opinions of students and teachers in the study. According to Adler and Adler, observation is “the fundamental base of all research methods” (1987, p.257). Observation in natural settings can be guided by the use of checklists or open-ended diaries where field notes are taken freely by the researcher (Angrosino & Mays de Pérez, 2003). The latter was chosen in the present research because it supported the identification of activities and interactions that could not have been predicted. To help the systematisation of the data, the software Evernote was used, which allowed the researcher to take written notes along with the recording of voices, photos or documents related to the observation being taken and save them in a catalogue that was later organised in different categories, such as topic, date of collection, activity.

Notions of objectivity and subjectivity have been addressed by the literature in relation to observation techniques and have evolved over the years. Whereas the notion of objectivity in the ethnography tradition and the idea of the researcher being separated from the “object” of study, were mostly upheld by anthropologists during the beginning of the last century, currently such assumptions are less popular. In contrast, current literature on observation acknowledges that the interaction that takes place between the researcher and the subject of study may modify behaviour and consequently cannot be objectified (Angrosino & Mays de Pérez, 2003, p.111). As a researcher I spent entire school days observing students’ and teachers’ activities and behaviours. My approach aimed to not intrude in the pace of the learning lesson, yet inevitably I was part of the setting being observed. This means that students and the

teacher were aware of my presence and many times students would ask me questions, or showed me their progress in a certain activity or simply wanted to talk. Thus, as described by Adler and Adler (1987) my role during observation time was of a participant-observer, hence someone with a membership role as opposed to just an observer. Though I was not an “active-member researcher” as I did not assume active commitments and responsibilities in regards to the classroom activities, I did become involved in the role of “peripheral-member researcher” obtaining an insiders’ perspective (Angrosino & Mays de Pérez, 2003).

- b) Video recordings:** According to Derry et al., (2010) video recording technologies provide researchers with powerful “microscopes that greatly increase the interactional detail that can be obtained” (p.6) in a research setting. The recordings allow not only an increase in granularity regarding behaviour, attitudes, and activities happening in the research setting, but also the possibility of re-constructing a corpus of events over time in a particular case study (Zacks & Tversky, 2001). Researchers have been utilising video recordings in the classroom since the late 1970s. According to Derry et al., (2010) video can be used for inductive and deductive analysis; it can be also used for illustrating powerful stories, like case studies which can take either deductive or inductive perspectives. In addition, literature on education research demonstrates that videos have been used for identifying teaching best practices, thus supporting the analysis of professional development and differences in teaching and learning across cultures (see for instance the research by Jacobs et al., (2006) which drew on videos from the TIMMS project).

I used video recordings to support my understanding of the narrative embedded in the classroom and as evidence to help organise, find patterns and highlight the insights of the particularities of the specific ideas and context of the case study (Derry et al. 2010). Video recordings were also selected as a way to revisit students’ interactions, collaboration, and literacy practices and to capture in full detail the interactions-in-context such as eye gaze, gesture, body posture, content of talk, tone of voice, facial expressions. The information captured through video recordings supported the analysis of the case study (Barron, 2003). In addition, videos were particularly relevant for the discourse analysis of the off-line class (see findings in section 5.2.1).

- c) Collection of physical and digital artefacts:** Records or artefacts —either digital or physical —can be defined as representations of forms of transaction and meaning making (Hodder, 2003). Such records differ from testimonies gathered during interviews or field notes done during observations (Denzin & Lincoln, 2013) and are important for research because as Hodder (2003) points out ‘what people say’ is often very different from “what people do” (p.158). Such material traces are also not available in the spoken form, and have the quality of endurance over time, hence giving perspective into the phenomenon of study. Material traces as a form of qualitative method have been used across disciplines such as archaeology, technology-enhanced learning and cognitive psychology (Hodder, 2003).

In the present research, I collected lesson plans designed by the teacher, students’ work in progress and final outputs of specific tasks, along with photographs taken over the three term period. Consequently, in the present research, I examine what the students were able to materialise in the form of artefacts for school work, considering the affordances of the technologies available for them, the way students were taught to use those technologies and the way they reconfigure the use of those technologies when doing school work. In particular I selected two multimodal artefacts for in-depth analysis which are documented in section 5.3.3.

- d) Interviews:** Interviews are established strategies to gather data in social science, and in education (Denzin & Lincoln, 2013). Interviews can be classified as informal conversational interviews, interview-guide approaches, standardised open-ended interviews and closed-ended interviews (Patton 1987). Whereas with the former type, there is no predetermination of questions or order, in the latter type of interviews, responses are fixed and an order is followed. In between these two extremes are combinations of types of interviews that allow respectively, more flexibility or more structure, to an interview protocol.

The interview protocols included the themes to be covered in discussion with the researcher along with some prompts to guide the conversation. Such a strategy allowed me to select aspects of relevance within the theme without manipulating or guiding the answers towards an ‘expected’ result (Marton, 1986). Interviews were conducted with teachers and students (Interview protocols can be found in Appendix 1 and 2). The teachers’ interview protocol also included a section about background

information such as gender, years of teaching practice and self-perception of technology usage in the classroom. In addition, during the field work I often asked informal questions to students and teachers with regards to what they were doing. Ideas gathered from such informal interviews were recorded as part of written notes on Evernote and sometimes videotaped.

- e) **Entry logs:** The capacity of certain technological tools to sort, store, and retrieve information from asynchronous interactions has increased the use of entry logs in research. Particularly, entry logs have been widely utilised in the context of higher education to study blended learning. For instance, platforms such as virtual learning management systems, and more recently social media tools and MOOCs have been implemented for learning purposes in the classroom (see for instance, Kay et al., 2013; Kennedy-Clark & Thompson, 2013a, 2013b; Uddin & Jacobson, 2013).

In the present study I gathered entry logs of students and the head teacher over four months posted on Edmodo. The Edmodo platform supports entry logs of various types, involving written digital text, along with multimedia logs such as photos, videos, pod-casts, animations, games, and hyperlinks that connect students' work to online platforms on the Web (for instance websites, YouTube videos) and new forms of communication forms, such as emoticons and other visual and semiotic representations that accompany the written text (Gourlay et al., 2014). Findings including the analysis of entry logs can be found in section 5.2.3.

- f) **Survey:** A survey is the only quantitative data collection method applied in the present study. Survey methods are constructed to gather opinions about topics from a certain population in a predetermined way (Babbie, 2009). Surveys can be online or paper based. Studies have reported better response rates in online-based surveys, yet this is subjective to the sampling and the targeting population (Haywood et al. 2004). As the population was linked to a physical space, I decided to conduct a paper-based survey, ensuring the maximum rates of responses by conducting the survey on a day when all the students attended school. Thus, incentives or prizes were not needed to increase return rates and the issue of a biased representation of participants responding in the sample was avoided as the whole class answered the survey. The survey included a four-point Likert scale, ranging from strongly agree to strongly disagree (1 to 4) and three open-ended questions. The survey was adapted from Wang

& Holcombe (2010) who designed the survey “Adolescents’ Perceptions of School Environment, Engagement, and Academic Achievement in Middle School” and can be found in Appendix 3. A section on technology perception in the classroom was added to the adapted version of Wang & Holcombe (2010) survey (open-ended questions). A pilot survey was designed and trialled with a small number of students outside the case study. The students who responded the pilot survey were attending other schools and had no involvement with the main research study. The final version of the survey aimed to identify (i) students’ perception of their classroom environment, (ii) students’ school engagement, (iii) and students’ perception of technology in the classroom. Given the limitations of space of the thesis, only the section of the survey related to technology is presented here. It is expected that future publications will report the findings from the other sections of the survey.

4.1.5 Data analysis

For clarity, data analysis was organised around the three key dimensions that guided the present study: a) space and tools, b) interactions, and c) artefacts and new literacies. The need to include multi-method approaches to address the research questions is grounded in the qualitative umbrella of this study which acknowledges the need of observing subjects in their own space, in their own language, on their own terms (Kirk & Miller, 1986). Likewise, naturalistic phenomenon should be analysed by including the various processes occurring in a selected case study. For instance, through a networked learning analysis I was able to deconstruct the activities happening across the physical and the digital space of the classroom, however such analytical tool said little about the perceptions of the participants who enacted those activities and their reasons to engage in certain activities. Thus, through a thematic analysis of teachers and students’ perceptions and a descriptive data analysis from a survey, I could link actions with agents. Similarly, the dimension on interactions employed a discourse analysis technique and a content analysis technique. Both type of analysis helped to understand the variations of language employed in the physical and the online space, as each approach gives a specific insight on the ways participants were interacting in the blended classroom. Finally, understanding artefacts and new literacies required to provide a general identification of the types of literacy practices that students engaged in the classroom, but also a more in depth focus on the artefacts being developed by students. For that, a thematic

analysis and a multimodal analysis were employed. However, such identification said little about why teachers designed those literacy tasks in the classroom and how students engaged in those activities. The incorporation of the interviews, through a thematic analysis approach, made that link possible.

A general overview of the analytical approaches is explained below, yet additional discussion of these approaches and their relationship with each research question can be found in the findings chapter, at the beginning of each section.

Space and tools

Networked learning analysis was used to explore teaching and learning practices embedded in a primary blended environment. A networked analysis looks at three interrelated aspects of learning activities: the set, the epistemic and the social (Carvalho & Goodyear, 2014; Goodyear et al., 2014; Goodyear & Retalis, 2010). Because the main interest of this analysis was to see how the set design (the blended space) may influence teaching and learning, I focused on this dimension, however this was just an analytical decision. As it will shortly reveal in the findings section 5.1.1, the epistemic, the social aspect and the co-creation and co-configuration are intertwined as they are constitutive elements of any networked learning (Carvalho & Goodyear, 2014). Consequently, even though the analysis has a focus on the set design, the epistemic and the social dimension were also covered as they are intimately related in the blended space.

I also drew on Biggs and Tang (2007) and their concept of an *activity-centred* position in order to capture in detail the events and activities enacted across the set design. This concept shares similarities with Wertsch's (1998) notion about agents acting through “mediated means” such as language, mathematic symbolic system, figures, or maps (Vygotsky, 1981). Biggs and Tang (2007) focus particularly on the actions that the agents do, moving forward the examination of just tools, and instead, seeing value in the activities that agents enact with the affordances of the tools available in the blended space. Data analysis involved tracing the activities of students and the teacher across the digital and the physical spaces and coding them according to the networked learning model. This involved the analysis of various data sets, particularly the observations done during the field work, the recordings of students' interactions on Edmodo and students' production of tasks' outputs on digital and physical

mediums. It also included the revision and alignment of evidence of activities across the physical and the digital space. I used NVivo software to organize the data activities gathered in the physical space and those that were retrieved from the digital space.

A networked analysis takes into account only observable data, such as record of classrooms, entry logs, or students' artefacts. However, it provides little insight related to actors underlying reasons about why certain activities take place and in relation to the ways and purposes for communication (de Laat, 2006; de Laat et al., 2007). To overcome this problem, current research is using multi-method approaches (Weinberger & Fischer, 2006). Ultimately, the analytical approaches are interrelated as they contribute to understand a phenomenon from different focuses and through different data set. In addition, this also contributed to the triangulation of the data, strengthening the trustworthiness of the study (Denzin & Lincoln, 2013; Denzin, 1978). Hence, a thematic analysis approach was employed for analysing students' and teachers' perceptions of blended learning.

Thematic analysis is a qualitative analytic method similar to grounded theory (Braun & Clarke, 2006); although both methods search for patterns and themes in a corpus of data, the latter aims for the construction of theory (Glaser, 1998) whereas the former outlines salient themes and elements facilitating the structuring of major themes, but without aiming to elaborate a theory and hypothesis based on the empirical data (Attride-Stirling, 2001). In particular, all the interviews from teachers and students were transcribed and the software NVivo was used to codify the qualitative data. From here, analytical codes, dimensions and categories were created in light of the results of the data and in alignment with the conceptual framework of the present study.

A similar inductive procedure was utilised to analyse the open-ended questions from the students' survey which adopted a form of a metaphor. Students were prompted with the following metaphors:

“If technology were a food, how would it look (taste) like”.

“If Edmodo were a food, how would it look (taste) like”.

The use of metaphors has been utilised in educational research for eliciting worldviews and connecting thinking with tacit assumptions and beliefs (Sfard, 1998; Wan, 2014). As Sfard (1998) describes, “metaphors are the most primitive, most elusive, and yet amazingly

informative objects of analysis. Their special power stems from the fact that they often cross the borders between the spontaneous and the scientific, between the intuitive and the formal” (p.4). Since language transports and is constitutive of rational and everyday practices, metaphors allow the connection of formal thinking and tacit experiences (Reddy, 1978). The ubiquity of metaphors and the fact that language allows humans to talk about a concept and at the same time relate that talk to another dissimilar concept proves the utility of metaphors for understanding a phenomenon. Thus, eliciting the metaphors that students create about the use of technology and Edmodo, was the main purpose of analysis in this section (an explanation about the use of metaphors in research on education is extended in section 5.1.5).

Finally, three questions from a survey were employed to capture students’ perceptions about technology in the classroom (see section about data collection 4.1.4 for a detailed explanation on the characteristics of the survey). For that, a descriptive analysis was undertaken by using the software SPSS. This resulted in outputs extracted from students’ closed-ended response which can be visualised in a table including the frequency and the percentage in each category of the Likert scale.

Interactions

Using a situated discourse analysis technique, selected classroom interactions in the physical space and in the online space were analysed (Bloome et al., 2005). This analytical approach served to explore the research question about students’ and teachers’ discursive patterns in the blended classroom. As Bloome and Clark (2006) state, “we use discourse-in-use to ask who is using language and other semiotic tools to do what, with whom, to whom, when, where and how” (p.209). Consequently, discourse analysis focuses attention on how people adopt tools to communicate and engage in semiotic practices and in turn create social realities. Adapted from Bloome et al. (2005) events are considered as “bounded series of actions and reactions that people make in response to each other at the level of the face-to-face interaction” (p.5). In addition to the face-to-face interactions, events were considered at the level of interactions that occur in the online space of the Edmodo wall. As Bloome et al.,(2005) point out, “conceptualising events in empirical spaces for inferring practices is both appropriate and useful” (p.6). Two levels of analysis were included:

1. Contextualisation cues: how does the speaker/writer use the language and other situated cues?
2. Turn taking: how does the pattern of turn-taking relate to shared expectations among participants of a particular situation/event?

In order to break down these ideas into more detailed units of analysis, I asked a number of questions while examining the data:

- Who is expected/has the right to take the floor?
- Who is expected to answer questions/solve problems?
- Are questions framed by the teacher legitimate opportunities for students to freely answer, or are they tied to limited answers/solutions?
- Are students given opportunities to initiate, make a statement, ask or challenge an opinion on a given topic?

At the first level of analysis I focused on a close examination of the use of language as well as the use of paralinguistic/prosodic and proxemic cues by participants —students and teachers— within the utterances. These conventions are based on the adaptation of Bloom et al. (2005) and Curwood (2014). Of course, the analysis of the discourse on the Edmodo wall (online) only considered the use of language and the use of new visual modes of communication, such as emoticons. The contextualisation cues can be seen in Table 7.

Contextualisation cues	Symbol
<i>Paralinguistic/prosodic</i>	
Stress	Underline
Velocity slower than surrounding discourse	<>
Velocity quicker than surrounding discourse	><
Volume shifts louder	Bold
Volume shift softer	=
Voice, pitch or style change	*
Many students speaking at once	:::
Short pause	
Long pause	
Undecipherable	?
<i>Proxemics</i>	

Close distance	[]
Long distance] [
<i>New visual modes of communication</i>	
Emoticons	=

Table 7. Contextualisation cues adapted from Bloom et al. (2005) and Curwood (2014)

At the second level of analysis I focused on examining situated patterns of turn-taking in the classroom, including both digital and physical. Here my interest was in focusing on language embedded in underlying social relations. In this way, the analysis could provide cues to identify the ways in which students and teachers interact in the blended classroom. In addition, the analysis involved looking at the roles and identities of students and the teacher as revealed and mediated by language. I applied the Initiation, Response, Evaluation (IRE) structure (Mehan, 1979) to examine turn-taking in the blended classroom. In his seminal study, Mehan (1979) looked at the social organisation in the classroom across different subject areas over a year, concluding that the most common sequence of interaction in the classroom was the IRE sequence. This pattern of interaction in the classroom started with the teacher asking a question with an expected correct solution. This initiating move was followed by students answering the question prompted by the teacher and completed by the teacher's evaluation of the students' response. Since Mehan's published his seminal work, there has been a great debate regarding the patterns of interactions in the classroom spaces, questioning the real opportunities that students have to engage in cognitive processes during classroom talk (Bloome & Clark, 2006; Christie, 2002, 2003). Although the IRE structure talk was initially used to examine classroom talk, I expanded on this structure in order to better reflect the various layers of talk structure happening in the classroom. This explains why some codes were double-coded, as a twofold function of the language was observed. Thus, while the language is "doing" one thing, the teacher intent is making it serve another purpose. An extended discussion regarding the situated discourse analysis employed, can be found in the findings, section 5.2.1.

A second analytical approach was utilised to examine the online interactions in the blended classroom. A content analysis approach was complementary to the situated discourse analysis approach as it allowed to examine in detailed the interactions occurring online. This was also relevant as, —in contrast to the situated discourse analysis were I selected specific events— a content analysis approach allowed the inclusion of all the interactions occurring during four months, and consequently it provided an understanding of how all the participants interacted

over time. Some of the questions that arose from the situated discourse analysis and that were later covered by a content analysis approach were for instance: What type of interactions were students engaging in? and, How were students' communicative patterns organised and facilitated in the online space?. In particular, this coding schema allowed identifying if students were active participants in the online space and if so, how such activities took place. In addition, it deliberately indicates that not only the teacher, but also students might play a role in the learning activities occurring online. For this, all interactions of students online in the social network site Edmodo were extracted. This included four months of data. The entry logs (or individual posting) were analysed using a content analysis technique (Krippendorff, 2013) employing the Schema for Tutoring Processes, which was applied and expanded, as its original version was designed for students in tertiary education (Anderson, Rourke, Garrison, & Archer, 2001). Thus the original version was expanded in order to capture the nature of primary school interactions. This schema consisted of three main categories: Instructional design and organisation (ID); facilitating of discourse (FD); and direct instruction (DI). The coding scheme along with the indicators and examples can be seen in Table 8.

Instructional Design and Organisation		
<i>Indicators</i>	<i>Examples</i>	<i>Verbs associated</i>
Setting curriculum	'This week we will be discussing..'	Prompt tasks; provide
Designing methods	'I am going to divide you into groups, and you will be debate...'	guidelines; provide resources
Establishing time parameters	'Please post a message by Friday...'	
Utilising medium effectively	'Try to address issues that others have raised when you post'	
Establishing 'netiquette'	'Keep your messages short...'	
Making macro comments about course content	'This discussion is intended to give you a broad set of tools/skills which you will be able to use in deciding when and how to use different techniques'	
Guiding towards resources	Resources added to develop tasks such as Edcanvas, YouTube videos.	
Facilitating discourse		
<i>Indicators</i>	<i>Examples</i>	
Identifying areas of agreement/disagreement	'Joe, Mary has provided a compelling counterexample to your hypothesis. Would you care to respond?'	Moderate discussions; share personal information; elicit opinions; encourage involvements; praise; solve technical problems
Seeking to reach consensus/understanding	'I think Joe and Mary are saying essentially the same thing'	
Encouraging, acknowledging, or reinforcing students contributions	'Thank you for your insightful comments'	
	'Good work'	
Setting climate for learning	'Don't feel self-conscious about	

Drawing in participants, prompting discussion	thinking out loud on the forum. This is a place to try out ideas after all'	
Assess the efficacy of the process	'Any thoughts on the issue?'	
Checking, reviewing procedures (e.g. homework)	Was anyone doing the daily digest today?'	
Giving instructions on how to proceed and responding to technical concerns	'The document is not attached'	
	'we just write the tasks that we are aiming to do in the order that we want to do them in'	
	'Just scroll down and you will find it.'	
Clarifying	'Was it Sprry?'	
Direct Instruction		
<i>Indicators</i>	<i>Examples</i>	
Answering questions	'Bates says...what do you think'	Ask questions about the topic established; offer comments; offer feedback; provide suggestions;
Share information/questions		
Focus the discussion on specific issues	'I think that's dead end. I would you ask you to consider...'	synthesize opinions; offer clarifications; resolve task problems; offer opinions
Summarise the discussion	'the original question was...Joe said...Mary said...we concluded that...we still haven't addressed'	
Confirm understanding through assessment and explanatory feedback	'you're close but you didn't account for... this is important because'	
Present solution	'The correct answer is'	
Clarify, Diagnose misconception	'Remember, Bates is speaking from an administrative perspective, so be careful when you say...'	
Inject knowledge from diverse sources, e.g., textbook, articles, internet, personal experiences	This idea reminds me on a website that has similar elements, this is the link www.bla.com	

Table 8. Schema for analysing students' engaging in tutoring practices, adapted from Anderson (2001)

The Anderson coding schema has been previously used to understand the potential of Information and Communication Technologies for learning, and in particular in learning networks in higher education, presenting good reliability (Anderson et al., 2001; de Laat, 2006). Contributions of students and the teacher on the Edmodo wall were systematically extracted over four school months and coded using the categories of the schema. It is important to note that contributions were related to a variety of learning activities regarding literacy, numeracy or project-based work, and, thus did not focus on specific tasks (for instance a team-work task or a specific project).

Artefacts and new literacies

Thematic analysis was used in order to examine how new literacies are enacted in the blended classroom, and in particular how traces of such practices become visible on the Edmodo wall. All the interactions posted on the Edmodo wall by students and the teacher over four months were retrieved and gathered in a database. This allowed an analysis of the interactions occurring in the online space. The entry-logs of students and the teacher on Edmodo were observed multiple times applying an inductive criteria (Braun & Clarke, 2006). Iterations of reading of the data resulted in key analytic themes, and are summarised in Table 9.

Key themes	Descriptors
Instruction	Teacher modelling Teacher/student moderation Reciprocal teaching; peer teaching
Online classroom	Student/teacher identity Student/teacher agency Student/teacher position and voice
Edmodo affordances	Portal for: accessing information; providing content Portal for distribution of: resources; knowledge; dialogue Platform for collaboration Platform for sharing through multiple modes of expression Platform for supporting: interactions; sharing of discourse; audience formation; authoring processes
Edmodo constraints	Need for self-regulation Need to set boundaries/Netiquette Access Troubleshooting

Table 9. Key themes identified on the Edmodo wall

In addition, a multimodal analysis was also applied to two videos produced by students in this blended classroom in order to better understand students' modal choices, and to examine how such choices might function to reshape students' engagement with English subject in the blended classroom. Multimodality is understood as embedded in *social semiotics* (Hodge & Kress, 1988). From a social semiotic perspective, any attempt at communication is a social endeavour. Whether driven by the interest of representing a point of view, establishing dialogue with others or stimulating the audience through semiotic signifiers, meaning making is underpinned by a social attempt (Burn & Parker, 2003). Halliday's work on social semiotics or Systemic Functional Linguistics (SFL) (Halliday, 1978) laid the foundation for current intersemiotic analysis. Although Halliday's work focuses on language only, others have applied the following semiotic functions to multimodal analysis (Kalantzis & Cope, 2012; Kress, 2013):

1) ideational

2) interpersonal

3) textual

These three functions are also coined as representational, orientational and organisational (Burn & Parker, 2003; Lemke, 2002). Here, I use such words interchangeably to refer to multimodal choice. The ideational, interpersonal and textual modes refer to functions that can be found in a given communicative practice (Bezemer & Kress, 2014):

- in relation to ideas represented and communicated;
- in relation to the people interacting;
- and in relation to the coherence of the form adopted for communication, such as internal and external coherence of the sentence.

Building on Halliday's work, scholars such as Royce (1998, 2007) developed a framework to analyse multimodal text that combines the visual text, the verbal text and the relationship between such texts (Royce, 1998). Royce argues that a composition that shows coherence between the visual and the verbal is an indicator of *intersemiotic complementarity* (Royce, 1998). However such analysis offers little insight into the understanding of other mediums such as videos, games or simulations, as in these latter texts the boundaries between the visual and the verbal are not clearly delineated, because the spoken word and the moving image are entangled.

Later, Burn and Parker (2001, 2003) drawing on sociologist Goffman (1959) and on the theorist Metz (1974), developed a framework that allowed the investigation not just of the written and the visual text, as in Royce's (1998) approach, but of the moving image, or as they called it the *kineikonic mode*, literally "the mode of the moving image" (Burn & Parker, 2003, p.13). Burn and Parker (2003) combined the "language of filming" with the "practices of filming" such as music, action, or shot level, in their analytic framework. In particular, they include the following elements in their analysis of the *kineikonic mode*: music, action, shot level, written language, speech, movement over time, the design of social space, the combination of modes, functional load (Burn & Parker, 2003, p.25). This analytical framework was selected as it provides a systematic approach to understand the multimodal

choices of students in this classroom to design and produce their movies. However, a critical perspective from Burn and Parker's work (2001, 2003) was taken, in order to adapt such framework to the modes that were found in students' videos selected for analysis. In addition, Curwood and Gibbons's work (2010), was used for this adaptation. The following codes were used to analyse the video produced by Patrick, Sam and Eric and the video designed by Kim:

1. *Time*: related to the notion of image, this code accounts for a text that is not static but rather moves in time.
2. *Image*: although the final aim of a multimodal analysis is to understand how modes act in conjunction, in order to do so, dividing the elements of the group is needed. As a result, an image of the videos was analysed every two seconds. In particular the framing and the angle at which the shot was taken, were included. Framing and shot indicate power relations and proximity, or conversely, social distance between the viewer and the maker and give an idea on how the social relational aspect is accounted in the moving text.
3. *Action*: related to the notion of image, action refers to the major activity happening in every unit of study each two seconds in the video. As Burn and Parker (2003) state, action is intimately related to voice and agency as it represents the selection that the author(s) of the video have made in terms of meaning making and consequently the message that the author (s) is trying to convey.
4. *Written text*: refers to the characteristics of the printed text included in the video. In particular refers to the content, font, size position and colour of the printed text.
5. *Audio*: in this category audio was used to denote both speech and music. In the case of speech I looked at the type of speech included in the video. For instance, a narrative speech, or a first person speech. Music was another way to analyse audio. For that, the style of music (e.g contemporary/classic; including lyrics or excluding lyrics) and the language used (e.g English or German) was considered.
6. *Transition*: it signifies a change in the story manifested in the video. Transitions may mark a shift between the past and the present and a consequent change in the style and characteristics of previous codes.

Although a first layer of analysis was useful in deconstructing students' multimodal choices, it did not indicate clearly the underlying messages contained in such choices. Thus, a second layer of analysis was added to link multimodal choices with issues such as: how students positioned themselves in the multimodal text; what types of relationships they established with the audience; and the type of content that they were stressing, while engaging in kineikonic production. Consequently three elements were considered in this second layer of analysis: a) the narrative aspect; b) students' positions and interaction with the viewer; c) and juxtaposition of modes to convey meaning. This analysis is based on an adaptation of the three metafunctions coined originally by Halliday, *ideational*, *interpersonal* and *compositional* (Bezemer & Kress, 2014; Kress & van Leeuwen, 2001; Kress, 2010). A description of these metafunctions were offered previously in this section of data analysis.

4.2 Trustworthiness of the data

Since the introduction of qualitative research into the field of education, questions have been raised regarding the precision of qualitative research. Scholars have critically considered how to judge the trustworthiness of qualitative research and debated whether the terms and frameworks from quantitative research can (or even should) be applied to qualitative research. Validity and reliability are concepts that relate to a positivist and post-positivist paradigm of research (Babbie, 2009). As such, it is believed that the subject (researcher) and the object of study are separate entities and that the ultimate goal of the researcher is to unravel the truth by applying rigorous and systematic scientific methods. Ultimately a positivist approach underlies the philosophical position that there is an absolute true knowledge able to be measured through the scientific method. Validity and reliability in this context are essential in order to assure alignment between the concept being studied and what is actually being reported; and second to assure that the results can be extrapolated to other samples in the population.

The present study differs from a positivist epistemological view about research as it acknowledges the impossibility to uncover the "truth" of any phenomenon. Instead it attempts to explore and examine a phenomenon recognising the effects that the researcher has in the inquiry process and the bias embedded in such logic of inquiry. The concepts of validity and reliability under a qualitative approach are replaced by the notions of

trustworthiness, rigor and quality (Guba, 1981). Thus, while the attempt to discover knowledge by measuring techniques is not applied in this study, it is still important to obtain results that are justifiable and establish confidence in the findings (Denzin & Lincoln, 2013).

The nature of rigor within qualitative research, refers to making “data and explanatory schemes as public and replicable as possible” (Denzin, 1978, p.7). According to the literature, establishing trustworthiness of the findings is essential for qualitative research. Verification procedures are directly linked to the credibility, transferability, dependability, and confirmability of the study (Creswell & Miller, 2000). Creswell & Miller (2000) found eight forms of verifications in the literature; later Creswell (2013) suggests the need for qualitative studies to include no less than two of the eight in order to meet trustworthiness goals. These forms of verification can be seen below:

- (a) prolonged engagement and persistent observation,
- (b) triangulation,
- (c) peer review or debriefing,
- (d) negative case analysis,
- (e) clarifying researcher bias,
- (f) member checks,
- (g) thick description,
- (h) external audits.

In the present study, the first form of verification was accomplished by establishing engagement in the space of the data collection over three school terms. Moreover, a main way to increase the trustworthiness, rigor and quality of a predominantly qualitative case study is by triangulating information (Baxter & Jack, 2008). Two main types of triangulation are considered in this analysis: first the inclusion of multiple methods of data collection (interviews, observations, video recordings, collection of artefacts, entry logs and a survey), and second the inclusion of various sources from which to gather information (this is considered by including 30 students participating in the study along with the teachers teaching Year 6 in the school and the principal of the school. Consequently I observed traces

of learning embedded in discursive practices, artefact production and cultural practices across spaces.

Another form of verification identified by Creswell (2013) is thick description. Thick description draws on the context in order to give a detailed account of field experiences (Geertz, 1973). This contrast with entering into a field site focusing on previously selected patterns of behaviour. This form of verification was considered at all stages of the study. By employing these three forms of verification, the present study meets trustworthiness standards (Creswell, 2013).

4.3 Ethical considerations

The present study was undertaken in accordance with the ethical regulations of the University of Sydney and the Faculty of Education and Social Work as well as with established general ethical considerations involving informed consent, anonymity and confidentiality (Neuman, 2000, 2006). Participation Consent Forms were provided and Parental Consent was sought for all the participants aged under 18 years, prior to the commencement of the study. Participant Consent Forms were accompanied with a Participant Information Statement explaining the main aims of this research. Participants were given clear information of the purpose of the study alongside clear accounts of how data would be collected and managed. In this regard, information remained confidential through all the stages of the study and participants' identification as well as the name of the school was kept anonymous. Participants were also asked to consent to the audio recording of interviews and video recording during classroom observations and to consent to the researcher's use of the collection of online communication and the digital artefacts they produced. Finally, even though the present research includes young students in the data collection process, which according to the Human Ethics Department might be a factor of risk, the students were observed in a regular setting and no further interventions were made.

5. FINDINGS

This chapter presents results of the analysis of the blended learning environment of the year 6 classroom. The findings are divided into three sections. Section 5.1 examines the link between spaces and tools. Section 5.2 explores the interactions between the teacher and the students in and across the physical space and the online space. Section 5.3 examines the new literacies and the multimodal artefacts produced by students in the classroom. In each section, the analytic framework underlining this research—including a social, cultural, distributed, material and networked learning approach— helps to illuminate how actors, their interactions and activities, as well as their artefacts, are interwoven in the blended space. Each section begins with a brief contextualisation of the focus of analysis, including the research question and the methodology applied.

5.1 Linking spaces and tools in the blended classroom

What do we need to know about the relation between space and tools for learning? (Goodyear et al., 2014) is a key question in a context where primary classrooms are progressively adopting blended learning. The answer is not straightforward. Although several studies have supported this line of inquiry for over a decade in higher education (Bliuc et al., 2011; Carvalho, & Goodyear, 2014), research has been slow in acknowledging the need to address these issues in schools, and in particular, in primary years of schooling. As suggested early in the theoretical review, tools mediate learning and they do so in different ways (Gibson, 1986; Norman, 1988). The configuration of the space plays a significant role in this relation, as it includes the types of tools available to students at any given time and the kinds of activities that participants of a learning environment can engage in. In this section, I will first explore the configuration of the space for learning and then I will complement this analysis with the consideration of participants' perspectives of the way technological tools and in particular Edmodo shape their learning (sections 5.1.3 and 5.1.5).

5.1.1 The configuration of the set design (space and tools) in the blended classroom

In order to explore the connections between space and tools in the blended classroom I examined a physical space where students and teachers interact in conventional face-to-face and in online spaces. I used the architecture of productive learning networks framework (Carvalho & Goodyear, 2014) to analyse relationships among students' learning activities, teachers' instruction, and the spaces, tools, and resources they interact with in the classroom.

Research into the role of physical and digital spaces in learning settings not only involves thinking about agents, tools, and the layout of those environments but also implies understanding of how those factors come into play, interact, connect, and interfere with one another during learning events. The present analysis was guided by the following research question:

- How do the space and the tools available in a blended classroom shape teachers' and students' practices?

The present analysis of teaching and learning takes an activity-centred approach, emphasising the relational aspect of agents (the students and the teachers) and the digital and physical classroom resources. Consequently, I look at the intersection between agents and objects, and the activities and actions that evidence the relational aspect of elements, agents, and the learning and teaching practices in a physical and in an online space. As contextualized in the theoretical section of this thesis, a networked learning approach supported the present analysis (Goodyear et al., 2014; Goodyear & Carvalho, 2014a) by focusing on the activities happening between agents and tools across multiple spaces in the blended classroom. I then consider how material and digital elements in the online and physical spaces are related to particular ways of teaching and learning. Thus, students' and teachers' practices across digital and physical spaces are examined through a networked learning approach. While I examined the data through the lenses of the set design, the analysis also included epistemic and social aspects as well as co-creation and co-configuration, as those aspects are constitutive elements of the architectural framework of networked learning and, consequently, intimately related to set design (Carvalho & Goodyear, 2014). Data analysis involved tracing the activities of students and teacher across the digital and the physical spaces and coding them according to the networked learning model (see section 4.1.5).

I begin by describing the *set design* that was in place for students and teachers during the project. Next, I examine Claire's practices in the context of a blended environment. Finally,

in section 5.1.5, I connect those activities with the perceptions of the agents (teachers and students) about technological tools and the influence on students' learning activities.

Understanding the set design: Physical space

The set design analysed in this research consists of both a physical and a digital space. The physical space has two floors and a wide staircase that connects the two areas of the large open plan environment. In the physical space, the material elements of the classroom included large and A4 sized whiteboards, two project screens, one in each level of the plan, and walls that function as a canvas for writing, drawing, and sketching. Tools available in the space include students' and teachers' laptops, notepads, pens and paper. The furniture in the space combined conventional elements of a classroom environment such as seats and tables along with less traditional and movable furniture such as bean bags, laptop trays and rugs, which in combination with power points, allowed students to work on the floor.

During the theme park project, the class moved mostly around the second floor and the wide stairs that connect the large classroom. While working in these spaces, I observed students engaging in three types of activities. The first type was related to Claire's direct instruction, involving setting the tasks for the day, presenting resources for the task, and answering students' questions and was regularly undertaken in the second floor. When setting these tasks, Claire asked students to gather together in one big circle facing her; while she had her laptop, a whiteboard and a screen in close proximity. The second type of activity was related to the presentation of students' work and was consistently located in the second floor. During those activities the space functioned as a stage where students presented their draft and final work to their peers and teachers using the facilities of the screen and laptops. The third type of activity was situated on the staircase and on the second floor, and it was related to students' independent work. During these activities, students were free to move around unconstrained. For instance, students could sit on movable furniture and configure themselves within the physical space. Students could often make decisions regarding their tools, including whether to work with pen and paper, laptops, or both, and their proximity to other students.

The latter activities show evidence of students' agency during learning activities. Such agency was not only related to decision making regarding their physical trajectories during

learning lessons, but, I suggest, it was also related to students' cognitive involvement in the tasks. For instance, checking other students' work, collaborating with their peers, and having a sense of their comparative progress during learning lessons was facilitated by students' ability to move around the space. Such activities differ in the use of the space to activities described as type one and two (above) in which students were expected to face the teacher (or the students when presenting) and to be quiet and attentive. As observed, the set design of the classroom space was flexible in accommodating structured activities, which in combination with the social implicit agreements for circulating and, collaborating with peers, promoted students' agency and independence. Figures 9 and 10 show the physical spaces where the project took place.



Figure 9. Physical space of the Year Six class



Figure 10. Physical space of the Year Six: Stairs used during independent learning

Understanding the set design: Online space

The online space consisted of a learning management system (LMS), a social network site (SNS), a Wi-Fi network and a 1:1 student-laptop policy ratio, due to the school BYOD (Bring Your Own Device Policy), and students' email accounts. The online space also included undefined locations where students use their laptops to enter online *portals* (Gee, 2004) such as the SNS, the LMS, and their email accounts. Those portals, accessible anytime and anywhere, enabled students to participate and follow up the online learning activities outside the classroom. Undefined spaces where learning and literacy activities continued during the project involved for instance students' houses, the school library, the school yard, even the bus (Pahl, 2014).

The LMS functioned as a repository of information, through a curriculum announcement board where teachers, students and parents could access the term schedule, tasks, and resources related to learning tasks. The information displayed was customised depending on who was accessing the LMS. Therefore, students, teachers, and parents saw different interfaces, each supporting the connection of relevant learning resources and the curriculum

to the agents involved in the process of schooling. During the project, the main function of this digital space was to archive, access and display relevant documentation related to theme park tasks. Throughout the project, Claire uploaded resources that the students were able to access anytime and anywhere.

Edmodo was the SNS used in this classroom (see section 3.1.5). The layout of the interface allows users to engage in social networking practices (Greenhow, 2011) involving the design of their own profile; traversing, interacting and sharing content across the network in an asynchronous mode; and receiving notifications on assignments, due dates, and learning activities. Although the activities in which students and the teacher engaged in the online space were spread over different devices, applications, and interfaces, often the communication of pedagogical instruction happened through text-based asynchronous interactions on Edmodo. This is not surprising given that this tool is specifically designed to promote dialogue between the agents in the network, yet it was often preferential for teaching purposes compared to synchronous face-to-face communication in the physical classroom.

Navigating between the physical and the digital spaces

A distinctive element in this learning network is that activities oscillated within and across online and physical settings, yet also over time. This echoes Hutchins (2000), who states that:

cognitive processes may be distributed across the members of a social group, cognitive processes may be distributed in the sense that the operation of the cognitive system involves coordination between internal and external (material or environmental) structure, and processes may be distributed through time in such a way that the products of earlier events can transform the nature of later events (p.1).

Whereas the use of the physical space was highlighted at the beginning and end of the project, activities in the online space acquired a noticeable predominance during the middle of the project. This does not mean that either of the spaces has an exclusive function when in its peak, rather there is a clear oscillation and interdependence between them. For instance, at the beginning of the project the teacher emphasised the use of the physical space and material resources for engaging students. In turn, this affected the social and epistemic design that capitalise on face-to-face interactions aiming to stimulate students' prior knowledge and

interest in the project. Over this period, no other devices other than pen and paper were used. The focus was on students' attention to the teacher's discourse and on students' dialogue about their experiences with theme parks.

This contrasts with the intense use of laptops, Edmodo and the LMS when students initiated the development of their projects. In particular, students' use of the online connectivity and Internet allowed them to develop their projects. I will revisit this idea later in the analysis.

Set design and insights on teachers' practices

Teachers' practices in this *learning network* environment are strongly distributed across different spaces and tools. Instructional activities such as setting tasks and establishing time parameters were channelled through online portals, particularly through the use of Edmodo. This type of activity was possible due to the affordance of the SNS, which permits quick asynchronous interactions and works as a repository where students can revisit their work at a later time. For instance, after the first learning lesson, Claire uploaded a post on the Edmodo wall. In this post she recapped the instructions explained during the lesson and the due day for submission. She also included a link where students could find a compilation of resources relevant for completing the weekly task about the theme park. She would repeat this action of distributing and reinforcing information over the three following weeks. The instruction on Edmodo is illustrated in Extract 1.

History of Theme Parks

Due Jun 7, 2013

1. Research the history of and present your findings on PP or Prezi of one of the following theme parks:

- a) Sydney's Wonderland
- b) Luna Park (circa 1980)
- c) Old Sydney Town

2. Explain the theme of the park

3. Display some of the major attraction

4. Explain the reason for closure

5. Describe 3 lessons learned from this park's closure

We'll be using this resource for our Theme Park Imaginarium (Edcanvas | Theme Park Imaginarium Part 1, Jun 4, 2013)



Extract 1. Teacher's announcement on the Edmodo wall

During the project Claire shared content-related resources on the LMS and used Edmodo to communicate to students where the resources about the theme park project could be found. By capitalising on the affordances of online tools, the teacher was able to design tasks that invited students to engage in active learning practices such as self-directed and independent learning. In contrast, a teacher within a conventional classroom environment would have had to invest time during the learning lesson to introduce the concepts needed for students' active work. The use of the online space in turn liberated time for the teacher to focus on personalised teaching. The analysis suggests that the explicit inclusion of online elements in the set design was intrinsically connected to an epistemic design that envisaged the redistribution of instructions and knowledge-related content, which then enabled other forms of instructional and learning activities in the physical context.

Along with the distribution of the teachers' instructions and content-related practices across spaces and tools, the nature of teachers' resources was also distributed over a variety of modes. The digital resources consisted of Microsoft Word documents as well as audio and video files; they also included multimodal, visual, aural, kineikonic and written modes (Curwood & Cowell, 2011). Such digital resources were different (Norman, 1988; Zhang & Norman, 1994) in materiality and shape, extending the traditional use of pen and notebook in the classroom. By opening each of these resources, students were directed towards different digital spaces. Consequently, when Claire geared her teaching methods towards the digital, students were learning to use other resources different to conventional tools, such as pen and paper, worksheets and notebooks. This led students to alternative ways of thinking, sharing, and producing outputs in the classroom. As di Sessa (2000) argues, the tools of written text and mathematic graphemes constitute the foundation of formal education and the elements with which to think, calculate and represent ideas. Yet in a digitally saturated era, other modes and tools for thinking enable young learners to effectively participate in society (Jenkins et al., 2009). Therefore, the findings suggest that the affordances of this set design and the tasks that the teacher designed in this *learning network* environment augmented the range of students' cognitive possibilities.

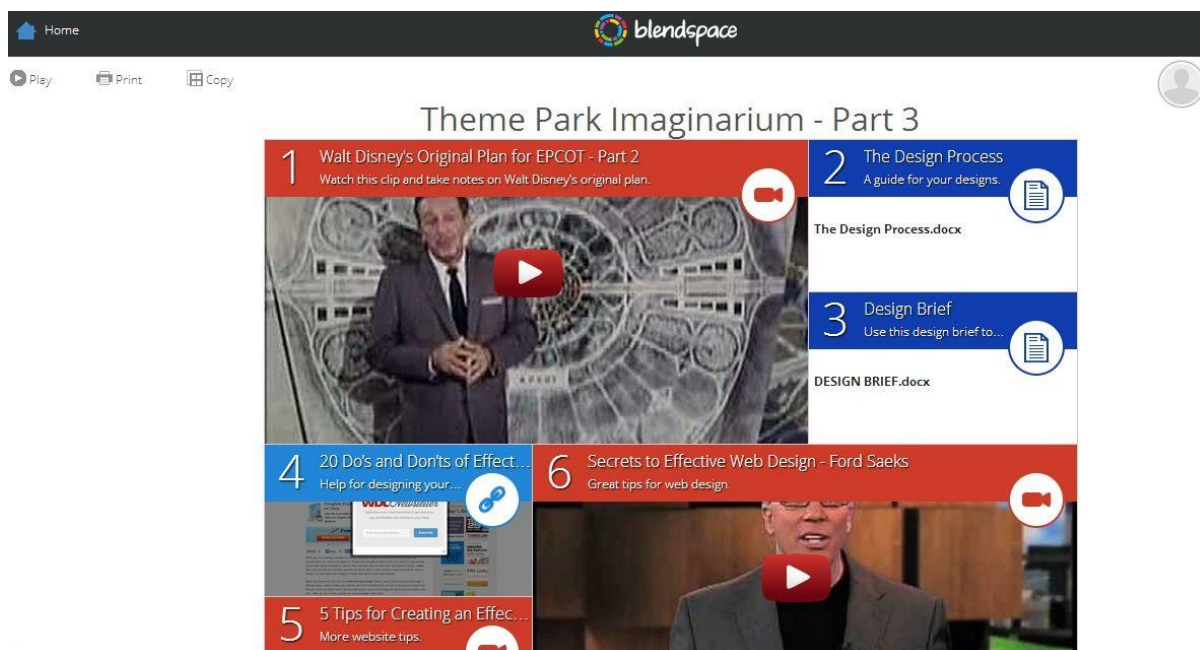


Figure 11. Edcanvas designed by the teacher during the theme park project

According to the *architecture of productive learning networks* approach, ICT is used to support connections between agents and resources in a learning context (Carvalho & Goodyear, 2014). What differentiates this type of connection from formal face-to-face connections is that the epistemic transaction, including social interactions, production of outputs, verbal thinking, and collaboration, is highly distributed. The *connections*, and consequently the distributed knowledge among the relational elements in a learning environment, are constitutive to the definition of productive learning networks.

Another feature of teacher practices in this space was the distribution of knowledge across agents. In other words, the role of the teacher as the one who was in control of the management and the knowledge in the classroom was distributed across students and the teacher. The distribution of this function was facilitated due to the coexistence of a set design that offers a space for face-to-face communication in the classroom and Edmodo in the online space. For instance, whenever the teacher posted requirements, a number of questions from students was raised. Instead of waiting for a teacher's reply, what I observed consistently from the data is that in these cases students positioned themselves in a teacher's role and answered other students' questions. By checking students' questions, coming up with solutions, revisiting the information posted on the online wall at different times, and elaborating and expanding on peers' answers, a pattern of reciprocal teaching appeared consistently across the activities (Palincsar & Brown, 1985; Palincsar & Ladewski, 2006;

Palincsar, 1998). Here it is clear how a set design that distributes elements in physical and online spaces facilitates reciprocal teaching among students and allows the knowledge to be redistributed among the agents participating in the project. Consequently, not only the teacher but also the students were able to share resources and knowledge about class activities. This idea is further analysed in the findings chapter in section 5.2. Extract 2 illustrates this idea.

Teacher and students interactions on Edmodo	Agents	Date	Type of interactions
Theme Park Design Turn In Due Jun 27, 2013 Individually or in approved groups, students create an 'Australiana' themed park concept website and model for future investors including the following elements: Theme park name Logo Catch Phrase Vision Statement Indigenous considerations Inclusive considerations CIA considerations	Teacher	17/06/13	Task announcement
What does "vision statement" mean?? :)	Student 1	18/06/13	Clarification
vision statement???	Student 2	18/06/13	Clarification
what are all of these considerations	Student 3	18/06/13	Clarification
Vision Statement is your vision for your theme park... i think.	Student 4	24/06/13	Student's contribution
I hope that answers your questions	Student 5	24/06/13	Student's social acknowledgment
It is a statement about the goals and basic theme of your park.	Student 6	24/06/13	Student's contribution
Ok thanks guys! :)	Student 4	24/06/13	Student's social acknowledgment
What does the CIA mean ??? plz respond ASAP	Student 7	25/06/13	Clarification
Christianity in action, it means what are you going to put in your park that might be about God or whatever religion :)	Student 4	25/06/13	Student's contribution
YAY, now I have finishes all of the questions and onto my sketch up! :)	Student 4	26/06/13	Student's social acknowledgment

Extract 2. Interactions on Edmodo

As the evidence above suggests, extending the opportunities for teachers to use digital resources not only affects teachers' repertoire of instruction but also offers opportunities for students to engage in reciprocal teaching and collaborative patterns of interactions affecting both teachers' and students' practices. In other words, the connections among agents and tools in a blended learning environment are rich and diverse, enhancing the process of distributed cognition across its elements. As Lave (1988) explains, "Cognition is a complex social phenomenon...distributed-stretched over not divided among-mind, body activity and culturally organized settings (which includes other actors)" (p.1).

A traditional classroom environment often limits the chances of social interaction due to several factors including the length of the learning lesson, issues of knowledge and authority and the layout of the learning space; as a result, the social configurations of teaching and learning tend to be more hierarchical and teacher-centred (Collins & Halverson, 2009). The findings of this study are consistent with research suggesting that the blending of face-to-face with an asynchronous digital environment allows each student's voice to be heard, gives less constraint in terms of time or space for students to think about their contribution, and increases students' self-expression (Lazonder et al., 2003; Warschauer, 1996).

It is important to acknowledge that the set design is just one dimension of the learning network. The set design was selected for analytical purposes, yet the set design needs to be seen as a relational component, in combination with the social design and the epistemic design. The social and the epistemic design are key in providing a complete "picture" about this blended classroom. So for instance, if we consider the case in which students were not encouraged to participate online, they would most likely not have engaged in the threaded discussion. Ultimately activities are occurring in the classroom because of the types of tasks the teachers are proposing, which involve drawing on the tools and resources available to them. This relational link between social, epistemic and set design in the primary blended classrooms and the possibilities in offering variances for learning are further reviewed in the next sections.

Set design and insights on students' learning activities

This analysis revealed some interesting patterns of students' learning activities. First, the set design of this learning space facilitates students' independent work, which allowed them to navigate the web, choose the resources they need for achieving the outcome of tasks, and in turn develop an individual learning trajectory. To successfully navigate blended spaces and employ various tools, students need a metacognitive awareness about their learning. These metacognitive processes, I argue, are often more complex than those associated with practices that are anchored solely in the physical space of the classroom as students have to make constant decisions about learning activities. This can be seen as potential opportunities for students to engage in self-directed and self-regulated learning, yet as I will shortly address, it might also involve limitations.

Given the numerous decisions students have to make with regards to digital and analogous tools, physical and digital spaces, and time, metacognitive activities including planning, selecting, keeping clarity of the tasks and monitoring time for handing in tasks, adopt a rather multifaceted shape in this *learning network* environment. For instance, Daniel (a pseudonym) sought to design a mind map that involved the following trajectory of actions. He first used Wikipedia and the Web to search for information about mind maps; he then used Edmodo to remind himself about instructions for the task initially set during the learning lesson and to see the questions his peers had posted about the task. Next, Daniel used pen and paper to register, externalise, and organise his ideas. Finally, he navigated the online space and used an online mind mapping tool to design and visualise his ideas about his theme park design; unlike physical tools, this permitted him to quickly try out different combinations by writing and deleting possible concepts to be added in his work.

The trajectories that Daniel and the rest of the students undertook during the theme park project enabled them to engage in independent learning but also to experience different patterns of thinking. This echoes Oviatt's (2013) research that found that interfaces capable of multiple representations, modalities, and linguistic codes can stimulate cognition and performance. Oviatt also found that digital tools stimulate higher levels of communication compared to analogous ones. Having access to multiple tools in the set design, along with a well-crafted epistemic design, stimulated the use of digital tools with which students could experiment to find new ways to represent content knowledge. For instance, I counted several applications that students were trying for this purpose such as Interactive timeline, Trimble3D warehouse, Aspyr, Sketch Express, Mind map, Bubble-us, Stkyz.

The availability of multiple applications that students could access through the Internet to develop their projects might stimulate cognition but at the same time might add complexity due to the constant decision making process that students have to engage with when working in a blended environment of this type. Therefore, tools' affordances provide possibilities for cognitive expansion (Norman, 1988), but if not managed correctly, they also can impact on students' cognitive load (Hoffler & Leutner, 2007).

Finally, students were observed engaging in activities related to new literacies (Lankshear & Knobel, 2011). Unlike traditional instructional methods that often rely on pen and paper, individual seatwork and *recitation scripts* (Wells, 2000), students were challenged in this space to use distributed tools, engage in different reading paths, create texts that are

multimodal (Kress, 2010), and keep track of meanings that count as new symbols for communications in the online space such as emoticons and visualisations. The set design also offered opportunities for students to be aware of audiences other than the teacher and therefore create emerging *portals* where students could share their work (Gee, 2005, 2008; Lammers et al., 2012). Finally, the set design also allows students to experience new forms of interacting and authoring; in doing so, students are learning to cope with the fast speed of feedback that some digital tools, such as Edmodo, enable. This idea will be further analysed in the finding section related to new literacies and artefacts in section 5.3.1 and 5.3.3.

5.1.2 Synthesis of this section

As indicated at the beginning of this section, through the analysis of the relations between elements in the set design, the learning activities and mediated actions of 30 students and the teacher, I was able to examine and highlight the role that space and tools in the space have in a blended primary classroom. This analysis illustrates how elements in the set design offer possibilities for teachers to innovate their teaching practices and how in turn such practices are likely to affect students' learning activities. Self-directed and opportunities for students to engage in independent work were observed. In addition, students were able to engage in rich dialogue with their peers in parallel to the support given by the teacher during classes. Furthermore, the way knowledge was distributed across agents (Claire and the students) was an emerging finding and was further explored through a discourse analysis and a content analysis technique (see section 5.2.1 and 5.2.3). The findings also showed how Claire effectively used the online space for distributing and sharing resources and subject area. This allowed her extra face-to-face time to engage in personalised teaching with students. The question posed by Hewitt and Scardamalia (1998) over two decades ago about what kinds of distribution enhance learning resonates with the shape of distribution in this blended school environment. In this example, physical and online spaces were used by the teachers in productive ways, thereby capitalising on affordances of digital tools to encourage students' independent and active learning. In turn, this affects and is influenced by their epistemic and social experiences. These results show the importance of supporting teachers to integrate new tools and learning processes with a focus on students' potential rather than on technology acquisition in the blended classroom (Koehler & Mishra, 2009). Even though the analysis of this learning network shows productive results, blended classrooms is a complex process that

requires not only the availability of technical resources and support, but the alignment of teachers' beliefs and practices to technology integration in the classroom. These ideas were analysed and are documented in the findings section.

5.1.3 Perceptions of teachers about technology in the blended classroom

In order to gain a better understanding of how blended learning takes place in this classroom and contextualise the data gathered by observations (in the physical classroom and the digital space), I triangulated the data with interviews with teachers. Informed by the types of activities the teacher and students were engaged in, the types of tools selected in those activities, and the type of navigation that students and the teachers were enacting across the physical and the digital environment, the next step in this inquiry was to complement this with less tangible evidence about the perceptions of the agents in this environment. I applied a thematic analysis method to look for evidence about the underlying meanings of technology integration from the agents' point of view. The following research question guided this analysis:

- What are teachers' perceptions of technology and Edmodo in the blended classroom?

As scholars have consistently addressed, increased access to ICTs has resulted in the better equipment of technological tools in the classroom, yet this has not significantly permeated teaching practices (Ertmer & Ottenbreit-Leftwich, 2010; Howard, Chan, & Caputi, 2014; Howard, 2013). Here I examine teachers' own beliefs regarding technology integration in the classroom. By drawing on teachers' interviews I attempt to get a deep understanding of their beliefs about the integration of technology in their teaching practices. The steps for the analysis of the interviews were:

1. Analysis of the data according to teachers' self-report on their knowledge on technology
2. Analysis of the data according to teachers' value and beliefs of technology for teaching in terms of constraints and affordances
3. Analysis of the data according to teachers' construction of identity

4. Analysis of the data according to teachers self-report on school support and social expectations regarding technology integration in the classroom

In the following section I present the testimonies of four teachers working in the same blended classroom space with a total of 180 students.

Teachers' competency with technology

At the time of the data collection, the four teachers interviewed —except Mrs. Melinda— have more than one year of experience in the classroom space. Teachers in this classroom space work with students in Years 5 and 6 (see section 4.1.2 for an explanation about the study context). Overall, teachers rated their competence with technology in a positive way. In a four-point Likert scale level from one to four, teachers situated their competency with technology between competent and very competent. Despite the overall positive perceptions in terms of their abilities to use technology in the classroom, it is interesting to note that the younger teachers self-reported better competencies with technology than the senior teachers, suggesting a relation between age and competence with technology. This is consistent with studies that have reported age as a determinant factor on technology integration in the classroom (Prensky, 2006).

Name	Role	Age (range)	Years of teaching experience	Competence with technology
Miss Claire	English teacher	31-40	11	Very competent
Mrs Kate	English teacher	20-30	4	Very competent
Mr Robert	Math teacher	51-60	25	Competent
Mrs Melinda	English teacher	41-50	15	Competent

Table 10. Characteristics of teachers and competency with technology

Research suggests that teachers are often resistant to integrate technology in the classroom which may depend upon a number of interrelated factors such as negative experiences using technology, anxiety and a lack of perceived value of teaching with technology (Darby, 2008; Howard, 2013). In addition, research on educational technology reports consistently that teachers feeling more competent with technology are also more likely to integrate technology

in their practice (Darby, 2008; Ertmer & Ottenbreit-Leftwich, 2010; Mueller, Wood, Willoughby, Ross, & Specht, 2008).

According to the interviews, much of teachers' confidence with technology has been developed as part of a strong support from the school which is crystallised in weekly professional development sessions. As a senior teacher explains:

We have an IT department and every Monday PLC (professional learning time). So any new forms of ways of doing things with technology, time is taken out to train the staff each week. A lot of that is in PLC time. (Interview 12 April 2013).

Despite the support, some teachers do experience some sort of discomfort in keeping up with technology. Age is mentioned as a factor that relates to their sense of competency with technology. As the senior teacher mentions:

However with me being older, sometimes I'm finding going a bit behind the board. People who are in their '40s or '30s are a lot up with it. (Interview 12 April 2013).

Because there are so many things coming sometimes I scratch my head and I'm —Oh no, a new thing!—. (Interview 12 April 2013).

Having time to explore the many possibilities that digital tools may offer, is another factor mentioned by one of the senior teachers that have allowed her to feel more competent with technology "I'm able to use it more because I've got more time to research and do different things".

As well as the support provided by the school, teachers own interest on exploring technology use in the classroom is key. As Claire shares:

There are a few things that I personally do so for instance twitter helps me to keep on track with the latest things that have come up that would be the number one thing that helps me but also I go to teach-meetings and conferences to help me keep on track and I also subscribe to IT groups where we get emails of new things that come out. (Interview 15 July 2013).

Collaborative work between teachers is another key factor mentioned in addition to the support provided by the school, the availability of time, and teachers' own interest and time

invested in technology. As evidenced by the participants, team-work is important as it allows a progressive incorporation of new technologies in the classroom that relies not on individuals but on the collaborative work and shared vision of a group.

You have to pace yourself, because...and this is where our team mentally come in as well because we all see different things all the time we do draw on each other's resources so it's not that I have to go out and find all these things. (Interview 17 July 2013).

Teachers perceive that negative feelings such as "being overwhelmed" are balanced up because they work together in collaborative ways in the classroom. When teachers share and draw on each other's knowledge about technology, they distribute the responsibility and pressure of being the only experts. Integrating a team work strategy to face technological challenges also allows teachers to sometimes adopt the role of learners/novices within their own community (Wenger, 1998). As Mrs. Kate explains, teachers who are less confident feel comfortable to adopt a position of novices (Brown et al., 1989), thus allowing the ones who feel more confident to take active roles in teaching their peers.

And some of them are more proactive than others, so I think the ones that find it a little bit overwhelming are happy to go "ok I'm happy for you to teach me what's going on next", but I think as a whole we all go "have you seen this" or "have you seen how this works" so it gets integrated slowly and it's not all at once. (Interview 17 July 2013).

Teachers' values of teaching with technology

Unlike the literature suggesting that teachers find little value in integrating technology in their teaching practices, or that it is too "expensive" to integrate technology in their practices as it requires too much time for a small impact on students learning (Howard, 2013; Kervin, Verenikina, Jones, & Beath, 2013), the testimonies of teachers in this classroom report consistently that technologies add value to their practice, and in turn, positively impact on supporting students' learning. What is observed in this networked environment is an alignment between teachers' ideas about student-centred approaches of learning and the belief that technology can be positively used to enhance students' learning. For instance, Claire shares:

I think I would die without it (technology) now. It is just an excellent tool that helps my students and myself to be much more clear about what I'm trying to communicate...I think technology allows the students and myself to access resources at any time, they don't have to be in the building or be at school to be able to access resources and to think about learning which actually guides them to my aim, which is to be lifelong learners. (Interview 11 April 2013).

Claire's ideas regarding technology integration are consistent with other teachers working in the classroom. Mrs. Kate for instance first acknowledges that the role of technology in the classroom is central, yet she then elaborates on that idea, emphasising that technology is "only a tool".

The role of technology is huge in what we do, but I also look back to where we come from and I realised that is a tool rather than an absolute, so while we utilized as much as we can now, I also understand that it can be used in different ways and that it can be used less or more depending on what technology is available at the time. (Interview 17 July 2013).

Consistent with the ideas of his colleagues, Mr. Robert, the most senior teacher, reflects on the role of technology, comparing some of the activities students are able to do now with the activities they used to do in the past. For instance, Mr. Robert suggests that while in the past students' attention in the physical classroom was oriented towards the whitewall, now it is oriented towards various *portals*. Of course this signals a better equipment of technology in the classroom (such as the inclusion of monitors, whiteboards, laptops); however, what is more revealing is that these new tools allow teachers to display and create content in various ways. These new tools and their uses, in turn has an impact on teachers' current routines and practices, as now they can draw on different resources and as a consequence need to select when to rely on analogous or digital tools. For instance, the observations reveal that teachers draw on various tools available in the classroom to strengthen their own explanations of concepts. When planning tasks, teachers take the availability and affordances of the existent tools into account, hence orchestrating the material and social resources existent in the classroom (Goodyear & Carvalho, 2014b). This is consistent with Oliver & Trigwell (2005) who highlighted that the potential of blended learning lies in the possibility of creating a rich learning environment by allowing students to experience variation in aspects of the object of study (p.22).

Mr. Robert has also experienced the transition from teaching in a conventional face to face way, to the incorporation of online learning.

A lot of our curriculum is online now. We've created the portal and they are able to study at home now; and if they are overseas or on holidays they are able to continue with the curriculum, whereas once upon a time you just will set a project and that would be it. (Interview 12 April 2013).

The value of technology is highly regarded in this case, as students are able to access the curriculum and consequently, engage in school tasks and independent learning even when they cannot attend school.

In all the teachers' views, technology has also added value to their practices, as it has allowed them to design tasks where students can be more active and can creatively engage in learning processes. As one of the teachers mentioned, rote memorization is often what is expected when students hand in worksheets. Conversely, some technologies allowed teachers to design tasks where students could incorporate their own design input to the task; therefore, by modifying the task, students were participating as co-constructors of learning.

So it is more creative too, once upon a time you set a certain amount of work and you set a sheet of work —could be a comprehension task— and all students would answer that in the same way. They copy work from the board on a sheet and they glue that in their books. Now, they are answering the tasks in their own way. They have to follow a procedure but they have to present it creatively in the way they like it, as long as they have answered the questions in the procedure task. (Interview 12 April 2013).

The teachers also acknowledge that the introduction of digital tools, particularly laptops, in the classroom has benefited certain students. This is interesting as it evidences the link between the tools available, cognition and student everyday practices in schools. For instance, Mrs. Kate reflects on her teaching experience and notes that by drawing on digital tools, students with less developed motor skills can have more opportunities to hand in work which looks as tidy and organised as the work of their peers.

Some students are so messy and yet have no understanding that if they use a computer that would help them more and, so I have to really push them and say —

well I know you are not as confident on a computer as you are using pen and paper but you have to use the computer as a tool—. (Interview 17 July 2013).

As elicited by teachers, technology can support the design of flexible tasks. The effects of the new affordances of digital and material resources in the blended classroom space are affected not only at a surface level, but they seem to impact the very nature of the types of task the teacher design, and how these are experienced both by the teacher and the students (Thibaut, n.d.). An examination of this relationship is explored in section 5.3.1.

Teachers' identity construction

A number of studies have analysed technology integration in the classroom to support teachers' pedagogy (Curwood, 2011; Ertmer, 2005; Laurillard, 2009). These scholars posit that technology integration in the classroom is far from being a unidirectional input-output process, arguing that it has strong connections with less measurable elements, such as teachers' own beliefs and cultural values about technology (Curwood, 2014). Construction of the self contributes to shape the professional practice (Juzwik & Ives, 2010; Putnam & Borko, 2000). In this regard, the interviews show progression towards an alignment between teaching and the use of technology to enhance learning. Yet, the interviews make clear that there are complexities involved in this process. A senior teacher, who has been working in the classroom for several years, comments:

Initially I resisted because my brain dynamic is very structured and ordered and I was concerned that I would not have the freedom of teaching the kids the way I wanted to teach them...now looking back I love this... I love kids taking ownership of their work, not just the teachers taking ownership, just imparting and handing out. (Interview 12 April 2013).

Sometimes when something is wrong with my computer and I asked a student to come and you know a couple of IT students and they will fix it so they are able to do that. (Interview 12 April 2013).

Acknowledging that students can often act in the role of experts implies a shift in how teachers perceive themselves. This suggests that for some teachers, the idea of constructing

their identities primarily as recipients and transmitters of knowledge is no longer applicable. As Collins and Halverson (2010) posit, “teachers serve as experts whose job is to pass on their expertise to students. Hence, most teachers do not like to see their authority challenged by students who find contradictory information or who ask questions beyond their expertise” (p.19). Similarly, Hirst (2004) suggests that educational behaviour based on knowledge transmission configures “authoritarian social relations and recognisable teacher and student identities” (p.43). Unlike that unidirectional and hierarchical model of schooling, in this learning network, agents are expanding their opportunities and the roles that they can play (de Laat et al., 2007). Yet, such expansion and re-formulation in the expectation of students and teachers might challenge teachers’ identities. For instance, according to Mrs. Melinda, she sometimes feels that technology enables her to “remove” herself from being a teacher. Her remark can be interpreted in various ways, as it can signal a new way of understanding teachers’ roles or conversely as teachers losing their sense of identity, as if the roles that they used to define themselves as professionals are now, in part, being replaced by technological devices.

I think technology sometimes just replaces the whiteboard but a lot of the time it allows you to remove yourself from being the teacher and to let the technology help teach the kids. (Interview 18 July 2013).

To follow up these ideas, I asked teachers in the classroom “How do you see yourself as a teacher?”. For instance, Claire explains:

I think for me I try to focus on kids and their independence, so for me I’m definitely more sort of a facilitator of thoughts. I like to guide students to the feeling that they have actually crafted something themselves rather than I just completely input all of my knowledge into them. I don’t feel like I’m the big end of all the knowledge. I definitely know that the constructive knowledge of a group is actually much more powerful than my personal knowledge. (Interview 15 July 2013).

Through the analysis of Claire’s beliefs about technology unveiled over the interviews, as well as the observations of the practices and pedagogies she was implementing in the classroom, it became clear that her beliefs about integration of technology in the classroom moved away from techno-centric approaches and a print-centric framework for assessment. This finding is in agreement with research identifying that cultural models, or everyday

beliefs, directly influence teachers' approach to technology integration, instructional design, and assessment (e.g. Curwood, 2014; Ertmer & Ottenbreit-Leftwich, 2010).

Perceptions of other teachers working in this learning space are similar to Claire's view. For instance Mrs. Kate shares:

I see myself more as a facilitator, more than a teacher and obviously I have some knowledge that is more helpful than they have but I see myself facilitating more... and encouraging rather than a knower of everything. (Interview 17 July 2013).

Similarly Mrs. Melinda mentioned "I'd like to see myself as a facilitator, that I'm relational. These are probably the two things". Although I observed this group of teachers working in the classroom, I was interested in how their own ideas about their identity as teachers were reflected in their everyday practice. Mrs. Kate, for instance summarises her everyday practice as a constant "checking" on students work, rather than on working on her pre-established goals. Thus, she signals a focus on students' individual development.

I'm just constantly checking in where they are up to and making sure that where they are up to is where they should be, giving them tips if I go around or if they asked me I can give them little hints on how to get there; so, just focusing on where they are going to need me rather than me having a set "this is where I'm going to go". (Interview 17 July 2013).

Mr. Robert recalls the differences of teaching between now and in the past. In his view, teachers have the same authority as in the past, yet now the links between the student and the teacher are configured in a different way. He sees these links as more "relational", as teachers are more closely connected to the students. While incorporating the students' state of mind, Mr. Robert has experienced a shift from a focus on transmission of information to taking students' needs into account in his teaching decisions.

We have the same authority, I find probably more relational...teachers do not have to be so strict apart from when instructions are given and they need to hear, so we might be very firm in —ok so you need to hear and you need to listen now— but otherwise the relationship is more sort of a peer mentor role, more of a facilitator than from a person who is just pontificating and giving instructions all the time and all these information coming from the teacher; whereas we are there to facilitate them to

discover through technology and through each other. Not one head but many heads are helping each other. (Interview 12 April 2013).

Scholars investigating how learning is enacted in the school context more than two decades ago are alert to the individualistic perspective on schooling, strongly based on student single achievement assessed in the way of the acquisition of theoretical knowledge (Brown et al., 1989; Resnick, 2007). Scholars now are still making the same call (Coiro et al., 2008; Curwood, 2012; Steinkuehler & King, 2009). Instead of understanding learning as silos of information disconnected with the real world, Resnick, (1987a) proposed to draw on collaborative and sharing learning models, such as the ones that emerge in out-of-school contexts and in work environments where epistemic knowledge can be situated. Similarly, Mr. Robert's reflection also signals a shift from "one source of knowledge" to many "sources of knowledge". According to this idea, teachers' authority is no longer only based on knowledge, but on the role of the teacher to facilitate links between people and tools; which in turn might enable learning processes. In addition, the recognition of the value that "many heads" have in co-creation of knowledge also signals a configuration of a *learning network* where social interactions are considered as part of the learning process (Brown & Adler, 2008; Lankshear & Knobel, 2011; Lave & Wenger, 1991; Vygotsky, 1978).

This analysis has identified that teachers' identity is not a fixed construct, but a construct that might change over time. Age marks a difference in how teachers perceived themselves and their practice. While the two younger teachers perceived themselves as "facilitators" with a focus on students' needs, and as "distributors of social and material resources", the more senior teachers interviewed reported a shift from a focus on teacher-centred/transmission of knowledge to a focus on student-centred practices and facilitation (Trigwell, Prosser, & Waterhouse, 1999). While the relation of technology to the construction of identity is not problematised in the first case (Claire and Kate), in the second case (Mr. Robert and Mrs. Melinda) technology has been disruptive and perhaps a catalyst in their modification of teachers' roles. It is interesting to note how technology in the first case is taken for granted, perhaps invisible and less problematic. The reverse can be observed in the second case, for instance, when one of the teachers considers that technology sometimes "allows you to remove yourself from being the teacher and to let the technology help teach the kids".

Teachers' perceptions of school support and social context

Scholars have identified that the context where teachers work can strongly affect teachers' everyday practices and consequently pedagogical innovations with technology (Roehrig, Kruse, & Kern, 2007; Somekh, 2007). In agreement with this literature, the data of the present study suggests that context can positively impact teachers' integration of technology in the classroom. As previously documented, the school supports teachers with paid weekly training time in order to support professional development. In addition to teachers receiving professional development, it is interesting to see that teachers often contribute to the professional development sessions in the school. As Mrs. Kate explains:

As a school we have such a good PD so, so often the classroom (*the space where teachers are working*) is a few steps ahead after we get sent to PDs and they are "oh you need to use this now" and we are like "oh we've been using that for 8 months but "that's great let us teach you" and so you become a facilitator to your colleagues, and then they build up on that, so is a flow on effect. (Interview 17 July 2013).

Teachers in this classroom space document not only being "enablers for learning" in relation to their students and sometimes to their colleagues, but they also learn from their own students, for example in matters related to technology. This interchange of roles allows the teachers to draw on their students' expertise for their own practice and professional development. For instance, students often hear about a new software application before their teachers. Whenever this happens, teachers evaluate its learning value, prior to the team's adoption of the new application, which is then often shared during professional development. Mrs. Kate comments "often because we are just immersed on it, and the kids are just showing us stuff and then we do get hold at something and just run with it because that's the kind of team that we are; but throughout the school we are sharing as well".

A non-judgmental and supportive school culture is also highly valued by teachers. For instance, the innovation in pedagogies and integration of technology was a change that was initially resisted by senior teachers in this space. Such feelings of anxiety and resistance have gradually changed. This confirms that beliefs towards teaching are not only a personal construction, but are instead strongly affected by the perception of peers and the values of the school. This is in agreement with literature investigating teachers' factors related to technology integration in the classroom (Harris & Rutledge, 2010; Howard, 2013). For

instance, a senior teacher reveals in the interviews that by not feeling judged for his mistakes, he became less anxious about the practice and in turn started to integrate new tools in his practice.

if a person like me is able to adapt I think anyone is able to adapt. I don't think that is all about just a certain kind of teacher who can cope, I actually think that every teacher can, but you have to be willing to do it for whatever reason and the other thing is that the heads of the school allows to make mistakes and are not judgmental. (Interview 17 July 2013).

Prior to the digitalisation process, scholars have tried to understand the relationship between people and tools, and in particular, how sometimes tools become “invisible” to the user. For instance, Heidegger, (1986) described how a blind person's cane eventually becomes part of the person rather than a tool. In such a process the tool becomes invisible to the user and instead, part of the user. Later Norman, (1988) attempted to classify the new relation between the user and the tool by using the notion of affordances. Similarly, in literacy, Plato and more recently Ong (1986) have tried to explain the enormous changes in the nature of communication with the arrival of pen and paper. It seems that tools become so close to people's practice that they become invisible. This is not to say that tools have deterministic properties. Recognising the difference between teachers' history of practice has implications in relation to establishing a supportive environment for teachers whose professional identities were constructed on the basis of pen and paper and whose identities and professional practices might be consequently challenged by technological tools.

Finally the practice of teaching without walls, thus being exposed to the eyes of other teachers, parents and people who visit the school is also an element that has modified their perceptions of how pedagogies are enacted in the classroom. In combination with the integration of technology, teachers have gradually learnt to perform in a different way in this classroom space.

once upon a time if the principal looks like coming into my room, or parents or visitors I would freak out...now I don't even think about it because we are just so used to it,... so that's the key, to get used to it, it has become part of the norm. (Interview 17 July 2013).

As evidenced by the teachers in this case study, the social context and the support from the school leaders as well as the school community as a whole, are variables that need to be taken into account when implementing strategies of technology integration in the classroom. Literature on technology integration in the classroom has identified that contexts, in the form of social pressure and school values, are important factors to influence teachers' technological integration (e.g. Ertmer & Ottenbreit-Leftwich, 2010; Zhao & Frank, 2003).

This practice of knowledge sharing between teachers allows the formation of a community of practice (Wenger, 1998). This, at the same time, introduces a protective factor for teachers in dealing with the anxiety generated by the fast pace of technological changes (Howard et al., 2014; Howard, 2013). I argue that feelings of anxiety may lessen because the responsibilities are shared and dependent on the team, rather than on just each individual. In addition, teachers identified that the integration of students' knowledge and skills about technological tools can be used to leverage their own state of the art about technology. This has significant implications for school policies, particularly when organising professional development in school. Too often the form of professional development is techno-centric, short-term, disconnected to teaching aims, and decontextualized to the characteristics of the classroom, and more importantly it reproduces a hierarchical process of knowledge transmission implemented from outside the "knowledge of the classroom" (Curwood, 2011, 2013; Koehler & Mishra, 2009). Instead, here it was observed that effective professional development was developed from inside. I argue that this is key in making teaching integration of technology a sustainable process. In addition, time was regarded by all teachers as key to pace their integration of technology in the classroom and to adopt innovative technologies. Tables 11 and 12 offer a summary of the descriptors found in this section.

Dimensions	Descriptors
Teachers' perception on their competency with technology	Competent/very competent As an ongoing process
Teachers' values of technology for teaching	Technology as resource for information Technology as a medium for ongoing learning Technology to design student-centred learning tasks Technology to promote creativity and students' own knowledge construction
Teachers' identity construction	Teachers construct their identities around the notion of facilitation and guidance Teachers construct their identities as orchestrators of the resources in the form of tools and people available in the classroom The notion of knowledge might come from teachers

	and students and other digital and analogous resources
Teachers' perception on school support and social context	Supportive Non-judgmental school culture Expecting teachers to work collaborative, in teams and in open spaces
Learning	Learning as relational Learning requires many "heads" Learning as an ongoing practice The learning design focuses on the process, rather than on the output

Table 11. Factors underlining teachers' integration of technology

Dimensions	Descriptor
Competency (self-efficacy)	Mid to high
Value of teaching with technology	High
Teachers identity	Relational: orchestrator/facilitator of tools and resources
Teaching	Relational: collaborative, team-work
School support and social context	High
Learning	Relational: peer-mentor structure/ongoing

Table 12. Teachers' characteristics in the blended classroom

5.1.4 Synthesis of this section

In this section, blended learning was analysed from the perspective of the teachers. Understanding blended learning from the perspective —and first voice of teachers— is essential as it gives insights into how the process of technology integration has been shaped over time; what factors have been catalyst in this process and what challenges (if any) have teachers faced in their own practice, beliefs, cultural values and identities. By applying a thematic analysis technique, the data reveals some underlying factors shaping teachers' everyday practices in a space heavily mediated by technology. The findings suggest a strong relation between teachers' practices, beliefs and identities. Thus, teachers highly used technology in the classroom which is consistent with a strong value of technology for learning. In their view, technology enables them to design for learning in a way that caters for student active-practices. This is aligned with teachers' beliefs on teaching as a student-centred/facilitating practice (Kember, 1997; Oliver & Trigwell, 2005; Trigwell et al., 1999).

However, dissonance in such alignment was observed in senior teachers. Consequently the findings revealed that teachers, whose initial practices were formed in a non-digitally mediated environment, are more likely to need more support in adjusting to a blended environment. Consistent with the literature review, the analysis suggests that a situated and periodic professional development support (Curwood, 2011; Ertmer & Ottenbreit-Leftwich, 2010; Owston, 2006) is key in integrating technology in the classroom. Moreover, a supportive non-judgmental school culture (Howard et al., 2014), as well as a collaborative ethos among teachers are also highly valued factors by teachers. It is interesting to observe that teachers understood their practices as relational. In this sense the connection that they established with their students, although invested by authority and respect, was one of reciprocity and mutual exchange of knowledge. This was reflected in teachers valuing students' knowledge on technologies. Finally, rather than prescriptive ways of teaching with technology, it was observed throughout the interviews, that this group of teachers was constantly exploring, experimenting and evaluating technologies in the classroom.

5.1.5 Perceptions of students about technology in the blended classroom

There is a vast amount of research that has focused on teachers to understand the interplay of education and technology in the classroom including for instance, teachers' attitudes towards technology, beliefs on teaching and learning, or teachers' professional development (see section 3.1.4). Less attention has been given to including students' voices on teaching and learning (Scanlon, 2004), and in particular on students' perceptions of technology integration in the classroom (Li, 2007). The benefits of considering the phenomenon of blended learning as a tale of two sides, thus including teachers' and students' points of view, allows a more holistic examination of such a phenomenon. Echoing such ideas, a multi-agent and multi-method logic of inquiry was applied in the present study. The subsequent research question guided this analysis:

- What are students' perceptions of technology and Edmodo in the blended classroom?

The following results are part of a longer survey applied to the 30 students in the classroom. The survey consisted of two sections: a closed-ended part and an open-ended part. Due to the length limits of this thesis, only the dimension related to students' perceptions of technology is presented. This includes three closed-ended affirmations designed to elicit students'

opinions regarding the functions of technology. A four-point Likert scale (Strongly agree: 1; Agree: 2; Disagree:3; Strongly disagree:4) was used. The second part of the survey consisted of open-ended questions through which I explored students' perceptions of technology and Edmodo (details about the data analysis can be found in sections 4.1.4 and 4.1.5).

The first affirmation explored whether students' felt that their use of technology would make their work at school more fun. Since the late '80s scholars have identified links between technology and notions of "fun" (Ito, 2006; Song, Elias, Martinovic, Mueller-Wittig, & Chan, 2004). While some scholars consider that technology might only sugar-coat the effort involved in learning, others posit that technology can leverage "playful learning" (Ito, 2006; Kafai, 2006; Monroy-Hernández & Resnick, 2007; Resnick, 2007). As observed in the results (Table 13), the majority of the students strongly agree or agree that technology makes their work more fun. Nevertheless, two students disagree or strongly disagree with this affirmation.

I often feel that technology makes my work at school more fun

	Frequency	Percent	Valid Percent	Cumulative Percent
1	17	56.7	58.6	58.6
2	10	33.3	34.5	93.1
3	1	3.3	3.4	96.6
4	1	3.3	3.4	100
Total	29	96.7	100	
Missing	1	3.3		
Total	30	100		

Table 13. Student perceptions of technology at school. Affirmation 1

The second affirmation aimed at eliciting whether students perceived technology as enhancing their performance at school. Interestingly, students' responses of technology as allowing "me to work better at school" were more dispersed than the first affirmation. While the majority of the students strongly agree or agree, some students disagree or strongly disagree with the statement.

I often think that that technology allows me to work better at school

	Frequency	Percent	Valid Percent	Cumulative Percent
1	14	46.7	48.3	48.3
2	9	30.0	31.0	79.3
3	5	16.7	17.2	96.6
4	1	3.3	3.4	100
Total	29	96.7	100	
Missing	1	3.3		
Total	30	100		

Table 14. Student perceptions of technology at school. Affirmation 2

Finally, the survey asked students to rate the following affirmation: “I often feel that technology helps me in sharing my work with other students” (Table 15). Here it is noticeable how the majority of students strongly agree (73,3%) or agree (23.3%) with this sentence. Only one student disagreed with this affirmation. This suggests that students perceived technology as a medium to share. Anticipating students’ qualitative results which will be presented shortly, it is possible to suggest a link between students’ perceptions on technology and the activities they are able to afford through the mediation of technology.

I often feel that technology helps me in sharing my work with other students

	Frequency	Percent	Valid Percent	Cumulative Percent
1	22	73.3	73.3	73.3
2	7	23.3	23.3	96.7
3	1	3.3	3.3	100
Total	30	100	100	

Table 15. Student perceptions of technology at school. Affirmation 3

Triangulation of the data obtained from the survey, included asking students similar questions related to technology but from a qualitative point of view. This type of elicitation was done by asking students to make an analogy or metaphor between the conceptual system structure of technology and the social network site Edmodo, using something familiar to the students, such as food. Food was selected because is a system structure that all students can relate to in positive, negative or ambivalent ways. The literature suggests that by drawing on the use of

metaphors students are able to express their ideas in a less constrained way (Wan, 2014). For instance, Forceville (2008) explains that “metaphors tend to represent abstract phenomena in terms of something concretely perceived” (p.462). In addition, Lakoff and Johnson (1980) posit that the essence of a metaphor is “understanding and experiencing one kind of thing in terms of another” (p.5). These authors explain that because of the connection that a metaphor establishes between both language and conceptual system structure, metaphors are an “important source of evidence for what that system is like” (p.3). Furthermore, the authors argue that “since communication is based on the same conceptual system that we use in thinking and acting, language is an important source of evidence for what that system is like” (p.3). Given these potentialities, research is incorporating this technique in order to elicit perceptions about complex phenomena. For instance Mills, Unsworth, Bellocchi, Park, & Ritchie, (2014) utilised metaphors to understand the connection between emotions and space in primary school children. The first open question in the survey asked: “If technology were a food what would it look/taste like? Why?” The students’ responses about technology were gathered on NVivo and analysed (see section 4.1.5).

After several readings and saturation of the data the following categories emerged: (A) students perceiving technology as positive for their learning (13 references); (B) students perceiving technology as sometimes positive for their learning (10 references); (C) students perceiving technology as not positive/or don’t like this tool (3 references); (D) and students’ answers that did not refer specifically to link between technology and food (4 references). The majority of the students perceived positive values towards technology, for instance, attributes such as fun, helpful in class, a source to access information, or interactive were reported. However, some students’ metaphors also suggest a fairly ambivalent perception. Although these students considered that technology was useful for certain activities, it ultimately depended on what it was used for and how it was used. The language established between food and the category system of technology clearly identifies a perceived risk in technology usage in terms of “dominating” and “not being natural”. Finally, in category C students elicit negative connotations such as complex, uncontrollable, and negative relations to technology if it is excessively used or used without control.

Category	A (13 references) Technology as:	B (10 references) Technology as:	C (3 references) Technology as:
Codes	<ul style="list-style-type: none"> - Fun -Helpful in class -Source of knowledge -Interactive 	<ul style="list-style-type: none"> -Its value depends on the task 	<ul style="list-style-type: none"> -Complex -Uncontrollable -“Can go away” -“Brings annoyances”

Table 16. Affordances of technology as perceived by students

Examples of Category A:	Examples of category B (aggregated):	Examples in category C (aggregated):
Positive	Positive and negative	Negative
<p><i>If technology was a food I think it would be an apple. I think it would be an apple because it helps me a lot in class.</i></p> <p><i>If technology were a food it would look like a big burger. Because you can find anything in it and its full of a lot of things.</i></p> <p><i>Technology would look like a healthy finger food buffet because it is interactive, fun and helpful.</i></p> <p><i>If technology were a food it would look like a big burger. Because you can find anything in it and its full of a lot of things.</i></p> <p><i>A platter of knowledge waiting to be used. Why? Because we used it then stop using it (putting it back)</i></p>	<p><i>Technology would look like a steak with a couple of chewy bits. It is mostly good but not all of it.</i></p> <p><i>If technology were a food would look like a brownie. I think that it would be like a brownie because when it's burnt it is something you hate, when it is too liquid it will just not cooperate but sometimes it is perfect and nice and something you want.</i></p> <p><i>Technology would be a very yummy but at the same time not natural. It would look very yummy and very inviting, but at the same time if you have too much of it, it would be bad for you.</i></p> <p><i>Technology would be like chilli because it makes almost everything better but if it dominates it's not very nice. Too much of it and we get too used to it; it becomes dull and un-entertaining</i></p>	<p><i>It would be like cherry pie because it's nice but is not good for you.</i></p> <p><i>It would look like a watermelon because it's big and can roll away. Which means technology can be uncontrollable and can go away</i></p>

Table 17. Examples of technology affordances as perceived by students

The same process was repeated in order to elicit students' perceptions about Edmodo: their responses were gathered on NVivo and analysed. The question posed was: "If Edmodo were a food what would it look/taste like? Why?". After several readings and saturation of the data the following categories emerged: (A) students perceiving this tool as positive for their learning (17 references); (B) students perceiving Edmodo as sometimes positive for their learning (4 references); (C) students perceiving Edmodo as not positive/or don't like this tool (5 references); (D) and students' answers were unclear (3 references). Within the three first categories, specific codes that denote affordances and constraints were examined (category D was not codified as students did not elicit relations about Edmodo). In the first category (A),

subcategories were included to denote the different functions identified by students. Table 18 illustrates the results of the codification:

Category	A (17 references) Edmodo as:	B (4 references) Edmodo as:	C (5 references) Edmodo as:
Codes	<ul style="list-style-type: none"> -Facilitator of learning of everyday work -For sharing and collaboration -Source of knowledge -To develop a community -Source to interact/access information 	<ul style="list-style-type: none"> -Messy -Only useful with certain subjects/some people -Not the preferred tool to use 	<ul style="list-style-type: none"> -Source of problems -Complicated to use

Table 18. Affordances of Edmodo as perceived by students

Examples of affordances and constraints of Edmodo in each category as elicited in students' metaphors are shown below:

Examples of Category A:	Examples of category B (aggregated):	Examples in category C (aggregated):
Positive	Positive and negative	Negative
<p>Facilitator of learning <i>Soup, because soup can fill gaps and it's nice</i></p> <p><i>If Edmodo were a food it would be a healthy sweet ice cream because Edmodo helps me and is fun and easy.</i></p> <p>Sharing and collaboration <i>It would look like marvelous creations chocolate, because everyone can have some and each piece/discussion is different and exciting.</i> <i>Edmodo would be a cake that was backed by many and eaten by many.</i></p> <p>Source of knowledge/access information <i>If Edmodo were a food it would be a knowledgeable chip.</i> <i>It would be a bright juicy fruit with different ideas bursting out.</i> <i>It would be a big hamburger that you could transfer thoughts in and when other people eat it they would get your thoughts.</i></p> <p>To develop a community <i>It would be a grape because there</i></p>	<p><i>If Edmodo was a food it would be Jaffa cakes. Why? Because they both are great for some people but bad for others. Some people use Edmodo differently and some people might eat Jaffa cakes differently, like with milk or mixed with something else.</i></p> <p><i>Edmodo would be a broccoli because it is good but it is not my absolute favourite.</i></p> <p><i>Edmodo would look like a mango because you love to use it and boast how good it is but in certain subjects/seasons it is not useful even if you want it.</i></p>	<p><i>Edmodo would be a piece of slightly uncooked bacon. This is because it has good intensions but it manly has problems and annoyances.</i></p> <p><i>It would be raw fish because I find that it is complicated to upload and to keep and know what I'm doing.</i></p>

*are lots of kids (grapes) on the one page (vine).
If Edmodo were a food it would have to be a cake because it brings everybody together.
It would be a super yummy and my favourite food because it helps me to talk to other students for help and keep up with assignments. It would look like chocolate to me.*

Table 19. Examples Affordances of Edmodo as perceived by students

Discussion about students' perceptions of technology and Edmodo

The analysis of the perceptions of students on technology and the social learning site Edmodo, reveals interesting insights on tool mediation in the classroom. First, students identified digital tools as key supporters for sharing thoughts, beliefs, opinions, and work, along with accessing information, and community building. Second, students' insights on their use of technological tools in this blended space revealed commonalities with Laurillard (2012) and Luckin's (2012) models of learning with technology. In particular, students mentioned their use of tools as part of activities such as collaborating with others, discussing, receiving and giving information through asking questions or posting online. However, some students also reported that technological tools could be complex or could "bring annoyances".

Third, students also elicited other forms of learning not mentioned in Luckin's or Laurillard's models such as learning through sharing (e.g. thoughts, beliefs, opinions, and work) and by bringing people together. These categories are associated with a sense of community, belonging and inclusion. Such categories echo Lave and Wenger's (1991) and Wenger's (1998) work about communities of practices; and are consistent with emergent literature on social networking (Boyd, 2007; Steinkuehler & King, 2009). Students' perceptions on digital tool mediation described their presence online as a way to share, discuss, collaborate and feel part of the class. Drawing on a sociocultural approach, Bakhtin (1986) emphasises that the growth of students "inner persuasive voice" as opposed to authoritative patterns is key for the development of students' identity. Studies on social network sites such as *MySpace* documented that young people often developed digital identities in such spaces through profile formation, content production and sharing of content with others (Ellison & Boyd, 2013). Thus, by drawing on features mediated by images, graphics and texts, young people

were able to portray who they were at a specific moment in life. Although the possibilities of intense profile formation are clearly limited on Edmodo, as the network is bounded to the number of students in the class (see 3.1.5 for a broader discussion on this topic), Edmodo still allows student to create a learning presence online. In this space students could choose a profile picture, add notes, images, videos and other elements that helped them to construct their identities.

The notions of identity-construction and *multivoice* link to the notion of mediational tools (Vygotsky, 1997; Wertsch, 1985, 1998, 2002) in the blended classroom. So, this data suggests that by engaging in active interactions on Edmodo and by using other digital applications, students are given opportunities for co-constructing their own identity in the classroom (Bakhtin, 1986) in complex ways. The types of activity students engage in in this class seem to encourage identity formation that is less proximal to “students” receiving information and rote memorisation, but rather closer to a definition of “life-long learners” as students are also sharing, collaborating, searching for answers as well as providing answers. This has significant implications for understanding how learning is enacted in the blended classroom, suggesting the need to consider learning in its content/cognitive dimension, but also in its social dimension (Brown & Adler, 2008; Lankshear & Knobel, 2011). As outlined in the socio-cultural section, learning is enabled through the mediation of both tools and social interactions. It seems that blended learning in the primary classroom demands a careful consideration on how activities and interactions are offered (and mediated) in order to construct students’ identity and *inner persuasive voices*.

Digital technologies and Edmodo are also seen by some students as tools that do not work for everyone, nor for every task, and that they are complicated to use. Moreover, students identified the risk of overusing technology. Their reflections on technology in the classroom are in line with the idea that a focus on tool-use is not sufficient to understand digital-tool-mediation in the classroom (Laurillard, 2012; Luckin et al., 2012); revealing that technology can assist them to learn through sharing, discussing, collaborating and keeping track of their daily work. But this also varies depending on the type of task and the students. As expressed by students in this class, its use can be better for certain assignments, might suit some students better than others, and might be complicated as well.

5.1.6 Synthesis of this section

In this section, blended learning was examined through students' responses to a survey and through metaphors and students' answers. According to students' view, technology plays an important role in allowing them to share their work. Technology is also highly valued as making their work "more fun". These findings suggest relations between technology use and motivational aspects of learning. Less clear were the answers related to effective work at school, where students considered learning less dependent on digital technologies. This is consistent with literature which moves beyond techno-centric approaches on technology and education (Luckin et al., 2012). Students' perceptions on Edmodo reveal that they valued this tool. Findings arising from the analysis of students' metaphors, suggest that the way learning is enacted when mediated by Edmodo is highly social, interactive and rich in transactions of information and emotions (as a way to nurture a sense of community). The findings also reveal that students' presence online involves students' development of an online identity that complements their physical identity (Bakhtin, 1981, 1986). This echoes sociocultural approaches of learning as the notion of identity, highlighting how learning is co-shaped through interactions with others; now complemented in the online space. While many attributes of students are related to positive descriptors, students also identified problems with the use of technology and in particular with the use of Edmodo such as carrying problems and "annoyances", and risks such as overusing technology for learning.

5.2 Interactions in the blended classroom

The configuration of tools and space in any learning setting shapes the ways participants in a classroom environment can interact. Blended learning, in particular, expands the traditional notion of face-to-face interactions towards digitally mediated communication which can adopt synchronous or asynchronous forms. Since learning is mediated through communication and dialogue formation (van Lier, 1996; Vygotsky, 1978; Wenger et al., 2011; Wertsch, 1998) it is essential to understand the ways such mediation occurs in a primary blended environment. Analysis of discursive practices has provided evidence of the potentialities and limitations of interactions in the classrooms (Anderson et al., 2001; Bloome et al., 2005; Christie, 2002; Laat, 2006). The focus of analysis in this thesis shifts from a macro perspective (findings 5.1) to a meso perspective (findings 5.2) and will end with a

micro perspective on new literacies involving multimodal production mediated by technologies (findings 5.3). Thus, in this chapter a meso focus is used to explore the discursive practices of the offline and the online classroom. I first explore discursive practices in the online and the physical space and then I provide a fine grain analysis of the type of interactions mediated by Edmodo in the online space.

5.2.1 Discursive patterns across the physical space and the online space

In this section I examine the underlying structure of interactional patterns in the physical space and in the online space of the blended classroom. By examining such relationships, I aim to give an account of students' types of discourse and the structure of language in the classroom. As Trigwell (2011) posits, teaching "is about helping to make the learning of something possible" (p.6). Language is a key resource that teachers utilise in the classroom in order to explain concepts, facilitate participation, assign tasks or promote further thinking (Christie, 2002; Gee, 2004; Mercer, Littleton, & Wegerif, 2004). Students at the same time respond to those strategies and so, over time, patterns of interactions between participants are developed. Such patterns of interactions vary. Thus, depending on how communicative clues are shaped, a discursive pattern can promote or hinder students' active participation (Bernstein, 1995; Mehan, 1979). Since a major aspect of learning is mediated through language (Rogoff & Lave, 1984; van Lier, 1996; Vygotsky, 1978; Wertsch, 1998) it is essential to look at the discourse in the classroom in order to understand the social and communicative patterns in which learning happens. Particularly, it is critical to examine whether blended learning provides other linguistic opportunities, where student-centred learning may take place; and if so, how does it take place.

Here I focus on the discourses enacted through oral and written language as well as other non-verbal cues in the classroom. Consequently, I analysed written language stored in the online space, as well as spoken language gathered through video recording in the physical classroom. By using discourse analysis, I investigated how situated patterns of instruction and turn-taking in the classroom play a role in the process of learning. Mapping situated discourse patterns to understand teaching and learning in the offline classroom is not new (Bloome et al., 2005; Christie, 2002). Scholars from various areas of study such as linguistics, education and sociology have acknowledged that the pattern structures of the classroom reveal not only

a certain “teacher talk” but also how such talk shapes interactions in the classroom (Bakhtin, 1986, 1981; Christie, 2002; Gee, 2008; Halliday, 1978; Mehan, 1979). However, understanding both the offline and the online language in the primary classroom is emergent, as is the analysis of blended learning in primary school (Kalas et al., 2014; Means et al., 2013). Because of that, the findings in this section are key in contributing to design for blended learning environments in young populations. The analysis examines how dialogue embedded in social relations is shaped (or not) by the space where it takes place (physical and online). This analysis is guided by the following question:

- What are students’ and teachers’ discursive patterns in the blended classroom?

In this analysis, I started by employing Mehan’s (1979) Initiation-Response-Evaluation (IRE) structure. By mapping the discourse against the IRE pattern, the analysis illuminates similarities to, and differences from, the IRE structure, but also indicates how the patterns of interactions may differ depending on where they take place, offline or online. However, as I will shortly reveal, the IRE structure falls short of providing a comprehensive explanation of the blended classroom structure of “talk”, and consequently alternative (and complementary) perspectives such as positioning, power relations, exchange patterns and identity are used to make meaning of the year 6 classroom (Kamler, Maclean, Reid, & Simpson, 1994). A detailed discussion on the analytical method can be found in section 4.1.5.

Mehan’s findings suggesting that the IRE structure was the predominant type of talk in classroom settings had clear implications in learning processes. Put simply, this pattern structure clearly limits students’ own flow of thinking and constrains opportunities to verbalise students’ cognitive processes (Westgate, 1994). Later researchers have proposed that the IRE needs to be judged considering the “overall structure of the classroom” (Mercer, 2000; van Lier 2000). Christie (2002) for instance suggests looking at the “meanings in construction, the relative roles and responsibilities of teachers and students at the time of constructing those meanings, and the placement of such patterns in the overall larger cycle of classroom work” (p.5). The realisation that classroom discourse and patterns of talk have the capacity to impact processes of learning through constraining or enabling student participation has challenged scholars and educators to explore alternative patterns of discourse (Bloome et al., 2005; Christie, 2002; Christie, 2003; Gee, 2008; Mehan, 1979).

The following analysis is based on two consecutive lessons of approximately 65 minutes in total. These lessons are representative of teaching and learning in the classroom over the whole year. Extracts one, two and three are illustrative of face-to-face interactions, thus enacted in the physical space of the classroom. The lesson revolved around students solving a math problem about volume. In a prior lesson, students watched a video that showed two containers with different shapes. The video posed the question about which one holds more water. After watching the video, Claire asked the students to calculate the dimension of a 3D figure. Extracts about students solving the math problem at the beginning of the lesson, at the middle of the lesson and at the end of the lesson are shown below.

As the lesson in the face-to-face classroom was not followed up by the teacher in the online space, I selected extracts in the online space that represented the variety of interactions occurring in such space over the time of the study. Thus, extracts four, five and six are illustrative of online interactions happening on the Edmodo wall including interactions related to math, literacy and cross-curricular content, yet they are not related to the calculation of the 3D figure happening in the online space.

As stated in the data analysis section (4.1.4) the transcription conventions included contextualisation cues involving paralinguistic/prosodic, proxemics, and new modes of communication. These conventions help to illustrate the type of linguistic dialogue formation that occurred in the classroom. Examples of paralinguistic/prosodic are: stress (underline), volume shift (**bold**), short pause (**|**), undecipherable (**?**). Examples of proxemics involve close distance (**[]**) and long distance (**[|]**). Finally, in new modes of communication emoticons (**=**) were included (for a comprehensive description of the contextualisation cues please refer to Table 7). The table sets out the dialogue between teacher and students in three columns. The first column refers to the speaker (students or teachers). The second column shows the message unit and incorporates the contextualisation cues previously explained. Finally, the third column includes the IRE sequence analysis explained above. In Appendix 6, a description of spatial and non-verbal cues can be found. This description complements the illustration of the activities and dialogue described in this section.

Towards a discursive understanding of the face-to-face classroom space

Selection one of the discourse analysis

The first extract corresponds to talk initiated at the beginning of the lesson. During this time Claire set up and gave instruction organising the math activity she had planned for the day. As the discourse analysis reveals (see Appendix 6 for a full description of non-verbal and spatial cues in the classroom), the lesson was initiated with students entering the classroom, chatting, grabbing their novels and sitting down either on a circle or on chairs, facing different angles. Figure 12 illustrates the configuration of the space in the face-to-face classroom and helps to see the spatial positions of the teacher and the students.

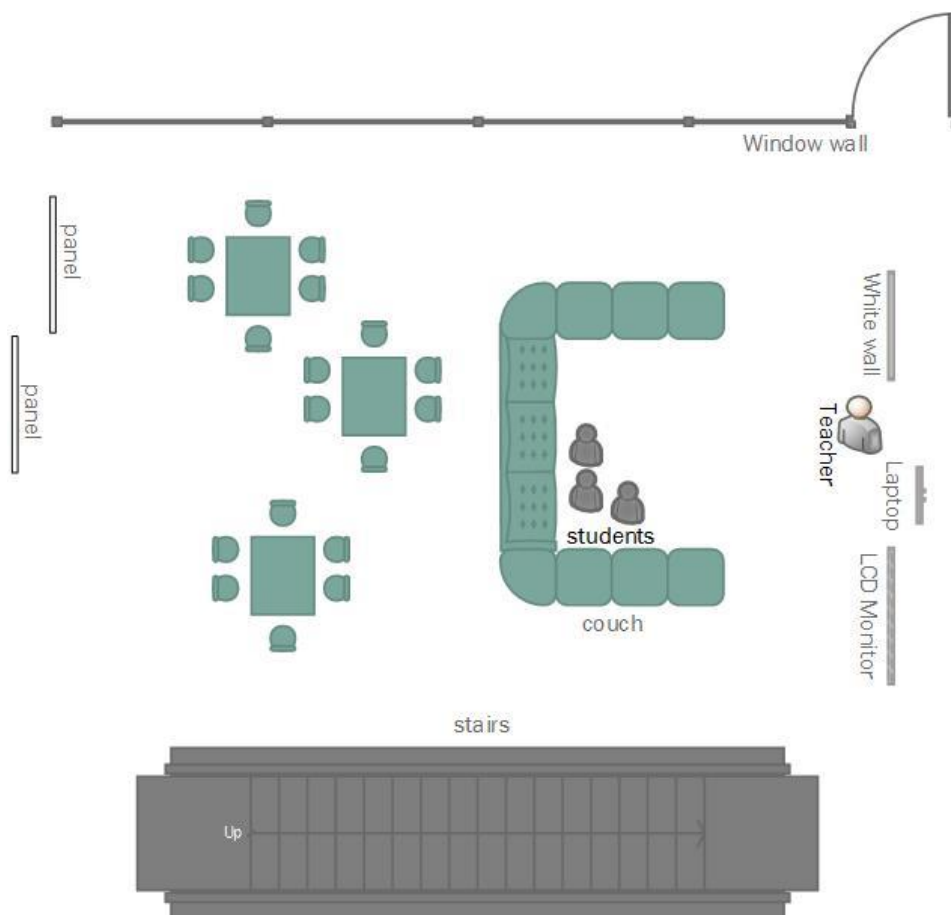


Figure 12. Teacher and students' positioning in the classroom at the beginning of the lesson

While the students were entering the classroom, the teacher was handing over post-its to the students, preparing the upcoming activity. Next she stood up close to the screen and observed the students after which, she put her hands together in front of her chest, as a non-verbal sign

of requesting students to be quiet and attentive. Claire's talk was indicative of transitioning students from the break time from which they were coming, to preparing students to focus on the lesson. Thus, the talk was strongly related to discipline, such as "silence", "we are waiting" and instructions on what to do such as "write your name" "don't fold it up". The logic of the sequence talk was strongly dominated by the teacher, until lines 23 to 26, where Claire allowed some space for students to raise questions.

Speaker	Message Unit	IRE sequence
Claire	[*]	
Claire	1.shhhh	Teacher question or initiation
Claire	2. Kim and Tobias can you hand over the notebooks please?	Teacher question or initiation
Claire	3. Ana, sit down please <this is the third time I have to remind you about what we are doing>	Teacher question or initiation
Claire][
Claire	4. Shh silence][Teacher question or initiation
Claire	[]	
Claire	5. I would like you to take a moment in that piece of paper < I gave you>	Teacher question or initiation
Claire	6. I would like you to write down <three people> that you are choosing to be in your group [*]	Teacher question or initiation
Claire	7. Write your name obviously on the top and then one two three	Teacher question or initiation
Claire	8. So your name at the top and then one, two, three in order of preference	Teacher question or initiation
Claire	9. >Actually not in order of preference< and then <bring it up to me and then come into the circle-	Teacher question or initiation
Claire	10. Try to number the people who you are choosing so it is easier for me to know who you are	Teacher question or initiation
Claire	11. Thanks	Teacher response
Claire	12. Once you have done yours, give it to me and come to the circle	Teacher question or initiation
Claire	13.> Don't fold it up, don't fold it up < just give it to me	Teacher response
Claire	14. If you have already given me your note ↑ I would like you to quick read what we were doing yesterday in maths so we are good to go -	Teacher question or initiation
Claire	15. Well done↑	Teacher evaluation or feedback
Claire	16. Those people having some initiative like Brad here is having a look through his numeracy book and checking what we are up to yesterday ^}	Teacher evaluation or feedback
Claire	17. We are still waiting for some people to come into the circle of goodness	Teacher evaluation or feedback
Claire	18. Let me go over the plan we have for today	Teacher question or initiation
Claire	19. So we are going to finish our math lesson from yesterday	Teacher question or initiation
Claire	20. And then what is going to happen is in learning session two you will be going into your writers' workshop groups.	Teacher question or initiation
Claire	21. So we can talk more about this not now ><but at the recess time it is the last day in <u>your particular writers group</u> (?)	Teacher question or initiation

Claire	22. Tomorrow we have an option if you wish to write a <description> and then we will regroup you in term 3	Teacher question or initiation
Harry	23. (?)	Student question
Claire	24. Most of you have already done it	Teacher evaluation or feedback
Patrick	25. (?)	Student question
Claire	26. Yes	Teacher evaluation or feedback

Extract 3. Selection 1 of the discourse analysis (transcription initiated at minute 0 of the lesson)

In this extract, the construction of dialogue by the teacher switched from the use of the pronoun “I” to the pronoun “we”. In addition she combined the use of moderators in the talk, such “I would like” with direct commands such as “bring it up to me and come in to the circle”. It is possible to see these changes as an attempt of Claire to be part of the “lesson” and to soften the dominance that she had so far over the talk. Yet it is also overt here how Claire is commanding her power in order for students to follow her instruction. Because the first extract is mostly related to speech aiming at describing the upcoming activities —only at the end are there some signals of discourse exchange —the most prevalent talk corresponds with the IRE pattern.

Despite the few verbal opportunities that students had in this section to actively engage in the lesson, Claire managed to include elements that signal the support of a co-constructive classroom. For instance, while asking the students to be quiet and read their books, she also asked students to write down with whom they would like to work in the upcoming activity. This is a sign of Claire’s inclusion of student’s voices in the math activity. Secondly, Claire also challenged a traditional teacher-centred classroom when she accompanied students in the activity of reading a book. So after handing out post-its for the students, Claire took a book, sat next to the students and read quietly with them (this is illustrated in detail in the description of the non-verbal/spatial cues of the transcript see Appendix 6). I argue that this action is not trivial, as it shows how the teacher is modelling a certain behaviour and interest for reading. In contrast to modelling the act of reading, Claire could have used that time for instance to preparing activities, or assessing students’ work. Yet she consistently over time repeated the behaviour of sitting and reading along with her students at the beginning of the lessons.

Selection 2 of the discourse analysis

The transcription of Extract 4 shows sequences taken during a math lesson. Here, students had to think about how to calculate the perimeter of a figure in order to solve the problem about which container holds more liquid. For that exercise, students had to apply concepts about tridimensional shapes and formulas associated with such notions. Students were given time to work together or in groups to solve the problem and then Claire would nominate students to express their ideas in front of the classroom.

Speaker	Message Unit	IRE sequence
	[*]	
Claire	66. Who has a different answer to <u>that</u>	Teacher question or initiation
Students	67. Several students raised their hands	Student response
Claire	68. And feeling confident about that-	Teacher question or initiation
Students	69. Several students raised their hands	Student response
Claire	70. Ok	Teacher evaluation or feedback
Claire	71. Let's have Dorothea and Mia	Teacher question or initiation
Claire	72. Let's give those boys a clap	Teacher evaluation or feedback
Claire	73. Thank you	Teacher evaluation or feedback
Claire	74. Ok let's have Dorothea and Mia	Teacher question or initiation
Claire	75. And Mia, you didn't join Dorothea?-	Teacher question or initiation
Mia	76. No	Student response
Claire	77. Ok	Teacher evaluation or feedback
Dorothea	78. Ok I time height by width-	Student response
Dorothea	79. Which equals 30.25 and then time 10 which equals 302.5 cm ³	Student response
Claire	80. Ok <u>excellent</u> thanks	Teacher evaluation or feedback
Claire	81. I just wanna talk about this	Teacher evaluation or feedback
Claire	82. Dorothea and I talked about this	Teacher evaluation or feedback
Claire	83. So it's <u>not</u> <wrong> but it's not a hundred percent <u>right</u>	Teacher question or initiation
Claire	84. <u>What</u> hasn't been accounted for in that calculation?	Teacher question or initiation/evaluation or feedback
Students	85. Several students raised their hands	Student response
Claire	86. So this would be the <u>next</u> step for you	Teacher evaluation or feedback
Claire	87. Diego?	Teacher question or initiation
Diego	88. The pi	Student answer
Claire	89. The pi	Teacher evaluation or feedback
	90. <Because> if I take those dimensions I am actually counting a rectangular prism rather than what we are trying to find which is a cylinder	Teacher evaluation or feedback
Claire	91. (?) <u>And</u> to be honest >even if it wasn't a hundred percent correct< she could probably still determined which one holds the most liquid by doing it that way	Teacher evaluation or feedback
Claire	92. Wouldn't she?	Teacher question or initiation/evaluation or feedback
Claire	93. >She could determine the answer which is the	Teacher evaluation or feedback

	most important<	
Claire	94. Ok ahh	Teacher evaluation or feedback
Students	95. Several students are raising their hands	Student response
Claire	96. Let's have <u>Peter</u>	Teacher question or initiation
Claire	97. Did you do it solo Peter?	Teacher question or initiation
Peter	98. No I did it with Nick and Martin	Student response
Claire	99. Do you guys wanna come up and help him?	Teacher question or initiation
Peter	100. We started off with the white tall glass	Student response
Peter	101. And we half of that is the radius so we (?) and that turn out to be 2.25	Student response
Peter	102. And then we time that by Pi that equals 14.3	Student response
Peter	103. And then we time that by 10 and that equals one hundred and forty one point three	Student response
Claire	104. Ok <u>interesting</u>	Teacher evaluation or feedback
Claire	105. Ok who have something	Teacher evaluation or feedback
Claire	106. Let's give them a clap	Teacher evaluation or feedback
Students	107. Students clap	Student response
Claire	108. It's <u>really</u> hard to have the courage to come and talk about something that you are <u>maybe</u> <not a hundred percent sure>	Teacher evaluation or feedback
Claire	109. But you know <u>is great</u>	Teacher evaluation or feedback
Claire	110. So we have a significant difference in the answer <u>here</u>	Teacher evaluation or feedback
Claire	111. I think we have to work out what happened here ^}	Teacher question or initiation/evaluation or feedback
Claire	112. Anyone wants to tell me what happens here why this is so different to <u>this?</u>	Teacher question or initiation
Claire	113. Ben	Teacher question or initiation

Extract 4. Selection 2 of the discourse analysis (transcription initiated at minute 33 of the lesson)

As the discourse analysis reveals, in terms of social interaction Claire played different roles including initiating, selecting, helping, assessing and facilitating the discussion (Comber, 2006). The dynamic of the lesson was based on the nomination of a student (or a group) to explain the process they undertook to solve the math problem. As illustrated in Figure 13, Claire explicitly invited the nominated students to share the space in front of the classroom where she was positioned.

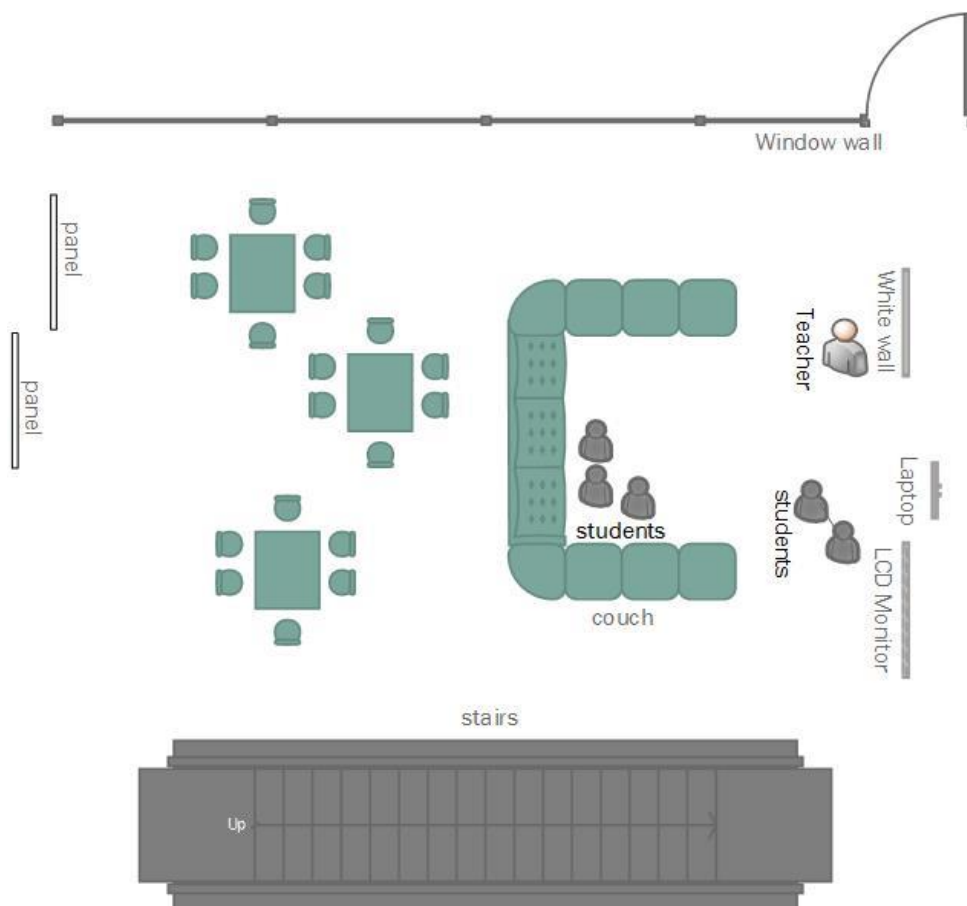


Figure 13. Teacher and students' positioning in the classroom during the middle of the lesson

While the students were responding —speaking aloud their thinking process while standing in front of the classroom— the teacher was annotating on the white-wall the steps described by the students. Thus, in this example Claire positioned herself as a helper of students. However, this initial sharing of space and power on the “stage” of the classroom was later reverted when she evaluated students’ responses. Lines 81 to 83 and 104 to 107 exemplify how Claire took back the role of teacher as the possessor of knowledge, and students as the receiver of information.

In both examples, Claire’s use of language was carefully selected. For instance, before assessing Dorothea’s explanation, Claire explicitly told the class that she had talked with Dorothea about the incorrect solution. This may be interpreted as Claire trying to get consent from Dorothea. This is an interesting way of negotiation, which reveals the teacher’s awareness about exposing a student’s work in front of the classroom; particularly when the result was incorrect. Later, in lines 91 to 94 Claire reinforced this idea when she recognised the positive aspects of the reasoning steps involved in Dorothea’s work, acknowledging the importance that “She could determine the answer which is the most important”. Similarly, in

the example of Peter, Nick and Martin, the teacher before starting the evaluation of their result, asked the rest of the students to give them a round of applause. The conscious language selected by the teacher can be observed in line 105. Here, it is clear how she first thought about evaluating the answer immediately, yet then she stopped and instead said “Let’s give them a clap”. This move in Claire’s speech can be interpreted as a way to reinforce students’ participation; regardless of students’ result. This communicative strategy prevented students’ negative emotions triggered by being publicly judged, particularly when they did not have the right answers. In addition, over the lessons, Claire deliberately dedicated time from “her talk” to show empathy to students who were showing their ideas in public by addressing comments such as “it is really hard” or “it is great”.

This part of the lesson follows a clear IRE sequence as the teacher initiated the talk, followed by students giving input on their problem solving reasoning and then the teacher offered evaluative judgment on their results. Of course, it is important to remember that the IRE is understood in this study as a general status process, not strictly in terms of line by line sentence analysis. An interesting aspect of this discourse structure, that moves away from the IRE structure, is the careful moderation of students’ interactions which was done by acknowledging their contributions, for example “ok, excellent thanks”, “ok, interesting” and by recognising the importance of their answers regardless of the accuracy of the solution, such as “to be honest even if it wasn’t a hundred percent correct she could probably still determine which one holds the most liquid by doing it that way, wouldn’t she?”.

The final move in this conversation structure is characterised by students giving input about the results and providing feedback about the accuracy of the results displayed on the whitewall. This was prompted by the teacher through open questions about the results written on the whiteboard to the classroom. Through the selection of the language, Claire included herself as part of the activity of problem solving; thus not only as an evaluator of students’ answers. For instance, line 111 illustrates “I think we have to work out what happened here” or line 99 evidenced “So we have a significant difference in the answer here”. Claire would then finalise students’ presentation with the nomination of another group. Interestingly, here the position of the teacher shifted from an “inclusive participant” to a role of power. The control of Claire over the classroom is signalled in her ability to nominate students —and by doing so— excluding other students from participating in the activity. Thus, Claire makes sometimes visible and sometimes invisible her dominant power position and control in the

orchestration of the classroom. In addition, the ability of the teacher to be “on role” and “off role” signalled the ways that language can be used to configure the relationship between participants in a learning setting. These findings are consistent with literature that highlights the multifaceted roles teachers and students might perform in the classroom space (Hey, 2006; Kamler et al., 1994; Nichols, 2008)

Selection three of the discourse analysis

In this selection (see Extract 5), Claire facilitated reflection about the type of task and the methods utilised for problem solving. She started by saying “so what we have learnt today”. The use of “we” marks the inclusion of Claire in the process of learning about problem solving and was repeatedly used by Claire during the reflection. She also made explicit the strategies she utilised to facilitate students’ learning, such as questioning skills and problem deconstruction. Claire also compared other lessons with the one implemented that day, so making overt the differences between both.

Speaker	Message Unit	IRE sequence
Claire	141. So <u>what</u> we have learnt today is actually a different form of <u>tasking construction</u> [*]	Teacher question of initiation/evaluation or feedback
Claire	142. Much more <u>broader</u> type of tasking construction,	Teacher question or initiation/evaluation or feedback
Claire	143. Rather than me >giving you a problem and you kind of highlighting or whatever<	Teacher evaluation or feedback
Claire	144. We actually <u>use</u> questioning skills to deconstruct the task to find the answer-	Teacher evaluation or feedback
Claire	145. We are going to go around in circle and say one thing that you have <u>liked</u> about maths we have done over today and yesterday-	Teacher question or initiation
Claire	146. I’ll give you a moment to <u>think</u> we are going to start from Danielle	Teacher question or initiation
Claire	147. Everyone think one thing that <they have <u>liked</u> > about maths today and yesterday	Teacher question or initiation
Students	148. (?) (after all students replied the teacher gave her opinion)	Student response
Claire	149. I’d liked ahh the <u>organic</u> communication that <u>happened</u>	Teacher evaluation or feedback
Claire	150. Don’t think you guys realised but organically	Teacher evaluation or feedback
Claire	151. A lot of people just got up and <u>where</u> “ah oh heard you guys talking about this it”s blah”	Teacher evaluation or feedback
Claire	152. And then just kind of that cross-pollination that I have talked about	Teacher evaluation or feedback

Claire	153. Where <u>bees</u> go and get a bit of <u>honey</u> from different places taking it back to their groups and sharing in the hive so >I see a lot of that happening<	Teacher evaluation or feedback
Claire	154. >Which is something that happens quite organically just happen naturally I didn”t have to talk to you or tell you move groups or share	Teacher evaluation or feedback
Claire	155. What would you change from this activity?	Teacher question or initiation
Students	156. (?) (all students gave an answer)	Student response

Extract 5. Selection 3 of the discourse analysis (transcription initiated at minute 59 of the lesson)

It is interesting to see how Claire’s self-reflection on the lesson acknowledged a desire to include pedagogical patterns that allow more flexibility in the structure of her classroom. For example, in line 143 she assessed her own practice by saying “rather than me giving you a problem and you kind of highlighting”. The deconstructive exercise she designed for the classroom that day can be interpreted as an attempt to move beyond the constraints of the language structure of the IRE. As observed so far, however, the IRE is still recognisable during the lesson, yet reshaped by the inclusion of students’ voice.

In addition to dedicating some time to explaining to students the type of instruction she chose to employ and the differences from other lessons, Claire’s language revealed an interest in eliciting students’ feedback about the lesson. She explicitly formulated two prompt questions and gave the floor to each student to express what they liked and what they would change about the lesson. The configuration of the space during this exercise was of a semicircle formed by couches and where the teacher was located next to the students, hence both students and the teacher were sharing the same position physically if not linguistically. Figure 14 illustrates this.

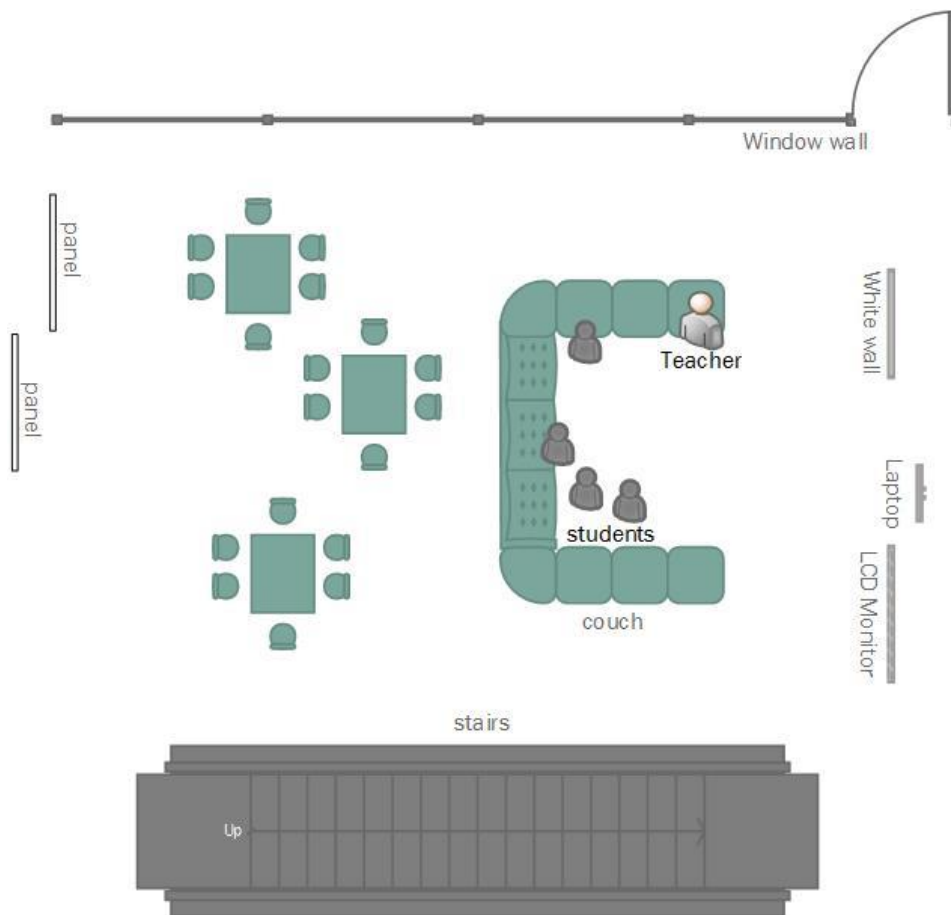


Figure 14. Teacher and students' positioning in the classroom at the end of the lesson

After listening to students' opinions, the teacher commented on what she liked and would change about the lesson. For instance, in lines 149 to 154 the teacher shared with the students what she observed when students were solving the math problem. Claire used the analogy of cross-pollination to refer to how students were taking ideas and transferring knowledge from one group to another in a rather organic as opposed to structured way. She gave students feedback on the importance of the sharing of knowledge, and celebrated the fact that it was initiated from students themselves rather than from the teacher. This can be linked with distributive patterns found in the previous section (5.1.1). This recognition suggests that while the teacher was "off stage", the students interacted in a different way from when the teacher was "on stage" leading the conversation. According to the teacher, the peer discourse generated was characterised by the sharing of knowledge and was important for prompting a general understanding about the solution of the problem.

The reflections of the teacher about the students' patterns of interaction are in line with Bloome et al. (2005) who suggest that mapping turn taking against the IRE structure of interaction is never a clean pattern. As observed in this case, in combination with the IRE

structure, often students created their own talk. By sharing answers, discussing ideas and reflecting on their solutions, students “talk” was overlapped with the IRE speech. Similarities with this type of practice can be related to students’ online interactions, to which I will refer shortly. Such talk was explicitly promoted by Claire and was often transformed into overlapped talk where students talk to each other in a less regulated, yet rich way. As observed by Claire, often as a result of such talk, students helped each other to learn. The metaphor of bees and the concept of “cross-pollination” mentioned by the teacher helped to understand how the social organisation of this classroom led to a more flexible pattern of interaction in which the IRE was re-signified with other turn taking structures. Consequently, this allowed for the inclusion of students’ co-construction of discourse and hence, their co-construction of knowledge in the physical space of the blended classroom.

Towards a discursive understanding of the online classroom space

Selection 4 of the discourse analysis (online space)

Extract 6 illustrates different activities happening simultaneously in the online space. For instance, Matthew is submitting his daily digest (an activity designed by Claire, where students have to summarise the activities done during the day and upload it online) whilst other students are uploading their “Information report”.

Speaker	Message Unit	IRE sequence
Claire	157. Information Report (submit here). In this task Claire asked the students to write a paragraph as an information report using scientific language describing their own personalities/identities.	Teacher question or initiation
Matthew	158. Here is my daily digest Aug 27, 2013	Student response
Brad	159. Brad’s are dark haired humans that love to learn. You will find him at school, an oval, At one of his friend’s houses, or at his house. He loves to play soccer with friends and family and loves socializing. He also skateboards as well as plays handball, tennis and reads. A Brad likes to sleep in and tries wake himself up. He loves to make new friends and is welcoming to everyone. Aug 27, 2013	Student response
Claire	160. I like how you tried not to repeat the same noun groups. Be mindful of your capitals and punctuation	Teacher evaluation or feedback
Ben	161. Ben’s skin is olive (Brownish skin.) A Ben likes	Student response

	to be outside. Since a Ben likes to stay outside you may see him skateboarding on the street or on the trampoline. Ben's go to school, a Ben normally sits with his friends. A Ben has many friends like A Wild Steve and Jamie. A Ben likes to relax almost a bit too much. Ben's have one area where they like to be, that place is on the street on his skateboard or at a friend's house. Ben's are reactive if someone taps him it will instantly turn around. A Ben likes to run around. A Ben is normally... Aug 27, 2013	
Claire	162. I like how there are lots of ideas here. How could you combine these together to have more complex sentences? Aug 28, 2013	Teacher evaluation or feedback
Tom	163. Toms are dark-haired human-like creatures that you are likely to find in the following habitats; school and their room at their house. The Tom is known to hoard large amounts of chocolate and other treats given to them at ceremonies hosted by their parents. Toms are shy and will not approach any other creatures. If however it knows the creature well it will happily share information about itself and free products. Toms are drawn to free products as they are to chocolate. They will be the first to find out what the catch is with the free product and if there isn't... Aug 27, 2013	Student response
Claire	164. Good use of non-personalisation! Aug 28, 2013	Teacher evaluation or feedback
Claire	166. Fabulous use of scientific language! Aug 28, 2013	Teacher evaluation or feedback

Extract 6. Selection 4 of the discourse analysis (online space)

In both cases it seems that students are initiating discourse in an independent way. However, such activities were carefully designed by the teacher. In the “Information report”, for instance, students were asked to use the “writing codes” of a report in order to describe themselves. Examples such as depersonalisation of the voice where students used the pronouns “he/she” instead of “I” are used here by the students in order to describe their identities. For instance Brad shares “Brad’s are dark haired humans that loves to learn”. Hence, by signalling such features Brad was expressing what makes him unique. Similarly, Ben and Tom also referred to their appearance and the activities they like in order to show their identities. It is interesting to note the length of students’ contributions and the depth in their description of themselves. For instance, students referred to aspects of their personalities that were not only related to what they like, but also too perhaps more personal characteristics such as being “shy” or “reactive” to certain things. This shows a certain openness and confidence of students to express their identity in this space.

Similarities with the IRE sequence can be observed here as the activity was initiated by the teacher (who posted the “Information Report” task), followed by students’ responses on the wall, and finalised with students receiving feedback from their work. Nevertheless, the written language also suggests a twist in the conventional formality of the IRE structure. Although the feedback was still evaluative, in contrast to the IRE structure, the feedback was written in a casual way and provided formative suggestions rather than formal assessment. Hence, Claire’s feedback lacked formal marking and included positive comments such as “great use of scientific language” as well as elements that could be improved. While providing feedback, Claire also used positive language which was evident in the adjectives employed such as “fabulous” and expressions such as “I like”. Here the position of the teacher reinforces her authority, yet the feedback, as in the face-to-face classroom, marks an orientation towards process rather than product.

Selection 5 of the discourse analysis (online space)

Extract 7 illustrates one of the many examples observed over four months in which students, in addition to responding to the teacher’s requirements, played roles of knowers and helpers of their peers. In this case Patrick initiated the written communication by posing a comment supported by a screenshot from Mathletic, a math learning website. The underlying structure of the comment elicits answers from the peers. On the same day, Patrick received an answer from Michael explaining why the answer on Mathletics was correct. Next, Claire, verbally recognised students’ participation and “shared knowledge”. Despite Michael’s attempt to clarify knowledge, Patrick’s doubt was still unsolved as evidenced in line 177.

Speaker	Message Unit	IRE sequence
Patrick	174. Sometimes mathletics is really strange... screen_shot_2013_08_07_at_6_10_05_pm2.png. Aug 7, 2013	Student comment
Michael	175. Dear Patrick, In your example mathletics is actually correct. You really did write the wrong answer. If a number has a - symbol in front of it, it’s like the lower the number the is, the higher it is. Yeah... it’s confusing. -3524 is actually higher than -3532 because it is less into the negatives. From Michael. Aug 7, 2013	Student response
Claire	176. Good answer, Michael. I love the shared	Teacher evaluation or feedback

	knowledge here!. Aug 8, 2013	
Patrick	177. -3524 is smaller than -3532. Aug 8 2013	Student response
Michael	178. No, it's the other way around. Aug 9, 2013	Student evaluation or feedback
David	179. Will it's negative numbers so it's the closest to 0 and -3524. Aug 9, 2013	Student evaluation or feedback
Eric	180. -3524 is closer than -3532 so actually it's the right answer. Aug 9, 2013	Student evaluation or feedback

Extract 7. Selection 5 of the discourse analysis (online space)

Next Michael evaluated Patrick's answer; in this case without including an explanation. After this attempt, two students, David and Eric, started the interaction by commenting and offering clarification on the logic of negative numbers.

Rather than a tight teacher driven pattern of dialogue formation, here one can observe responses and evaluations driven by students. This example helps to illustrate the various forms in which students position themselves in the online space. In this case, the IRE sequence is enacted by the students, not the teacher. The position of the teacher here is less related to functions of providing and clarifying conceptual knowledge, and more to supporting communication and interaction. Epistemic knowledge was negotiated between students. The language used by Michael, David and Eric suggests confidence and ownership in their epistemic schemas as each of them takes up the discursive role of evaluating Patrick's work. The modality chosen is direct and refers to a knowledge that is "known" and in which the students demonstrate "certainty". This contrasts with uses of language such as "I think" or "perhaps".

Students' written discourse also expressed empathy as they acknowledged the complexity of the concept, for instance when Michael expresses "yeah...it's confusing". The extract also reveals an aspect of time that is specific to communication mediated by technology, and that as a result shapes communication in the online space. For example, in this extract communication on the epistemic content was extended over four days. Here, it is clear how technological affordances are dependent on the users. So, though technology affords asynchronous communication between students over time, this affordance only became useful as students were willing to interact through this tool (Norman, 1988). This reveals the relevance of careful design in blended spaces. Here the teacher was able to generate a space where students felt they could freely express their thoughts regarding school content with their peers. This is particularly relevant, as this space was designed as unconstrained from

high stake tasks and marks a distinction from the demands expected in teacher-centred classroom spaces (Thibaut, Curwood, Carvalho, & Simpson, n.d.).

Selection 6 of the discourse analysis (online space)

The last example of online students' interactions on Edmodo involves various elements of classroom activities such as communication related to task management (what is the homework); epistemic activity (such as Sussie exposition of her literacy work); and praise of students' work. In all cases, the students were involved in the initiation, responses, and sometimes in the evaluation of the discourse. For instance, as lines 181 to 184 show, students took the role of requesting homework from their peers on time. However, though it is not observable in this extract, these types of interactions were earlier modelled by the teacher and progressively assimilated by the students.

Speaker	Message Unit	IRE sequence
Rod	181. Where is the Daily Digest?	Student question
Rod	182. Who's on the Daily Digest and What is the homework??	Student question
Eric	183. David Sep 11, 2013	Student response
Rod	184. Whats the homework Eric Sep 11, 2013	Student question
Eric	185. Spelling sheet Sep 11, 2013	Student response
Rod	186. KK, Sep 11, 2013	Student response
David	187. Here is the daily digest, Sorry it's late, David Sep 11, 2013	Student response
Nick	188. Nice work David! Sep 11, 2013	Student evaluation or feedback
Rod	189. I am at home and I didn't get a spelling sheet. YAY No Homework Sep 11, 2013	Student evaluation or feedback
Jennifer	190. You still have mathletics and reading to do. Sep 11, 2013	Student evaluation or feedback
Ana	191. You also have to do mathletics if you have any tasks still to do. Sep 11, 2013	Student response
Rod	192. Gotit Thanks Guys, Sep 11, 2013	Student response
Sussie	My hands trembled as I looked into the mysterious distance. It was a contemplating feeling. The loneliness and isolation. Never ever understood the beauty and darkness. My mind wondered off and my body become another soul. My delicate bones felt like falling into the moist dark ground. Sometimes when you remember things of the past your	

	indecisive mind gets the better of you. I fell slowly to the ground as though my beautiful background was falling in on me. The grasp of my soft...	
Amelia	193. Very good =) Sep 11, 2013	Student evaluation or feedback
Julia	194. Wow,it's amazing :) Sep 11, 2013	Student evaluation or feedback
Nick	195. Here is my description from the book I'm reading at the moment. My aunt was a tall, hard-featured lady, but by no means ill-looking. There was an inflexibility in her face, in her voice, in her gait and carriage, amply sufficient to account for the effect she had made upon a gentle creature like my mother; but her features were rather handsome than otherwise, though unbending and austere. I particularly noticed that she had a very quick, bright eye. Her hair, which was grey, was arranged in two plain divisions, under what I believe would be called a mob-cap;... Sep 10, 2013	Student response
Sean	196. Nice work Nick! Great description! Sep 10, 2013	Student evaluation or feedback
Brad	197. COOL NICK, NICE DESCRIPTION!!! Sep 10, 2013	Student evaluation or feedback
Andrew	198. You can turn caps lock of Brad. Sep 12, 2013	Student evaluation or feedback



Extract 8. Selection 6 of the discourse analysis (online space)

In this extract, students use the online space of Edmodo both to request and to provide information. Moreover, it also reveals that power and authority are sometimes employed, others shared and often explicitly delegated by the teacher. For instance in line 189, Rod expresses his satisfaction as he believed he is exempt from doing the homework. This misunderstanding is clarified by Jennifer and Ana who reminded him that the material for the homework is also available online. Students also took the corresponding position of the teacher to engage in normative clarification such as the recommendation of Andrew about “turning the caps lock off”. Students’ positioning themselves sometimes in authoritative roles and others in requesting roles suggest that the pedagogies of the primary classroom are intricately interwoven between actors in the online space.

Discussion on the discursive practices offline and online

The results observed in the physical space and in the online space show the relation between language and pedagogical choices and how such relations foster classroom orchestration in a student-centred way. As observed, the type of interaction promoted by the teacher in the blended space is not trivial. Instead it has key pedagogical implications, as it affects how

students are able to interact with others and often are scaffolded by their own peers. In this sense, it provides evidence of how learning happens not solely inside the brain, but is strongly mediated by the quality of interactions with others (Wertsch, 1985).

Visibility and invisibility of pedagogies through language might be understood as moments where the teacher controls, or conversely, hands over the power of the classroom. As Kember (1997) shows, pedagogy was for many years paralleled to teaching practices associated with: transfer of information; with an allocation of knowledge in the figure of the teacher; where the teacher plays the role of the presenter of information; where the content is regulated by curriculum; and where the students have the role of passive recipients. By creating spaces for the students to interact and construct their own answers, the teacher's pedagogical practices shift from the presenter of information and the possessor of knowledge to a facilitator of learning. Consequently, the teacher supports her students to construct identities through discourse in which they can position themselves in active roles of learners (Bakhtin, 1981, 1986).

As stated at the beginning of this chapter, teacher pedagogies can be designed in order to enable learning, yet pedagogies cannot replace what it takes for students to learn. As stated by Jahnke, Norqvist and Olsson (2014) "learning is not only a cognitive effort and teaching is not a delivery activity to reach the cognitive dimension. Instead, teaching is rather an activity-driven design, and learning is an on-going activity of knowledge production instead of consumption" (p.168). Interestingly, here in the blended learning classroom the discourse of students' learning is constituted by multifaceted roles where some students may also enable other students to learn. A sociocultural theory proposes that cultural settings are constitutive of cognitive development because they assist in shaping people's thoughts (Vygotsky, 1978). The cultural setting of the classroom and the discourse produced by its members is a reflection of the situated social practice of this blended classroom. Both, the face-to-face and the online dialogue highlight the central role that language, both oral and written, is playing in the configuration of the relation between teacher and students and the various identities co-constructed for the purpose of learning in this classroom. Through reciprocal interactions and discourse production students are internalising what happens at a social level in the individual mind (Vygotsky, 1978, 1997) and adopting ways of being in such processes in both face to face and digitally mediated spaces (Salmon, 2003, 2006).

From a distributed cognition approach, the sharing of power that Claire demonstrates in this analysis signals a pedagogy with a systemic underlying structure, where the participation of all the elements in the environment is involved in the construction of meaning (Hutchins, 1995, 2000). Related to Hutchins (2000) cognitive ethnography example, Claire's pedagogies show a recognition that in order to effectively coordinate "navigation" of the classroom, she cannot rely only on her personal knowledge. Instead she draws on the knowledge of other students as well as knowledge distributed in tools (for instance in the reliance on the affordances on Edmodo, the use of the whitewall as well as pen and paper) in order to successfully navigate the system of the classroom. The pedagogies observed in extracts one to six resonate with a distributed cognition approach, where knowledge is designed to be shared as opposed to be located solely in the teacher; such distribution in this classroom can be clearly observed across tools, people and time (Hutchins, 1995, 2000).

By positioning the mind out there in the world, rather than the world in the mind, a distributed cognition approach (Hutchins, 2000) suggests that through networks of interactions, individuals are better able to jointly work on solving problems or achieving outcomes. The pedagogical patterns observed across the physical and the digital space are stimulating students to make their cognitive thinking observable in a twofold way: by sharing space for students to develop their epistemic schemas online and sometimes in the physical classroom; and while doing so, by stimulating feedback that is not attached to "high stakes". Such pedagogies interwoven over ongoing formative feedback can be seen as a puzzle in which each part —students and the teacher— is mutually needed and considered to construct dialogue, or solve problems in the learning process. As Simpson and Walsh argue (2014) "to make a link between curriculum content and the discursive practices of teaching the teacher must consider the what and the how of learning; that is the content and means" (p.130). As the evidence shows, the pedagogical methods used by the teacher prompted students' active epistemic engagement in class activities across the curriculum content (Skidmore, 2006). Consequently, students were guided in being co-participants of the discursive practices. Particularly, the interactional patterns in the online space suggest that the teacher has modelled student-centred learning by handing over some pedagogical methods to students; who, in turn, are showing independence, control, and an active voice in the classroom.

The impact of the use of technology in the classroom, as observed in this analysis, may vary depending on how learning spaces are designed to be used. The use of online space could

have replicated a teacher-directed classroom or, as seen in this example, leveraged more student-centred interactions. The use of Edmodo in this case fostered the social aspect of learning and created another pedagogic channel for the teacher to enhance communication and interaction. Therefore, in this online space students were given a new space where they could elaborate and perhaps consolidate their learning. This finding is in line with a sociocultural approach to learning (Vygostky, 1978) in which the cultivation of social relationships is key for facilitating learning.

The underlying talk structure of the physical space was critical as it is here where students were first introduced to epistemic knowledge that they later applied online. In this sense, the use of the IRE structure in the face-to-face classroom was useful in giving instructions and providing content-knowledge, yet it was also combined with more flexible patterns of discourse in the classroom. The fact that classroom talk orchestration often requires one person to be actively talking, while the others remain silent, is not particular to school environments. The constraint of face-to-face communication is that in order for the “talk” to be heard, only one person can talk at a time. As seen in this case, the online space offers possibilities of multiple digitally-mediated asynchronous talk, thus complementing some of the limitations of directed talk (Black, 2005; Salmon, 2006). For instance, this was observed in the online space, when students offered various responses and evaluations to Patrick’s concern about Mathletics. Of course, asynchronous talk is strongly constrained as the gestures, intonations of the conversation and the physicality cannot be replaced. This is perhaps why the data suggests that the combination of both, results in an effective solution for designing student-centred blended spaces.

5.2.2 Synthesis of this section

At the beginning of this analysis I asked: What are students’ and teachers’ discursive patterns in the blended classroom? Through a situated discourse analysis the data reveals patterns of pedagogies mediated by language in the blended classroom. It was observed that the IRE structure was used in combination with other types of interaction patterns which were often enacted when the teacher was in the physical space and also was frequent in the asynchronous online interactions. In such instances, students were able to take up corresponding positions of “power” in relation to knowledge-facilitation and problem solving

with their peers. The pedagogical patterns observed across the physical and the digital space aligned with a distributed cognition approach where the orchestration of the activities drew on all the agents in the system, rather than only on teacher's knowledge. This was clearly seen when Claire stimulated students to share their cognitive thinking online and in the physical classroom.

Although in the physical space Claire was the authoritative figure, the one who facilitated students' responses and who provided the correct answer to students' inquiries, the pedagogies used by the teacher also allowed students' voices to be included. In addition, by providing encouragement and praise of students' thinking processes, Claire shows the value given to a formative assessment rather than an evaluative assessment. Consequently, the discourse analysis illustrates how students' learning was enabled through co-construction of knowledge rather than through teachers' transmission of knowledge (Duffy & Cunningham, 1996). Perhaps the most clear pedagogical pattern utilised by Claire that helped to reconfigure the IRE structure was the inclusion of students' voice over different instances of the lesson. Claire negotiates the participation with the students in the math lesson by enacting different roles, for instance by performing the role of "helper", "recipient of knowledge", "evaluator"; and when off stage, by delegating for some time the power, handing it over to the students. In the online space, students are positioning themselves in roles where they not only freely answer questions, but also are empowered to publicly frame questions and expect epistemic guidance from their peers as well as from the teacher. The structure of this talk perhaps is related to the fact that the pedagogical presence of the teacher in the online space is less overt. Hence, this allows more space for participants to interact, regardless of their positions of power carried by their formal identities of "teacher" or "students" in the physical space.

5.2.3 Asynchronous interactions on Edmodo

In this analysis, I examine the total collection of student interactions on the social network site Edmodo by employing a content analysis technique. This allows the generalisation of results extracted from the complexity of the original interactions traced on the asynchronous chat (de Laat et al., 2007). Consequently, this approach to interactions in the blended classroom complements the situated discourse analysis, by including not just selected

contributions, but the whole set of contributions of students and the teacher in the online space. In particular, my interest was to elucidate whether students' contributions share similarities with interactions conventionally regarded as *teacher roles*. For that I used the Anderson Coding Schema which allows an analysis of the online interactions on Edmodo based on three main categories: Instructional design and organisation (ID); facilitating of discourse (FD); and direct instruction (DI) (see Chapter 4, Table 8, for more details). To better understand the interactions of participants in the online space, I coded all the contributions of students and the teacher over four months on the Edmodo wall. This analysis was guided by the following research question:

- Are students' engaging in tutoring roles while interacting on Edmodo?

As explained in the literature review, social network sites are Web 2.0 tools that encourage interactions as well as identity construction through profile formation, media sharing, production and networking (Ellison & Boyd, 2013). There are multiple actions that students and teachers are able to complete on Edmodo, yet in this research I focus on communication that students and the teacher enacted on the digital chat space, commonly referred to as "the wall". Hence, other aspects of interactions such as teacher-student private communications are left aside. As previously explained, during numeracy and literacy lessons, instruction was based on face-to-face interactions, so Edmodo was used primarily outside of the classroom. It is important to note that the social interactions in which these students are engaged are "loose". In other words, students are not specifically collaborating for achieving a specific result, but the use of Edmodo was part of students' everyday activities, which may include work related to spelling, grammar, project-based work, or math exercises.

Instead, they interact about the various activities they are working on in the classroom. This distinction is relevant as it situates this study in a learning network environment, differentiating this group from other collective types of learning, such as learning in groups (Alvarez, Alarcon, & Nussbaum, 2011; Barron, 2003). Finally, it is important to note that handing in homework online by students was not included in the analysis; such contributions were coded as not applicable.

Participants' contributions

The analysis conducted over four months reveals that students are contributing to dialogue formation by engaging in tutoring roles. This result is consistent with the findings obtained in the earlier section that applied a situated discourse analysis and the IRE pattern structure. As the numbers of contributions show, the categories more used by students are facilitation of discourse (340 contributions) and direct instruction (140 contributions). Within the category of facilitation of discourse, activities such as moderating discussions, eliciting opinions; encouraging involvements, praise; and solving technical problems were found. In relation to the latter, students engage in tutoring roles by asking questions about the topic established; offering comments; offering feedback, providing suggestions; synthesising opinions; offering clarifications, and resolving task problems. Conversely, contributions categorised as instructional design were rare. This finding is expected as these contributions are related to design for learning, including for instance, prompting tasks, providing guidelines, providing resources. Contributions coded as “instructional design” initiate the activity of students and consequently enable other interactions such as facilitation of discourse and direct instruction to happen.

	June	July	August	September	Total
ID (Instructional design and organisation)	2	0	0	0	2
FD (Facilitation of discourse)	38	54	56	192	340
DI (Direct Instruction)	9	46	28	65	148
Total	49	100	84	257	490

Table 20. Students' total contributions coded as tutoring practices by category, Jun-Sept 2013

When counting all the contributions on Edmodo, overall Claire contributes little compared to students. Thus, over the months studied, in total the teacher makes 11% of the contributions in this environment. This result seems logical given that there are 30 students in the class and just one teacher involved in the digital asynchronous chat, yet it is also indicative of the predominance of student-driven talk and the changes in the patterns of classroom interaction

between the face-to-face and the online environment. This result is consistent with the findings of the prior section that examined interactions from a situated perspective. From a sociocultural approach this may be interpreted as a way in which tool mediation allows the construction of meaning, through interactions (Vygotsky, 1978; Wertsch, 1985). From a social learning perspective, it reveals how an online platform can function as a tool to construct meaning and distribute interactions (Brown & Adler, 2008; Thibaut et al., n.d.).

The contributions of Claire show a predominance of facilitation of discourse, followed by instructional design and direct instruction. The low number of contributions of the teacher in the category of “direct instruction” compared to the students gives an idea of the patterns of interactions established online.

	June	July	August	September	Total
ID	9	7	11	12	39
FD	12	4	47	40	103
DI	0	5	7	4	16
Total	21	16	65	56	158

Table 21. Teacher: total contributions coded as tutoring practices by category, Jun-Sept 2013

It was observed that though most students engage in teachers’ practices, there are differences between students. Figure 15 illustrates students engaging in tutoring roles. For instance, students such as Diego, David, Martin, and Julia, show a consistent high participation in contributions in this category. On the contrary, other students, such as Mia and Kate contributed little to such activities. In addition, Brad, Jennifer or Andrew are examples of students with a medium level of involvement.

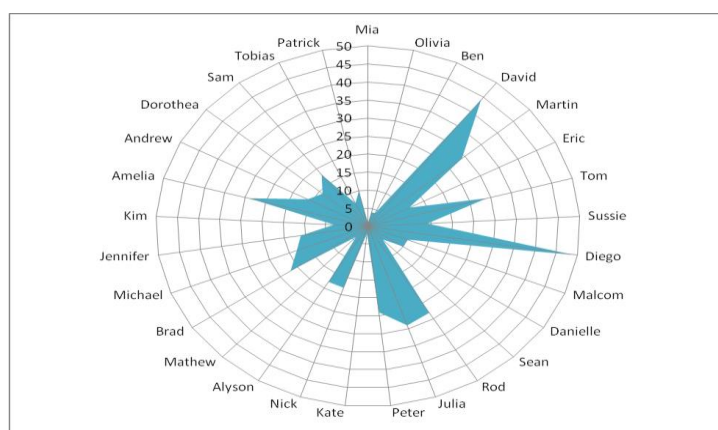


Figure 15. Students: Total contributions coded as teaching practices, Jun-Sept 2013

The contribution of Claire shows changes across time. For instance she shifts from a low level of contribution in June and July to a high level of contribution in August and September. The increase in the frequency of interactions in August and September might be related to the school calendar. So the rise in the number of contributions of Claire might signify an attempt to consolidate students' knowledge before they went on school break in September.

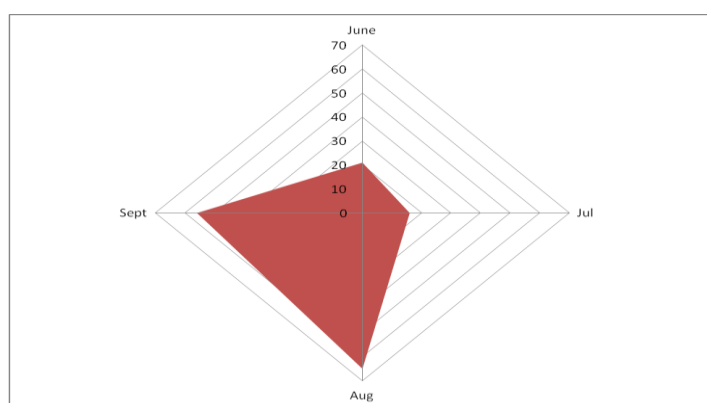


Figure 16. Teacher: Total contributions coded as teaching practices, Jun-Sept 2013

Insights on students' online contributions

As previously mentioned, some students' interactions showed a clear tendency towards facilitating discourse whereas others tended to interact mostly in direct instruction. For instance Diego and David showed a clear pattern towards giving direct instruction. By engaging in contributions with their peers, assessing, diagnosing misconception and providing feedback they mimicked teachers' direct instructions roles. For instance, extract 9 helps to illustrate David and Diego's pattern of contribution in the Edmodo wall:

Students extract	Time code	Description
David My maths question: What is 0 Kelvin	Jul 29 2013	Question posed by a student (as part of a task assignment)
Diego 0 kelvin is absolute zero, or -273.15°C . It is the coldest it is anywhere in the universe	Jul 29 2013	Content-related answer by David

Extract 9. Students engaging in teaching practices: Direct instruction

Other students' patterns of interaction reflect students' preference for facilitating of discourse. For instance, Amelia, Diego or Sam, recurrently engaged in contributions where they encouraged further participation of peers, actively praised their peers by acknowledging the quality of work, or reinforced positive behaviour on the wall. An illustration of facilitation of discourse can be observed in extract 10:

Students extract	Time	Description
Rod Here is my Zondle game on the week 8 spelling rule. Please reply with your scores	Sep 8, 2013	Digital game developed by a student
Amelia That was so fun, you should continue making games :)	Sep 8, 2013	Amelia praising Rod's work

Extract 10. Students engaging in teacher roles: Facilitation of discourse

As Table 20 shows, only two events were coded in the category of instructional design. This presents a large contrast compared to the number of interactions where students engaged in practices of "facilitation of discourse" or "direct instruction". These examples suggest that a number of students engaged in more central roles of participation whereas others present a rather peripheral participation. The data also suggests that some students traversed from central to peripheral roles depending on the topic and type of assignment.

As previously stated, unlike students' patterns, when analysing the teacher's participation on Edmodo, the units of meaning coded as "instructional design and organisation" were frequent. Such interactions were aimed to set curriculum, set tasks, to establish time parameters and to regulate the interactions by establishing a "netiquette". One recurrent activity of the teacher was setting curriculum outcomes. Extract 11 illustrates how the teacher gave instructions to her class in the subjects of numeracy and literacy through postings on Edmodo.

Claire's extract	Time code	Description
Pre-Learners - Week 7 <u>Turn In</u> Due Jun 10, 2013 Maths: Complete the 3 "Pre-Learner" Activities on the Week 6 Maths Edcanvas. Submit them onto the Week 7 Pre Learner Assignment. Literacy: Can you work out this week's		Claire's instructional design and organisation Guiding navigation of students online (Edcanvas embedded in the LMS, or linking the access of YouTube videos) Claire's design and set of

spelling rule? Look through the clues and watch the YouTube clip to help you. Tell me the rule along with 3 examples on the Week 7	short contributions by students
Pre -Learner Assignment What is an abstract noun? After looking through the Week 7 Grammar Edcanvas, write 3 examples on the Week 7 Pre-Learner Assignment	Claire's design and set of short contributions by students

Extract 11. Teacher engaging in practices of instructional design and organisation

When giving instruction on the digital wall, Claire prompts students to engage in authentic activities and short discussions, extending the topics taught during face-to-face learning lessons to the online space. She also uses short open-ended questions to stimulate discussion. Similarly to her style in the physical space that was examined earlier in this chapter (5.2.1), in the online space Claire encourages the thinking process rather than just the praise of the correct result. This has been reported in the literature as an important pedagogy to leverage students' construction of meaning (Rovai, 2004). Claire also contributes highly in facilitating discourse. Such contributions were mostly related to encouraging, acknowledging, or reinforcing students' work. Other interactions in this category were related to regulating the conversation by clarifying or correcting procedures. Extract 12 is an example of this:

Extract	Time code	Description
Rod Here is today's Daily Digest (word document attached)	Aug 9, 2013	Students contribution
Claire It's great to see where you're up to and to use that to measure whether we are on track	Aug 11, 2013	Teacher facilitating of discourse

Extract 12. Teacher engaging in practices of facilitation of discourse

Discussion on the asynchronous contributions

The analysis of the entry-logs revealed a rich amount of digitally mediated dialogue produced between students over time. Dialogue, defined as a “jointly created social interaction” (Johnson, 2004, p.144), underlies processes of negotiation occurring between mentors and novices in educational contexts. Through dialogue, novices are supported to gain a better understanding of content knowledge formation, while students engaging in roles of mentors are given opportunities to consolidate their knowledge when explaining concepts in their own

words to their peers (Brown et al., 1989; Rogoff, 1990). Dialogue is commonly associated with verbal communication, yet as observed in this case, dialogue can also adopt an asynchronous communication shape.

Whether reading, writing, or researching for class tasks, students' online contributions show how students talked to each other about class activities outside the space of the classroom. The evidence about dialogue formation and peer teaching shown in this section is consistent with research that shows how social interactions that are anchored in dialogue, such as collaboration, cooperation and peer teaching, are key in supporting knowledge construction (Brown et al., 1989; Dillenbourg, 2013; Wenger, 1998; Wertsch, 1998). Research on knowledge development has found that individuals gain understanding of concepts when explaining it to others (Veldhuis-Diermanse, 2002). In addition, patterns of turn-taking during conversation and ways to interact with others in groups are key for these collaborations to succeed (Barron, 2003; Greeno et al., 1996). Furthermore, research on students' interactions suggests that any interaction that involves sharing of information, guiding, questioning, problem formulation, structuring tasks or given counterarguments, stimulates students' learning and the learning of peers (Veldhuis-Diermanse, 2002).

While in the school classroom, dialogue traditionally has been associated with face-to-face interactions (Gee, 2004), the data shows that in this case students were also able to engage in dialogue formation and peer teaching on a digitally mediated platform. This not only reflects students' ability to display and express their ideas coherently while combining the use of the keyboard along with reading digital texts, but also reflects the opportunities that arise to expand classroom discussion which is often constrained during the learning lesson (Bloome et al., 2005). Studies examining the use of social media tools such as Twitter report similar results. For instance, studies examining the use of Twitter in an undergraduate population reported that students felt more engaged in the task due to the rich discussions, reflection and peer tutoring fostered through the use of Twitter (Junco, Elavsky, & Heiberger, 2013; Junco et al., 2011).

Students who were not active in dialogue formation may have also benefited from the posts displayed on the Edmodo wall. As suggested by the interviews with students, they were constantly reading the comments of other students on line. For instance, Adrian comments:

Edmodo is very very useful. So for instance when I was using my theme park I put up a post on Edmodo saying —does anyone have any ideas on what rides should I put on my theme park— and heaps of people just answered me of what I could use, and information of all sorts. (Interview 25 July 2013).

You put up (questions) on the wall and you have to answer questions that people put up on the wall and it is a very good way to engage in other's people thoughts not at school, so you get insight on what they are doing and then you can do better but not just at school like talking to the teacher or talking to your friends but you can access them anywhere. (Interview 25 July 2013).

The data suggests that students' asynchronous vicarious experiences (Ertmer & Ottenbreit-Leftwich, 2010) enabled by the implementation of a social network site in this classroom, constituted an entry point where students engaged in *legitimate peripheral participation* (Lave & Wenger, 1991). As expressed by Brown, Collins, & Duguid (1989):

Given the chance to observe and practice in situ the behaviour of members of a culture, people pick up relevant jargon, imitate behaviour, and gradually start to act in accordance with its norms. These cultural practices are often recondite and extremely complex. Nonetheless, given the opportunity to observe and practice them, people adopt them with great success. Students, for instance, can quickly get an implicit sense of what is suitable diction, what makes a relevant question, what is legitimate or illegitimate behaviour in a particular activity (p.34)

According to a social learning approach, opportunities for students to actively engage in dialogue formation but also to experience *legitimate peripheral participation* are important as students who are less confident in some topics are able to observe and gradually participate in discussions between more confident students. As observed in this case, participation in a community was mediated by different shapes of participation, from observing to active participation. Conversely if access to practices of more confident students or teachers is limited to other students, then growth opportunities derived from such observations are also restricted (Lave & Wenger, 1991).

Students' attitudes towards interacting on the Edmodo wall also suggest that students are learning to become autonomous and to mutually help each other. This echoes social learning as students are scaffolding problem solving that they cannot solve individually, by being

assisted not only by the teacher, but also by working with their peers in the online-class (Rogoff & Lave, 1984; Rogoff, 1990, 2003; Vygotsky, 1978). Thus, as a sociocultural theory posits, facilitation from peers with more expertise in certain subjects can assist learning of students with similar or less expertise within their zone of proximal development (Lave & Wenger, 1991; van Lier, 1996). Consequently, as students reciprocally help each other to solve problems in the online space, learning within ZPD occurs not only from the dialogue formed by teacher-student, but also from peer-peer interactions, (Boud, Cohen, & Sampson, 2014). As Wu (2003) argues about online discussion:

Language use and learning interact in a spiralling fashion within communities of learners; talking with more skilled members of the community enables the students to acquire some of the expertise in a language for operating within the domain. This in turn allows the student to contribute to the problem-solving effort and provides opportunities for further conversational exchanges about more advanced topics. Discourse is a means by which students construct knowledge as they strengthen and expand their individual understanding (p.169)

The findings are consistent with studies on asynchronous learning platforms which evidenced that peer evaluation and peer interaction can be drivers that increase the quality of students' thinking process (Johnson, 2004). These results are also congruent with Picardo's (2011) work on social networks stating that, "learning from one another is one of the deepest forms of learning our students ever experience. When effectively implemented, online social networking allows our students to continue learning from one another, under our guidance, beyond the school's walls" (paragraph.26).

The evidence also confirms previous research done comparing face-to-face and online space interactions, suggesting that asynchronous interactions enable reflective thinking and that online discussion generates a "text of the talk" that enables deep reflection of the text (Black, 2005). Black further argues that the "text of the talk" signs a twofold action: a process (discussion) and product (the document traced on the online thread). Thus, Vygostky's (1978) foundational ideas about tool mediation as needed for cognitive development is reflected here, as the contribution thread weaved by students signals the convergence of tool and text. In addition, a sociocultural perspective of learning posits that learning experiences of students are constructed in collaboration with others. The construction of meaning, thus depends upon the quality and type of interaction (Vygotsky, 1978; Wertsch, 1985). Hence, while students

participate as teachers in the asynchronous chat, students not only are contributing to a thread discussion, but they are also collaborating in content-knowledge development, and are co-constructing their own schemas about topics related to literacy, numeracy and science. They are engaging in knowledge-building rather than simply assimilating ideas designed by others (Hewitt & Scardamalia, 1998). In these processes knowledge is being shared, negotiated and discussed by the community of participants in their own situated understanding of concepts. For instance, when interacting about subject areas, such as positive and negative numbers, percentages, decimals, infinite numbers, spelling, grammar or how to construct narrative discourse, students drew on their own experiences to contribute on the wall.

The literature reports that technologies mimicking social media in the classroom enable interactions among participants, thus opening opportunities, but also presenting risks (Ludvigsen et al., 2011; Vines & Dysthe, 2009). Although the data does not clearly show patterns of asymmetric contributions by class leaders, this is a point that should be more clearly investigated in further research by comparing class leaders in the physical space and in the online space. Thus, attention needs to be taken in order to prevent feelings of isolation among students in online spaces (Palloff & Pratt, 2007; Salmon, 2006).

5.2.4 Synthesis of this section

At the beginning of this section I asked: Are students' engaging in tutoring roles while interacting on Edmodo? In order to answer this research question a content analysis technique and the Anderson Coding Schema were applied. This allowed the analysis of the online interactions on Edmodo based on three main categories: Instructional design and organisation (ID); facilitating of discourse (FD); and direct instruction (DI). Echoing theoretical approaches related to legitimate peripheral participation, social learning and tool distribution, the data suggests that students are actively participating in learning activities through dialogue formation. Students were found to adopt roles related to facilitation of discourse, such as moderation of dialogue and encouragement of interactions; and direct instruction involving contributions related to answering questions, sharing information and giving feedback. In contrast, Claire's contributions online are in turn, less significant in directing instruction (e.g answering questions or clarifying) and rather focused on activities related to classroom design and orchestration (Dillenbourg, 2013; Sharples, 2013). Most of Claire's

contributions online related to prompting tasks, providing guidelines and resources, and overseeing students' interactions. A closer look at the contributions of students online, suggested that when students actively or peripherally participate in interaction online, they engage in knowledge formation and peer teaching. A clear link between the findings of the earlier section on situated discourse analysis and the ones obtained through a content analysis approach are observed. Although different coding systems were used, both parts looked at how interactions take place. In particular, the idea that students were actively participating online and often engaging in more than responding to teacher requests (which was suggested in the first section about interactions) was confirmed in the present section.

5.3. Artefacts and new literacies in the blended classroom

As Ricoeur (1971) explains, concrete texts differ from the abstract structures of language in that they are “written” to do something (as cited by Hodder, p.157). Recently, scholars have focused attention on digitally mediated text, such as games, websites, or digital videos, also named as multimodal texts. These new literacy practices (The New London Group, 1996), are also often observed in online spaces (Ito et al., 2010, 2013; Jenkins et al., 2009; Lammers, Magnifico, & Curwood, 2014). As discussed in the theoretical chapter, tools have a twofold implication: they afford certain practices, yet at the same time constrain others (Gibson, 1986; Hutchins, 2010; Norman, 1988). In addition, texts also depend upon the material condition embedded in a particular historical, spatial and social setting, and its availability (Nieto, 2007; Vygotsky, 1978; Wertsch, 1985).

By linking artefacts to new literacy practices I highlight the interdependence existent between tools and communication and will analyse the kind of literacy practices that can be supported and the implications for learning processes at the school level. First, I examine the kinds of literacy practices produced by students when mediated by technological tools and displayed through Edmodo (5.3.1). Next, I explore new literacies in the classroom by analysing two videos produced by students (5.3.2). Here I also examine how the teacher drew on this multimodal tool for teaching literacy and cross-curricular content in the blended primary classroom.

5.3.1 New literacies and learning in the blended classroom

Research on the effects of social media and digital tools in out-of-school settings has suggested that such technologies are dramatically modifying the dynamics of children's literacy practices (Black, 2009; Greenhow, 2011; Ito et al., 2010; Lammers, Curwood, & Magnifico, 2012). In addition, changes in the nature of interactions and communication in the 21st Century present challenges to the literacy skills that young learners need to develop in an increasingly participatory culture (Jenkins et al., 2009). Despite the changes in out-of-school settings, there is little research dedicated to investigating this topic in primary schools (Fields & Grimes, 2012). As Boyd (2008) argues, many schools have been passive in responding to such changes and often have answered such demands by preventing students and teachers from accessing social networking technologies. This is problematic given the wider learning potential that digital technologies such as social network sites can provide in terms of collaboration and co-construction of knowledge (Selwyn, 2009) and that schools are currently better equipped with hardware and software (European Commission, 2013; Kalas et al., 2014; Underwood et al., 2010), and consequently, better prepared to integrate such technologies in the classroom.

It is important to note that the study of Edmodo allows an entry point to connect tool mediation and blended learning in school contexts. As such, the following analysis and discussion on Edmodo needs to be understood as part of a blended ecosystem, where other ways of literacy practices in the face-to-face space were taking place. This analysis seeks to contribute to the body of research on literacy and digital technologies by analysing how a class of students using Edmodo engages in literacy practices as part of their regular learning activities over the entire school year. The analysis is guided by the following questions:

- How are primary school teachers using a social network site in their daily activities in the classroom?
- What learning and literacy practices can be observed while students interact with their peers and teachers in a social network site?

The analysis examined students' and the teacher's entry logs on Edmodo. All the interactions posted on the Edmodo wall by students and the teacher over four months were retrieved and

gathered in a database. I observed the entry logs of students and teacher multiple times and key analytic themes were found (see section 4.1.5 for further details). It is important to note that the interactions of students and Claire on Edmodo took place primarily after the face-to-face lessons and sometimes at the end of the lesson when the teacher needed to clarify some aspects of homework. Therefore the interactions analysed occurred mostly outside the physical space of the classroom and asynchronously.

The role of the teacher in modelling the use of Edmodo

The role of the teacher was key in setting up the repertoires of interactions observed on the Edmodo wall over time. Thus, in this online environment, the *rules of the game* (Bernstein, 1995) were firmly grounded on content (learning tasks) but also in the recognition of each student's unique voice and identity. In this latter aspect, the interface of Edmodo helped students in expressing more than just issues related to homework delivery or completion of tasks. This could be seen in students' profiles, as each student was able to customise their online identity with photos and descriptions of what they like and activities of their interest.

In order to set up the *rules of the game*, at the beginning of the year, the teacher modelled the use of Edmodo by relating the features of this learning technology to tangible tools for communication such as a cork noticeboard. This exercise allowed students to make connections between their everyday activities in the classroom with online interactions. By asking students to comment on a cork noticeboard and by prompting questions to the students, such as "Would you like everyone to see your post on the cork noticeboard in the classroom?", Claire facilitated students' cognitive links between face-to-face and online communication. Claire also prompted discussions in relation to implications of online writing. For instance, the concept of the digital footprint and what does it mean in terms of the content and the meta-data that becomes available when interacting online was discussed. Students and the teacher also discussed the implications of online participation and topics such as cyber-safety, trust, security and the online information of users' storage online. Through these discussions, the relevance to post effectively and notions of netiquette was prompted. Students and the teacher agreed that the interactions on Edmodo would be exclusively related to school activities, with all postings conforming to the use of correct spelling and punctuation. When interviewed, Claire commented that she sees the introduction

of Edmodo as a way to prepare their students for public social media and ICT practices. While other teachers may avoid social media tools, she believed that it is important for teachers to include online tools and online content management as part of their teaching activities, because students will eventually have to face this environment.

The way the teacher modelled students' practices mediated by a social network site resonates with some aspects of social learning as students' interactions involve collaborative activities (Brown & Adler, 2008; Lankshear & Knobel, 2011). The way Claire prompted students' use of this technology echoes the properties of social networks as students actively shared information, asked questions and engaged in dialogue formation, thus augmenting connectivity within users/students. As a result the teacher stimulated students' interactions on activities anywhere and anytime. As Claire commented, "Having something like Edmodo where they can chat about stuff that they might need to know, I think that is really helpful". Such interactions on Edmodo were seen by the teacher as a way to scaffold students' abilities to be self-motivated and ongoing learners and were aimed at establishing foundational skills in relation to students' meta-cognitive processes with regards to their learning.

Semiotic mediation and distribution

The dynamics of text production and reading in the current classroom are being reshaped due to multimodality. Jewitt (2005) explains that "image, sound, and movement enter school classrooms in 'new' and significant ways, ways that reconfigure the relationship of image and word" (p.315). In a distributed approach (Hutchins, 2000; Salomon, 1993) the cognitive processes of thinking and meaning making are circulated through agents across physical and digital spaces, and with a variety of tools. One can think of the semiotic mediation occurring in this classroom as part and parcel of students' processes of thinking and literacy practices.

Through the thematic analysis of the data, it was observed that students not only relied on the use the digital written text to participate in social networking online, but also they regularly engaged in multimodal practices. Over the course of the year, students posted on the Edmodo wall numerous examples of multimodal text production, including images, audiocast, videos and the design of their own online games. This production was part of assessments assigned by the teacher online. When this occurred, students showed their awareness of various modes for representing meaning. For example, I observed how Sam, Mia and Danielle (all

pseudonyms) designed a website for a project related to theme parks. The task posted by the teacher on Edmodo instructed: “Individually or in approved groups, students create an Australiana-themed park concept website and model for future investors including the following elements: theme park name, logo, catch phrase, vision statement, Indigenous considerations and inclusive considerations”. Sam, Mia and Danielle worked together to collaboratively plan and demonstrate their understanding of theme parks, along with expressing their unique identities as designers portrayed in the conceptual model and website produced. Figure 17 illustrates part of their work:



Figure 17. Website created by students

Their communicative strategies to design their theme park website included the use of iconic symbols, the understanding and application of persuasive text, along with selection of specific colours and font for highlighting aspects of the narrative text. Moreover, students embedded a video to promote their theme park in which they advertised the different activities, rides and food available at the park. To represent those activities, students decided to use a drawing application so that their images were symbolic representations of food, rides and activities, as opposed to real photos copied from actual theme parks. Next they embedded the images in an animated video and uploaded it on the website. The selection of different techniques to represent their conceptual imagery of their theme park shows students' engagement with a variety of modes of representation and students' digital literacies abilities in relation to how and where to obtain those results using free resources from the Web. This demonstrates how students used their writing and reading skills in combination with the use of colour, font, and the layout of the page along with aural elements of text production to represent ideas and convey meaning. In particular, the ability to read digital texts, along with

the ability to compose digital texts involving spelling, punctuation, vocabulary, and layout were observed in this example.

Scholars argue that often the composition of a multimodal text is more demanding in terms of creativity than the print text because it requires “extended time for students to analyse an audience and synthesise a message across modalities” (Curwood & Cowell, 2011, p.117). This example, along with many other similar events, illustrates how literacy practices in the formal space of the classroom can be mediated and distributed through a social network site. Clearly a social network site does not afford multimodal text production by itself, yet it does mediate students’ digital literacy practices and importantly allows the distribution and visibility of students’ work to all members of the network. This point relates to the next finding of this section.

Students’ authoring processes, feedback and audience

Scholars investigating young learners’ writing processes mediated by technology have suggested the intimate relation between audience and authoring for writing development (Lammers, Magnifico, & Curwood, 2014). Magnifico (2010) posits that historically in schools, students often receive feedback on their work from a limited audience, frequently just the teacher. By contrast, in the observations of the Edmodo thread, it was evident that students were able to share their ideas, knowledge, and creations by engaging with an audience of 30 unique individuals. In doing so, students were experiencing different forms of interacting and authoring, and they were developing an authentic motivation to share their learning. The analysis reveals that the notion of assessment, as observed on the Edmodo wall, shifted from a summative one-time intervention provided by the knowledge-figure of the teacher, to an on-going, formative and decentralised practice.

The teacher promoted these interactions through pedagogical cues posted online. For instance, Claire often explicitly asked the students to comment on their peers’ work thereby allowing each student in the classroom to receive at least one comment/feedback on their work. Claire also modelled the use of praise within the network. For instance she would often openly give explicit recognition on the wall to outstanding work, as well as work that showed dedication and effort. An example of an activity that illustrates students’ engagement in authoring processes and audience can be illustrated in a task where students had to design a

game using the spelling rule of words ending in -ment. In order to complete the task, students used free online software applications. Figure 18 exemplifies the interface of the game that students used.

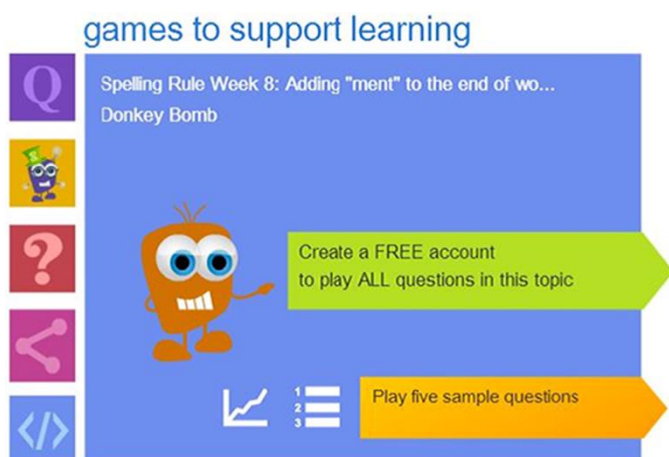


Figure 18. Zondle, a game interface used by the students

For instance, Rod a student in this class used the Zondle game interface to complete the task assigned by the teacher. When his design was ready, he published the game on the Edmodo wall. Next, Rod received feedback from his peers, as illustrated in Extract 13.

Rod, Sep 8, 2013

Here is my Zondle game on the week 8 spelling rule. Please reply with your scores

Brad, Sep 8, 2013

GO Rod, Great game and love the character voices. Keep up the good work!!! :D

Amelia, Sep 8, 2013

That was so fun, you should continue making games :)

Michael, Sep 8, 2013

Good game Rod!

Tom, Sep 8, 2013

Well done. It was engaging!

Sussie, Sep 8, 2013

Very nice game. It definitely tested my knowledge! :)

Julia, Sep 8, 2013

Great game! It had some very tricky words, good job :)

Extract 13. Students' feedback online

Rod, the author of this game, received active feedback after he finished his game on Edmodo. For instance, students acknowledged the use of character voices, the engaging aspect of the game as well as the use of complex words that made the game challenging and therefore stimulating to play. He also received positive feedback as an initial game designer with peers encouraging him to continue making games. The audience in this case was not just the

teacher but a broader one, constituted by all his peers in the classroom. What Rod's example illustrates is how the affordance of a social network technology can be used in fostering students' opportunities to engage in processes of authoring. This in turn allows students to engage with a broader audience and authentic feedback. Unlike the often limited space in the classroom to display students' work which is only accessible during class-time, Rod's game was visible digitally and could be accessed and commented on at any time. Thus, over time more students were interacting, playing and commenting on the game, while reinforcing key literacy skills.

The implications of such processes are not trivial. Scholars have suggested that multimodal texts in online platforms can be interactive as users can "write back". This process blends authorship, readership, production, and consumption (Greenhow, 2011, p. 466). At the same time, the designers of the game were recognised as authors and were given active and often immediate feedback about their work. Literature in this area shows that the sense of authoring impacts students' motivation and engagement with writing tasks (Lipstein & Renninger, 2007). From a learning perspective, allowing process of authoring also has an impact on students as they see their compositions as authentic, unique and with a sense of ownership (Black, 2009; Magnifico, 2010b; Warschauer, 2006). This contrasts with, and is qualitatively different from, practices where students have to complete worksheets, previously designed by the teacher (Lammers et al., 2014).

These findings are consistent with authentic ways of learning observed in out-of-school spaces (Brown et al., 1989; Ito et al., 2010; Resnick, 1987a) and with research examining similar social media application such as Twitter or Facebook. For instance, Dunlap and Lowenthal (2010) examined the use of Twitter in an online course. The researchers found that students' writing was effectively motivated by the awareness of an audience and students reported positive feeling because they sense they become part of a community of practice.

In addition, students engaging in authorship processes and experiencing audience feedback also brings notions of design embedded in semiotic practices. Hence the data could be interpreted as students playing designers' roles while working on their own games or other multimodal representations. Considering notions of design and literacy practices echoes Bezemer and Kress' (2009) ideas about the intimate interplay that is established between the designer as a communicator, the modes selected for conveying meaning and the audience. Of course, these experiences can also occur in the physical space of the classroom. But the

analysis of literacy in both the physical and the digital space showed that the link between the author/student, her design and the audience was more overt in the digital space.

5.3.2 Synthesis of this section

In this analysis I began by asking: How are school teachers and students using a social network site with learning purposes in the classroom and how are those practices connected with literacy practices? It is important to remember that such practices were happening in parallel to regular teaching in the physical classroom, hence teaching and learning was blended across spaces and tools. The examples provided in this section, along with many other games, videos and animations designed by students over the time of the data collection show that the inclusion of social networking practices as part of classroom activities, can be used as an entry point for the development of “new literacies” involving reading, writing, multimodal text design and the production of digitally mediated artefacts. In such contexts the data suggests that the traditional discourse patterns based on “vertical” teacher-centred configurations shift towards more “horizontal” and inclusive patterns of teaching literacy in the classroom (Kalantzis & Cope, 2012). Rather than a tension between off-line and on-line teaching, Claire perceived the use of Edmodo as an opportunity to promote new literacies with her students.

Although it is clear that Edmodo can support teachers in facilitating students to learn and engage in literacy practices, yet of course it does not replace decoding, comprehension and the reading and writing of print-based texts. Affordances from pen and paper and from digital technologies are different. Because of that, both require equally different strategies to approach teaching literacy in the classroom. This does not mean, for a moment, a judgment in value from one or the other. On the contrary, as observed in section 5.1.1 —an inclusive model of teaching literacy where the “old” and the “new” have space— enables wider variance in learning opportunities (Thibaut et al., n.d.). In addition, the data reveals the importance of preparing students for online activities. By drawing parallels between analogous tools for communicating and Edmodo, and discussing issues such as cyberbullying and netiquette students were prompted to engage in effective online interactions.

Finally, the social network site Edmodo allowed a more dynamic and multilinear relationship, rather than a unidirectional and linear type of feedback (Magnifico, 2010b). At the same time,

a link between author, audience, and feedback was created among students. This was enabled as Edmodo functioned as a portal where the digitally mediated artefacts produced by students were showcased. While designing, writing, reading, producing multimodal texts or consuming the artefacts such as games, students could enact literacy practices in more authentic ways. This finding is consistent with research that shows that one powerful reason for people's engagement in communicative processes is the stimulus of an audience (Burn & Parker, 2003). Although limited to the audience of the 30 students, the way literacy is taught by the teacher involves authentic processes that may impact students' engagement in their literacy practices.

5.3.3 Multimodality in the blended classroom

In previous findings of this study I have given an account on a macro and meso perspective of the blended classroom. From a macro perspective I explored relations between the physical and the digital space, the tools and the learning (Findings 5.1). From a meso perspective I explored interactions and communication across the physical and the online space (Findings 5.2.1 and 5.2.3) and the literacy practices observed in the online space (5.2.3). In this section, I offer a micro perspective on how the relation between space, tools, teaching and learning is crystallised in students' multimodal production. Thus, here I analyse literacy practices associated with new media and technology, with a specific focus on multimodal practices. Whereas learning in schools, particularly in upper primary and high school, is often rooted in print text and traditionally taught with an emphasis on books (Burroughs & Smagorinsky, 2009), teachers and students in this classroom used both digital and analogue tools for teaching and learning. Embracing other modes than the print text for teaching and learning underlies issues about the relation between technologies and representation in the blended classroom.

As reviewed in the literature (in particular section 3.2) exploring multimodal practices in schools is urgent. The digitalisation process encompasses challenges for schools as students need to learn to navigate the print word, but also the multimodal word. However, schools are delayed in implementing the digitalisation process, which started twenty years ago (Voogt et al., 2013). As a result, nowadays in many schools there is a mismatch between the practices of schooling and the way people work and interact for learning purposes outside the

classroom. For instance, scholars looking at learning in out-of-school contexts have shown how young learners are engaging in multimodal ways of representing and making meaning (Halverson, 2012; Steinkuehler et al., 2010). As Curwood & Gibbons (2010) argue including digital media production in the classroom can have profound effects in school learning, impacting students' identity formation and expression, enabling reflection about content, and allowing students to share their work with a broader audience than the teacher.

Drawing on a social semiotic framework (Burn & Parker, 2003) this section examines two multimodal projects created by students as part of their class assignments. To understand how meaning making is supported in the classroom and to get insights about student production I also included in this analysis the perceptions of teachers and the students who created the videos. In particular, this analysis asks:

- How are students engaging in new literacy practices in the blended classroom?
- What are students' and teachers' perceptions on multimodal production in the blended classroom?

In order to explore multimodal production in the classroom I offer an analysis of two multimodal works. These two videos were chosen as they are representative of videos created in each project by students. They were also purposefully chosen from different subject areas in order to showcase the various ways in which multimodal production and new literacy practices can be applied, and hence are transversal to subject areas.

First, I analysed a video designed and produced by three students —Patrick, Sam and Eric— as part of a *matrix task activity* (activities covering content across subjects). In this task designed by the teacher, students had to represent the history of the school. The topic of the video was given, yet the ways to communicate meaning, design, and produce were left free for students to choose. Second, I analyse a video related to a science content and produced by Kim, a 12 year old girl. Specifically the teacher was covering the states of matter (solid, liquid, gas and plasma). Claire asked the students to conduct an experiment in which students could demonstrate how long it would take ice to melt, and to explain the differences experimented in this process when water is combined with other elements.

By taking screenshots every two seconds of students' videos I was able to break down students' meaning making production. I then mapped what could be seen in the screen at each

two seconds-intervals with the following categories: time, image, action, written text, audio and transition. This allowed me to analyse the occurrence, absence and/or co-occurrence of modes in the multimodal text and to unravel the underlying relationships existent between content and modes for representation. Each video was observed several times and a description of the codes found in each screenshot was included. Each video includes two layers of analysis: 1) *context and transcription*, and 2) *social-semiotic account* (see details on multimodality literature in section 3.2.2; and details on the multimodal analysis in section 4.1.5).

Example 1: Patrick, Sam and Eric's video on the history of the school

First layer of analysis: context and transcription

This video was part of a class activity about the history of the school. Three senior teachers were invited to the class to tell the students about what it was like to be at the school at that time. Students worked on mind maps and brainstormed ideas on their books, comparing for instance what sort of technologies they had in the past with the sorts of technologies that they use now. Patrick, Sam and Eric first discussed ideas for their video and then, together designated roles. Patrick and Sam would play the role of actors and Eric of the cameraman. The task was designed by the teacher so that students could choose a medium for portraying the history of the school, yet they were also given boundaries. For instance, students were not allowed to speak in the movie. Reflecting on the reasons for this design constraint, they shared that “instead of just speaking and wanting to be quick, I think we have to think more and represent it more”. Such design constraint, prompted them to use the white board and speech bubbles. Students also chose to make a movie over other modes of representations such as drawings or pictures, because they liked “editing work”. To follow up this idea, I asked students if they were taught how to edit a movie as part of this task. Students commented that “if you had a bit of a fiddle on what you are doing you sort of get a sense to where to go” which implied that they were not specifically taught video production for this task. I will refer to this point later in this analysis. The tools used for the task were the software iMovie and their laptops.

According to the students, their design idea wanted “more than anything” to represent the concept of a silent movie and to represent a “then and now”. They were inspired by a silent

music they found at Sam's house. In total it took them two learning sessions (two hours) to finish the movie which involved both filming and editing. According to them, the most demanding part was to come up with the ideas. When I asked them how they decided that the movie was ready, the students suggested that "you could go and ask the teacher what does she think or sometimes you just feel that is ready". Sam for instance shared that "I think we hit it right on the spot even the handwriting wasn't that neat or the camera was jerky; we were aiming for a silent movie and that's what our final product came to". Sam's words revealed a clear idea about their design concept. As I will reveal shortly, from a semiotic perspective, this awareness helped them to produce a coherent complementary artefact (Curwood & Gibbons, 2010).

During the interview they showed me the different steps they followed to make the movie. While doing that, students showed awareness and competence of complex technical aspects of video production. While dragging images, selecting transitions, deciding on the music or choosing the style of "credits" at the end of the movie, students were engaging in conscious decisions for their multimodal production. For instance, according to the students working with transitions was essential as it made their movie look more professional. They explained that once they "felt" the movie was ready, they exported it and chose to save it in high definition, to make "the quality of the movie better". In addition, students commented on compatibility issues, suggesting that is better to export to a mov file because "most computers are windows". Next, they uploaded the video on YouTube. They made this decision because they could only upload a maximum of 50 megabytes file to the learning management system (LMS) of the school. By doing so, students demonstrated awareness of the trade-off existent between file-weight and quality. In addition, students also made references to freely available online software that could be used to download videos from YouTube. When asked again about how they learned about the production process of making a movie, students answered: we like to "play around". Finally, students considered "the process of making movies" relevant, because it can be applied to "further higher levels". For instance, Sam shared "now that I know about it I'm quite happy because I can apply my past knowledge to upcoming events that I may need to know".

After the interview, the next step was to analyse the video. By fragmenting the video in two-seconds-segments, I was able to see how the parts contributed to make the whole of the

artefact. In particular, this resulted in a total of 77 screenshots and 152 seconds. As Figure 19 illustrates, each two seconds segment of the video was narrativised by code.





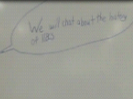

time	0	2	4	6	8
image					
action	text appears	change of scenario. Classroom background: two students looking at each other	students as if they were talking	students moving the white wall	new text on the top of the whiteboard framed in a bubble
written text	Matrix Task	Hi	Hi		We will chat about the history of 
written text's characteristics	white large letters using all the space on a red-dark background	handwritten large text on capital letters centred on the canvas of the Whitewall	continued		handwritten letters using a corner framed on a bubble
audio	silent movie music on piano; quick bits	continued	continued	continued	continued
transition				transition by flipping the whiteboard	

Figure 19. Images 0 to 8 of Sam, Patrick and Eric's video

First, the type of images selected by the students shows a combination between realistic setting, the actual environment of the classroom along with pre-designed slides available on PowerPoint. The video started with an opening image that contrasted with a white bold font against a strong red background. Next, the realistic environment is portrayed with two students standing up, but not facing the camera, just looking at each other sideways (Image 2 and 4). The text says “Hi” in handwritten font. This gives the reader a clue as to how the meaning would be conveyed over the length of the video. Students repeatedly used a “bubble” frame as a way to represent speech; so next to the bubble the students would act as if they were speaking the words written on the whitewall. Bubble frames can be considered as semiotic resources used by the students to signify their story used in conjunction with their body-gestures/representation. Audio constitutes an important signifier throughout the movie as it marks the pace of the video and signals many transitions over the length of the video. Interestingly, students used analogue tools and movements to transition from the introduction of the movie to the next section. So, instead of, for instance using technological resources given by the application iMovie, they chose to flip the whitewall to mark this transition. The whitewall would be used repeatedly to show information and transition to other themes in the movie. Next, in image 8 the viewer sees a representation of what they could expect to see

over the next minutes. The handwritten text on the whitewall says: “We will chat about the history of the school”.

The narrativisation of the two-second code reveals the script designed by the students and the structure underlying the video. It started with signposting the content of the video. Then continued with the account of “interesting facts” such as the “school started in 1982 by three men”. Followed by another set of “interesting facts” such as “Paul Balart (a pseudonym) was the first teacher and Mr. Dee (a pseudonym) was the first principal” or “the school was really small and they used the “Lifepack system”. While narrating the story of the school the students also used humour. This is a predominant characteristic of “silent movies” that has been addressed by literature on cinematography (Landecker, 2006). For instance this can be seen when Patrick asked —What is the Lifepack system?— and in a bubble we can see Sam’s thoughts —He should know this already!—. This move in the script of the movie not only gives informational facts and humour, but helps the viewer to become closer to the history of the school. The next move in the movie is marked by the comparison between the school in the past and currently “Now that you know about early school and how it started, let’s show you how it has changed”. The following words were written on the whiteboard and each of them marked a scene that is accompanied by students enacting the role of the teacher (Sam) and the student (Patrick): chalk; upgrade whiteboard; couches; and laptops.

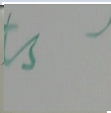
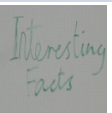
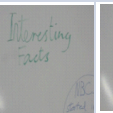
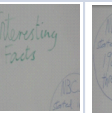
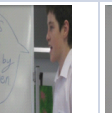
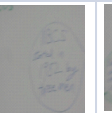

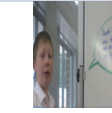
time	10	12	14	16	18	20	22	24
image								
action	imaged blurred	new text	zoom out	zoom out	new text framed 'in a bubble'. Patrick facing Sam	blurred	moved the white wall to the other side	the camera moves to the left side where Sam is mimiking speaking what is written on the whiteboard; first time the actors look at the camera
written text		Interesting facts	Interesting facts	Interesting facts	started in 1982 by three men			Paul Balart was the first teacher and Mr. Dee was the first principal.
written text's characteristics		text using the centre of the whiteboard	continued	continued	handwritten text using the right side corner framed on a bubble			same handwritten style using now a left side corner of the Whitewall
audio	continued	continued	continued	continued	continued	continued	continued	continued
transition	transition by blurring image		transition by zooming out			transition by blurring image	transition by blurring image and zooming out	

Figure 20. Images 10 to 20 of Sam, Patrick and Eric’s video

One prevalent combination of modes used by the students is transition. I counted 15 transitions over the 152 screenshots. As such, each transition turned into an action mode. Blurring the image, zooming out or in, as well as flipping the Whitewall or a combination of the above were used for signalling a change in topic, an addition of content or an extension of ideas. With the exception of the first and the last image (that marked the introduction and the end of the story) all sequences of ideas included a transition.

Second layer of analysis: social-semiotic account

Next, I analyse the multimedia production of Patrick, Sam and Eric in three main aspects: (a) the narrative aspect, (b) students' positions and interaction with the viewer, and (c) juxtaposition of modes to convey meaning. This is adapted from the three metafunctions system: ideational, interpersonal and compositional (Halliday, 1978).

a. The narrative aspect

Screenshots 0 to 152 depict the development of a story in which students portrayed the origins of the school and the way it has changed. Students considered differences in technology available and differences in the pedagogies. When looking at the video, it becomes evident that image and text have a complementary relationship (Royce, 1998). Both, image and text are directed towards the same topic and neither of them has superiority over the other; thus, the hand-written text and the gestures of Sam and Patrick, work together to construct meaning. Scholars have studied how young adults have used multimodal text production to generate space to react against traditional ideologies and ways of being in society (Bezemer & Kress, 2014; Kress & van Leeuwen, 2000; Kress, 2010). These studies suggest that including non-traditional modes for meaning making processes gives "new" means by which counter-narratives can find space in formal institutions (Curwood & Gibbons, 2010). Multimodal representations are particularly appealing in young adults who often encounter limited spaces in schools to reflect about their own development as individuals in their journey towards adulthood (Burn & Parker, 2003).

As reading and writing are ways in which schooling practices have been often represented and assessed, meaning making that draws on other modes such as visual, audio and *kineikonic*, suggests kinds of communication that by their very means counter-act traditional

means of school expression (Burn & Parker, 2003; Curwood & Gibbons, 2010; Goffman, 1959; Halverson, 2012). From a text-level perspective, multimodal practices offer students complex, and versatile ways to communicate and allow the viewer/reader to “read” the text in multiple ways, not restricted from left to right or to decoding words. In addition, it adds a visual and often aesthetic component to the representation of meaning. As a result, a multimodal artefact encompasses a unique composition (Jewitt, 2005) that offers to the reader a way to engage in multi-layered sensory experiences including, for instance, a visually or auditory rich composition.

While thinking about the narrative aspect of the story, I asked how the task designed by the teacher was conveyed. This is relevant as it shows how students positioned themselves in the classroom and the level of autonomy they had to engage in school tasks. For instance, one could argue that students with low level of autonomy would limit the number of modes and the use of such modes to represent knowledge in the classroom. In this respect, one element that is predominant throughout the video is that students made the topic of the “history of the school” a personal narrative that differed from an “objectified” report of the school facts. By engaging in “playing” roles of students and teachers, Patrick, Sam and Eric not only made the history of their school alive, but also the audience became engaged with it. This is signposted in the tone of the video which is informal rather than formal, and that is playful rather than serious. This is consistent with the way the students positioned themselves and the way they invited the viewer to get involved in the story, which will be analysed next.

b. Students’ positions and interaction with the viewer

How students positioned themselves in this school task was analysed through students’ choices of framing and shot angle (Kress & van Leeuwen, 2000). As mentioned previously, the shots were taken in the actual classroom environment, which consequently became the context/scenario of the video. The angle from which the viewer looks at the action in the moving image represents the level of involvement of the viewer (Kress & van Leeuwen, 2006; Kress, 2010). The analysis of this component over the 152 screenshots of the video reveals that most of the images were taken from a mid-lower gaze level. As a result, the viewer is positioned, most of the time, as a participant of the classroom. Thus, the viewer is becoming a part of, and being involved as another student in, the classroom. However, I also found variance in this pattern. For instance, image 0 and 152 —the first and the last image— were designed in a power point presentation and purposively signal the introduction and the

end of the movie. In addition, images 140-152 carried a higher angle shot decision, which conveys the effect of the viewer becoming “taller” than the students, or on a higher level than the actors in the movie. This implies superiority from the viewer perspective, as the viewer is able to see what the actors are doing. Such variation in the shot angle perhaps represents the change from student to teacher. This position differs from what the teacher was intending through the Edmodo space, which was analysed in previous sections.

Often the configuration of classroom space allows teachers to look at what students are doing. The teacher is often standing up and the students are sitting down. Interestingly, when linking students’ shot decision with teachers’ perceptions of their role in the classroom, there is consistency between both. As Mrs. Kate shares about her practice during the classroom “I’m going around and I’m checking what they are doing and I’m checking what’s in their work”. Similarly Claire expresses:

For me is a fine balance of looking over their shoulders and keeping an eye of what they are doing and allowing them to take their time and doing things on their own pace. (Interview 17 May 2013).

Hence, as portrayed in the video and as explained by the teachers, teaching and learning in the school involves a constant negotiation between autonomy and control between students and teachers. Figure 21 shows the transition from high level of involvement (being a student) to a level where the viewer is able to oversee action (being a teacher). Again the shot decisions in the movie portrayed both the angle of the student and the angle of the teacher and in both cases signal an invitation to the viewer to participate. This perhaps denotes a reflection about how these students perceived their everyday life in the school classroom.

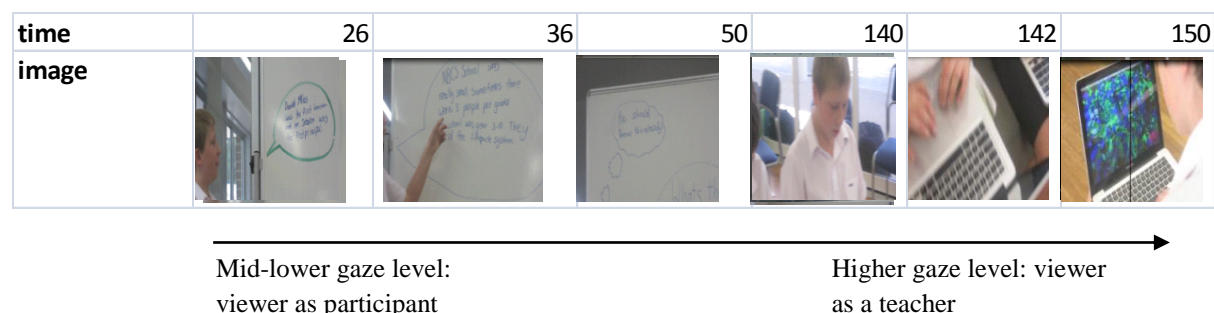


Figure 21. Transition from high level of involvement to low level of involvement

The angle of shooting transitions from mid-lower gaze level to a higher gaze level. This is detailed in images 26, 36, 50, 140, 142 and 150. As the level of shooting changes, the power of the viewer also changes from a lay-man/student level to the level of the teacher. In this latter, surveillance may be enacted (or not) (Foucault, 1975; Kress & van Leeuwen, 2006). It is interesting to see how some shooting levels echo the description of Mrs. Kate's own practices in the blended space:

Sometimes we find out about kids that they researched for something and something comes up, and you go "oh, my goodness". We just have to make their screens —wherever they are sitting— that we can walk behind them, so we are constantly circulating, looking at what is in their screens, so we are checking if they are looking at the right stuff. (Interview 17 July 2013).

Finally, social distance has been described in semiotic analysis to refer to the level of proximity existent between the viewer and the text (Foucault, 1975). Social distance is marked by the use of close ups or conversely long-shots (Burn & Parker, 2003). With the exception of close-up images used for transitions and images 140-150 the distance between the viewer and the text in this video has a mid-shot social distance. Hence, the viewer is not too far away from the action, not too close. This suggests that social distance as shot by the students in this video, mimics conventions of social distance in public spaces in Western cultures (Goffman, 1959).

c. Juxtaposition of modes to convey meaning

The use of the moving image to support communication may convey a more authentic reality than other modalities such as animations or drawings. In particular, this video conveys realism which can be observed through the selection of a real classroom background and the realism of the handwritten text included in the video.

The music in the movie was purposively selected to denote a "silent movie style". Thus the movie mimics old movies where the affordance of direct audio was not available (Landecker, 2006). Because of this constraint, film-makers in the early 20th century were forced to draw on other modes to make the story appealing. For instance actors had to exaggerate their gestures and body movements so that the viewer could relate to the emotions and actions in the story. This is something that was mimicked by Sam and Patrick (Barthes, 1981). Music in that context was a powerful resource that helped to mark the pace and the variance of the

action, and also helped to involve the viewer in the film by evoking feelings and emotions. By drawing on such resources, the students evoked a past time, signalling the main concept of the movie: to revisit the history of the school. As a result, the students' final work was a remix of traditional styles of filmmaking and contemporary styles, mediated via digital media production (Royce, 1998).

Frame was another element heavily used by the students. Similar to the function of the music, bubbles represent the speech of the actors. A semiotic reading might propose that the frame of the image (captured while shooting) was duplicated with the frame of the "bubble" made within the whiteboard. This simple resource was effective as it was coherent with the music and the tone of the movie. It also shows the ability of the students to take conventions of the written text and media, such as cartoons and animations, and use it in another canvas: the moving image.

The analysis reveals that students used both digital media along with analogue tools to convey meaning. For instance, they constructed the transitions in the movie relying on the effects provided by the iMovie maker software, but also on the action of flipping the whitewall, and importantly through their gestures. However, the large amount of written text in the screenshots somehow overshadowed the visual impact expected in a movie. Though students were actively involved in the enactment of the history of the school, they did not refer to their own experiences in the micro-world of the classroom. From this perspective, the story portrayed a situation rather than the students' individual experience. Thus, perhaps the students missed the opportunity to personalise their unique trajectories in this classroom space in this video.

Example 2: Kim's video on the properties of "Ice melting"

First layer of analysis: video context and transcription

This second multimodal analysis is based on a video developed by Kim in the context of the science class. It is composed of 1 minute and 46 seconds of footage. Kim created her video as part of a class activity dedicated to the study of states of matter, and in particular to the properties of water in different stages. All students were assigned to create a video related to this topic. As stated earlier, I choose this one as it is representative of students' work in this

school project. The decision to include this video for analysis was posterior to the field work process, hence, I was not able to include Kim's perceptions on the video making process as part of this analysis. Following the work from Burn & Parker (2003) and Curwood & Gibbons (2010) the same technique and codes as in the first example were used. Thus, screenshots every two seconds were taken which comprised a total of 106 images (Figure 22). Likewise, the same codes for analysis were applied. The first step of the analysis begins with the transcription and several readings for identifying salient codes. This process continued until the identification of codes was exhausted.

As observed in figure 22, this video is an exercise related to science. Kim engages the reader at the beginning by asking: "How long will it take ice to melt?" She reinforces this invitation by adding: "let's find out".

time image	0	2	4	6	8	10	12	14	16	18	20
image											
action	no action	no action	no action	no action	no action	no action	no action	no action	no action	no action	no action
written text	HOW LONG WILL IT TAKE ICE TO MELT?	Will it take the same time if it	continued	continued	HAS FOOD COLOURING IN IT	continued	Would fresh water be different as salt water?	continued	let's find out!	continued	Before Melting:
written text's characteristics	text centred with capital large letters; font conveys informality	same position of the text, change of font (intricate and also conveys informality) and colour (to light grey-blue)	continued	continued	same position of the text, change of font (intricate and also conveys informality) and colour (to yellow-brown)	continued	same position of the text, change of font (intricate and also conveys informality) and colour (to pale light orange)	continued	same position of the text, change of font (intricate, larger and also conveys informality) and colour (to black)	continued	same position of the text, change of font (intricate and also conveys informality) and colour (to light green)
audio	One direction, instrumental continues throughout video	continued	continued	continued	continued	continued	continued	continued	continued	continued	continued
transition											

Figure 22. Kim's video

The use of the plural form invites the viewer and demonstrates audience awareness to participate in the experiment. In Kim's video, the question about "how long would it take ice to melt" is answered by experimentation. Throughout the video I observed a strong reliance on text to convey meaning. Although colour and font is frequently used, such changes did not seem to respond to a particular reason apart from making the video more appealing. For instance, whenever there was a change in the colour, there was also a change in the font. The colours and font selected evoke informality, as the colours are vibrant and the fonts selected in each case convey a casual and relaxed mood. Unlike the formality of typefaces such as Times New Roman, here Kim purposefully made the choice to use more playful fonts

available on PowerPoint to imprint her own taste of what a science video can be. The narration of the video signals an informal way to provide information.

The strong reliance on text to convey meaning is broken two times over the video. In both cases, Kim drew on the affordances of the moving image to portray a realistic environment. Here the camera points at a real experiment which allowed her to demonstrate that her findings are based on empirical results. In her experiment, Kim places four glasses with different compositions: food colouring and salt; just salt; food colouring; and plain water. Next to the glasses, she puts the timer of her smartphone so that the viewer could see real time changes. In order to convey the modality of time, she uses transitions. By blurring the image, she makes sure that the time passing is accounted by the viewer. Audio is used by Kim in an incidental way. Hence, unlike the video of Sam, Patrick and Eric, here the content is overt and works without the signifier of past-time. However, the music selected —an instrumental version of a song by the teenager pop band “One Direction”— does convey ideas of “popular”, “easy”, “happy” and “young”. Together the narrative of Kim’s video suggests a *complementary* relation between font, colour and music (Burn & Parker, 2003). Thus, the selection of each mode helps to produce a common rhythm and a discourse that combines scientific content in a kind of informal and laid back way.

Second layer of analysis: social-semiotic account

a. The narrative aspect

The story in Kim’s video is closely bounded to the task requested by the teacher. So the story revolves around knowing whether ice has different melting points when the components of water are changed. Here, unlike the first video, there is less about imagining the history, and more about demonstrating a procedure through a scientific experiment. Hence, traditional ways of knowledge production through experimentation —which has been reproduced widely in text schools— are replicated by Kim. As a result, the documentation of scientific experimentation reminds of traditional models of pre-digital learning. However, Kim chose to twist these formalities by remixing the “traditional” way of conveying knowledge with her own cultural setting and with a personal approach to showcase the results. By drawing on informal fonts, vibrant colours and the use of music —that most young adults her age can relate to— she also is making a statement, and I argue a counter-narrative of the script given

by the teacher. In a way, Kim’s composition suggests that counter-narratives do not have to be radical or confrontational. Instead, in her video she utilises the same procedures of conventional scientific methods but conveyed her topic from the perspective of a 12 year-old student. Here, the access to video production allowed her to make this twist in the story.

In terms of the purpose of the story, the viewer learns through the video that the composition of water modifies the “freezing temperature” of the water. Kim demonstrates a scientific logic of inquiry by posing questions, conducting an experiment, making comparison and presenting results. While doing this, she demonstrates the differences of matter when changing from solid to liquid and the effects of added elements in such process. Hence, Kim successfully echoes the scientific logic of inquiry, yet adds glimpses of her identity as a teenager, and of her agency as a student through multimodal production.

b. Students’ positions and interaction with the viewer

Kim positioned herself as an “informal” rather than a “formal” narrator. She is the narrator of the story and utilises the written mode to explain her experiment. For instance she uses a direct language to explain her ideas which are illustrated when she proposes, “Let’s see which one melts fastest”. In addition, clues such as colour, audio and font signify a certain taste of cultural representations (Buckingham, Burn, & Cranmer, 2005; Coiro et al., 2008) which give the viewer hints about who produced the video. In addition, Kim explicitly demands through her video a relation with a young and informal audience, linking multimodal production with the taste and distinctions made by a certain audience (Bourdieu, 1984).

As Figure 23 illustrates, the shots of the experiment show a transition from higher level to a mid-lower level gaze. This is combined with close-ups taken to the different glasses.

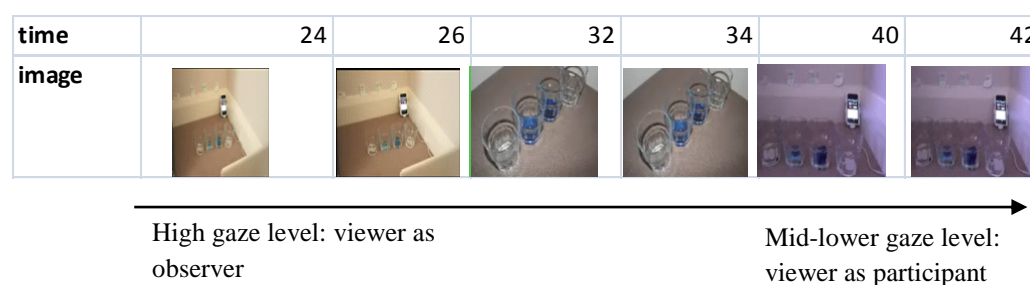


Figure 23. Position of the viewer

Kim's shot decisions suggest that she is trying to make the viewer a participant of the "melting ice" so that we can experience the changing nature of matter. However, overall the video offers a majority of screenshots taken from slides on Power Point. Consequently, the analysis of the position of the video maker is reduced to the shots that illustrate the experiment.

c. Juxtaposition of modes to convey meaning

The analysis of the screenshots of Kim's video reveals that the use of action, written text, audio and transition conveys authenticity and realism. Such use of mode is in line with the content of science and the experimental procedure depicted in this video. Unlike the first video, this lacks body language, gesture, or handwritten text. Instead, Kim completely relies on modes afforded by digital technologies such as digital text, digital transitions and the inclusion of a teenager's popular song. As a result, Kim's video has no representation through dramatic action which makes her video perhaps easier to decode than the first one. Because the content of Kim's video is more complex than the first one, the decision to make a "simple" design could be beneficial to the understanding of the scientific knowledge embedded in the video (Peters, 2013). This echoes studies done on multimedia production which argue that simple design-decision lowers the cognitive load perceived by the learner (Kirschner, Sweller, & Clark, 2006; Moreno & Mayer, 1999).

Discussion on students' videos and teachers' perception on multimodal production in the classroom

The dynamics of text production and reading are being reshaped in the blended classroom. Although multimodal composition has a long tradition (Harste, Woodward, & Burke, 1984; Kress, 2003), new technological tools are changing the set of skills, and the processes that are established for interpretation and meaning production. While both tasks were different in terms of the topic and the requirements, in both cases students were able to convey meaning evidencing their competence with the use of multiple modes, awareness of audience and in the first task, by showing collaboration among students. For instance, in the first example, students could not include speech, yet they were allowed to be creative to convey the history

of the school, whereas in the second task the scientific content imposed “design constraints” related to portraying the accuracy of the experiment. This echoes Jewitt (2005) who explains “image, sound, and movement enter school classrooms in new and significant ways” (p.315); thus, reshaping the relationship between modes and their use and function for learning purposes.

The two examples of multimodal text production help to illustrate how students are engaging with modes to complete tasks assigned by the teacher. Teaching in a blended space allows different possibilities for the teacher to design task activities. In particular, sharing students work is a key part in leveraging opportunities for learning. When sharing, students are able to communicate their work and receive feedback, which importantly informs them about the positive aspects and the ones that need to be reconsidered. In previous sections of this thesis I have shown how students share their work through Edmodo. However, in the example of the two multimodal production analysed in this section, students shared their work through a channel created on YouTube. So, in this blended classroom the teacher capitalised on free tools provide by ICTs, including both Edmodo and YouTube to enable opportunities for literacy practices and in particular, for engaging students with the distribution and sharing aspect of multimodal practices (Burn & Parker, 2003).

As with linguistic composition, a multimodal composition encompasses more than just various modes, but another language that has to be decoded, understood and produced (Buckingham et al., 2005; Burn, 2008). Consequently, designing for this type of learning activity and teaching such language brings complexities for teachers facing a blended classroom environment which I will explore in the next section.

Teaching multimodal texts

As Burn and Parker suggest (2003), the effectiveness of students’ multimodal production depends strongly upon teachers’ willingness to overcome the boundaries between subject areas and to stimulate students’ work beyond the print text. However, often pre-service teachers are not equipped with strategies to teach such productions (Burn & Parker, 2003; Yancey, 2004). Demands involved in multimodal production are not simple. Because of that, multimodal production requires teachers’ agency to facilitate learning throughout the entire multimodal process; thus involving discourse, design, production and distribution (Greenhow

et al., 2009). As the findings in section 5.3.1 suggest, student development of new literacy skills is not a one-task output but a long-term process.

The interviews with the teachers and the observations over three terms in the classroom space evidenced that students are immersed in a process where they slowly build their competency on digital tools. Instead of a formal lecture about the use of tools and the Internet, students in year 5 observe and are encouraged to work in mixed-age groups with year 6 students, thus slowly entering from a zone of legitimate peripheral participation to a zone of expertise (Lave & Wenger, 1991). Consequently, when students are in Year Six, they are able to use a varied range of digital tools and apply such knowledge for different purposes. The knowledge acquired in such process builds on the knowledge of the teacher, but also importantly on the knowledge of their peers. Perhaps this explained why students at the beginning of this section did not recall that they were taught to use multimodal video production for the assignment. Instead, they gathered those competences over time, and now (in their third term of Year 6, when the videos were made) they were able to use such tools for learning purposes.

As Mrs. Kate shares:

Well it's interesting watching year 5 coming because you start to see them that they do not know how to get to certain places, they might not know how to get to YouTube,...but by now (June) I know that most of them would know how to use PowerPoint, they would know how to use Word, they would know how to use Prezi, umm a lot of them would know how to use iMovie or MediaPlayer,... every week you see that they are using something new. (Interview 17 July 2013).

As a result of this teaching strategy which allows students to be immersed in a connected space and to engage in vicarious experiences, students are able to progressively learn about a variety of tools and improve in their use. From a learning perspective, this signals the co-construction of a shared space, rather than a lecture space (Åkerlind, 2004; Trigwell, 2011). According to Mrs Kate:

I think they are immersed in it, and we let them be immersed in it, and we let them play and we let them create, and we don't give them a strict "you have to use this program for this thing". So as they get more comfortable with different things we push them into something else, so they have to investigate about something else, so I think over time it just builds and builds. (Interview 17 July 2013).

The way teachers define their own identity as professionals' plays a role here too, as in this classroom often students demonstrate higher competencies in the use of certain technologies than teachers. As elaborated in section 5.1.3, if teachers' identities are constructed from the perspective of an authoritative figure and a knowledge transmission model (Kember, 1997) then teachers' identities might be threatened. However, as illustrated by the teachers, they construct their identity in alternative ways.

So sometimes they get better than you are so, I have girls coming to me and say we've been using the green screen and we've been putting movies and things behind us, and I don't even know how to do that! So often they are surpassing us in our understanding which is awesome. (Interview 17 July 2013).

Assessment of multimodal texts

Allowing students to evidence their learning by drawing on other modes different from the canonical format, also posits challenges for teachers as the products of such compositions are never the same, and often end up in unexpected outcomes (Burke & Hammett, 2009; Burke & Rowsell, 2007). Assessment in this regard becomes a complex task for teachers as it changes the script model of teaching and learning (Burn & Parker, 2003; Yancey, 2004). Thus, the inclusion of multimodal production in the classroom posits an urgent question regarding how to assess students' multimodal products. As Lewis (2007) points out, new technologies challenge what teachers are expected to do as their design, performance and ways of assessment are no longer rooted only in the alphabetic text. Moreover, Curwood, (2012) argues that although teachers are increasingly integrating digital tools in their practices, the question that remains is how to assess such types of composition. When asked about this issue, teachers in this Year Six class had different opinions. For instance, Mrs. Kate says:

I think you can measure that in the exact same way as if it were in a traditional classroom. They upload their work, they print their work, email us their work so we can look exactly the same as if you were handing in a poster or a bookwork or whatever, so we assess in exactly the same criteria as you would in a traditional classroom. (Interview 17 July 2013).

As seen in the videos and expressed by the teachers, the notion of multimodality is not necessarily bounded to digital tools. Students can draw on different types of materials in order to represent meaning. As Mrs. Kate shared “it is also awesome to see them mixing them too”, she continued “they are doing physical building and making them with egg cartoons so that’s giving them another tool, and that changes throughout the year depending on our focus”. Mrs. Pauline also celebrated students being able to show their learning using different modes and applying digital and analogous materials “I think there is much benefit in letting the kids to choose how they present”. However whereas Mrs. Kate saw the assessment of multimodal production as non-problematic, Mrs. Pauline expressed some apprehension regarding consistency in the assessment when other modes are introduced:

It makes assessment harder because it feels that is not consistent, because if one kid is handing in a picture and one kid is handing in a video how can it be consistent? So I guess we have to ask ourselves if we are asking the right questions. (Interview 18 July 2013).

Similar to Mrs. Kate, Claire considers that multimodal texts offer a venue for students to engage and demonstrate their knowledge drawing on multiple modes of expression:

We try to merge the outcomes together and in the merging of that is obviously the Bloom taxonomy; so, obviously a low level of thinking would be an easier kind of task compared to a deeper level of thinking and we also combine that with the multiple intelligences so we are throwing another layer there, where they can present that visually or written or in a dramatic form so we like to have a variety of different outputs to similar kind of outcomes. (Interview 15 July 2013).

As observed, assessment of multimodal texts is embedded in a complex process that supports the shift from single/right answers to multiple/open answers to a problem. In this case, flexibility for designing and assessing tasks which incorporate new technologies and support multimodal text production is not a neutral decision, as it may impact students’ learning development in the classroom. The digitalisation process has provided more opportunities for publication, distribution and consequently has enabled creators to access a wider audience and to receive more feedback. The patterns of distribution of text in this classroom show some signs towards benefiting from such digital platforms. For instance, Patrick, Sam and Eric explained the benefits of uploading their video on YouTube, yet they did not refer

explicitly to the concept of audience and feedback. Likewise, Kim's video can also be accessed openly on YouTube, and some of her work has received comments in this public space. It would be interesting to consider further opportunities of distribution provided by the Web 2.0 to enhance the process of discourse, design, production and distribution involved in multimodal communication in the blended classroom.

5.3.4 Synthesis of this section

This analysis of multimodality begins by asking how students were engaging in multimodal text production in the blended classroom. The findings discussed in this chapter show the kinds of tools students used for creating their videos, the abilities they were demonstrating in such processes, the ways they were integrating multiple modes for representation, and their understanding of production and distribution of their work. In particular, Patrick, Sam and Eric's video shows that they used digital media in four key ways: (i) to remix old and new ways of filmmaking; (ii) to depict a story about the history of their school, (iii) to show their identity as active participants in the construction of the history of the school, and (iv) to share and invite the audience to participate in the history of the school. On the other hand, Kim's video depicts how narratives of formal scientific content-knowledge can be re-shaped through multimodal production. Hence, although Kim's video reproduced a strict logic of scientific inquiry, she re-shaped this formal format by incorporating elements that are familiar to, and popular with, a young adult audience. In agreement with the findings on literacy practices mediated through Edmodo, the multimodal practices analysed in this section show students engaging in creative, active and situated work in the blended classroom.

The videos analysed are just two examples of many multimodal products gathered over the time of the data collection. Such production includes not only the *kineikonic* mode but also websites, games, photos, drawings, hand-made sketches, and so on. Burn and Parker (2003) posit that "because communication is not limited to spoken or written language, accounting for other modes of expression—including sound, gesture, visual image and movement— is essential" (p.63). This imposes challenges to teachers as they are required to teach both print and multimodal composition and to assure that students show competencies in both types of composition, assuring fairness in the assessment of such tasks. As illustrated in this case

study, teachers relied strongly on a long-term learning curve for students to build on tool use and multimodal production. Hence, students are expected to build skills gradually over time, and as the complexity of the tasks also builds over time. Finally, the findings suggest that the use of free digital platforms allows students to engage in meaning making practices in a dynamic way, including engaging in the process of publication, distribution and feedback.

6. CONCLUSION AND FURTHER RESEARCH

6.1 Synthesis of the findings

This study examines processes of teaching, learning and literacy practices in a primary blended classroom. It provides a thick description (Geertz, 1973) of blended learning across subunits of analysis. Echoing Fielding and Moss (2011) the present study looks at possibilities and opportunities to expand our understanding about the potential of blended learning for young learners; yet it by no means attempts to give an exhaustive, unique and definite answer to the challenge of how to teach and learn with technology in the primary classroom. The analysis is underpinned by sociocultural, distributed and networked learning approaches. By employing a multi-agent and multi-method logic of inquiry, insights emerged regarding the role of the social context as well as the mediation of tools across spaces to support and promote learning (Hutchins, 1995; Pea, 1993; Salomon, 1993; Vygotsky, 1978, 1997; Wertsch, 2003). A multi-agent and multi-method approach provided key insights into the research questions, making it possible to understand how a blended space shapes the dynamic of the primary classroom. Such approach contributes to understand the primary classroom as a learning network where teachers' distributed orchestration occurs not only at the physical level, but also across the digital space. This is a novel approach to examining teaching and learning in the primary classroom, which not only offers emergent insight into how young people engage in learning processes and how to stimulate such process through pedagogy; but also contributes to draw links with other educational research fields, such as blended learning in higher education, networked learning in professional contexts and blended learning in secondary education (Bliuc et al., 2011; de Laat et al., 2007; Goodyear et al., 2014; Wenger et al., 2011).

Blended learning was analysed focusing on three dimensions: spaces and tools; interactions; artefacts and new literacies. For analytical purposes these three dimensions were divided, yet

they are intimately related. In fact, it is the understanding of the link between them that provides insights on blended learning. As stated earlier, this study aimed to shed light on social and material elements in a learning environment. Hence, it considers these elements not only as a context where cognitive processes take place, but as constitutive of learning. Relationships between space, tools, activity and agents refer back to some of the concepts discussed in chapter 2 such as *enculturation*, *dialogue formation*, *affordances* and *set design*. These relationships are also related to concepts discussed in the literature review (Chapter 3) including the theory and practice of blended learning, and the changing notion of literacy. In addition, special attention was given to models of teaching and learning with technology and the current incorporation of social media tools in the classroom, and the social network site Edmodo.

Chapter 5 presented the findings of the three analytical dimensions of this study. The first analysis provided a macro perspective on blended space, considering the set design as an anchor (Goodyear et al., 2014). The findings of this section suggest that the blended space enabled students to be active, autonomous and self-directed in their learning. These results are consistent with the literature on blended learning (Barbour et al., 2011; Christensen, Horn, & Staker, 2013; Gerbic, 2011; Means et al., 2013). The blended space was flexible in accommodating various types of activities along with tools and resources that promote students' agency and independence. The physical space and the online space had complementary roles. Whereas the former allowed a more structured style of instruction which was guided by the teacher and characterised by the explanation of content, the latter was characterised by a more horizontal distribution of resources, dialogue and student-driven participation. Importantly, it was observed that the activities that occurred in the physical space were essential for the work that occurred in the online space. So students and the teacher relied on both physical and online spaces to engage in learning activities.

In addition, the analysis suggests that a main function of the online space was to allow distributive processes in the classroom. Content-knowledge, instructions and content-related interactions were distributed on Edmodo. This process of distribution was not trivial. It was observed that in fact, it had key implications for the process of teaching and learning in the classroom. For instance, the teacher was able to engage in personalised teaching, due to the time that was liberated by using an online mode of instruction. This was also clear when distribution of management and knowledge was shared with students in the online space. This

distributive process allowed students to engage in peer-teaching, collaboration and sharing of resources, as well as offered students opportunities to use a wide range of analogous and digital tools. Furthermore, the findings reveal that the availability of technology offered students alternative ways to think, share, and produce content in the classroom (Jonassen, 2006; Oviatt, 2013). However, the cognitive load and the complexity of the tasks that students had to comprehend and decode in their every day practices, required high levels of students' metacognitive awareness as well as competence in using digital tools. This of course may present challenges and limitations for those involved in designing for teaching and learning in blended spaces.

The thematic analysis of teachers' perceptions shows that rather than a tension between off-line and on-line teaching, the teachers perceived the use of technologies as an opportunity to promote self-directing learning skills and creativity; to cover areas across the curriculum and to prepare students to engage in independent work, hence to set the foundations of student life-long learning skills. The findings are also consistent with studies suggesting that technology integration in the classroom is not only dependent upon observable factors, such as access of resources and competence, but strongly dependent upon the value that teachers give to technology for leveraging learning (Ertmer & Ottenbreit-Leftwich, 2010; Kember, 1997; Oliver & Trigwell, 2005; Trigwell et al., 1999).

The data reveals interesting links between collaborative teaching and effective integration of technology. For instance, feelings of anxiety related to the implementation of technology lessen when the pressure is experienced as a collaborative endeavour. The findings are consistent with literature that suggests the need for situated, and periodic professional development in order to prepare teachers for technology integration in the classroom (Curwood, 2011; Ertmer & Ottenbreit-Leftwich, 2010). Finally, the analysis reveals that teachers perceived their practices as relational, and with a strong focus on preparing students for their future. This is aligned with teachers' conceptions of teaching as a student-centred practice (Fisher, Denning, Higgins, & Loveless, 2012; Loveless, 2011; Trigwell, 2011). In addition, the data shows that teachers, whose initial practices were established in print-centric classroom environments, were more likely to need more support in adjusting to a blended environment.

In students' view, technology allows them to learn through investigation, collaboration, and to often make their work "fun". This is in agreement with the literature, which suggests that

technology is used as a medium to search for information, access resources, to interact, and collaborate (Kereluik, Mishra, Fahnoe, & Terry, 2013; Laurillard, 2012). Importantly, the analysis also reveals emergent functions showing that, for students, technology had a key role in facilitating the sharing of their work. This sense of sharing was connected to shared interests (Barron, 2006), and emotional connections to one another, echoing the notion of communities of practice developed by Wenger (1998). These attributes are particularly clear in relation to Edmodo where students reported that it functioned as a tool for developing a sense of community that “brings people together”. Also it was observed that by engaging in profile formation, content sharing and traversing users’ profiles, students were stimulated to develop their own voice and to see themselves enacting different roles, such as receivers of information, but also as active participants of knowledge formation (Bereiter, 2002; Greenhow et al., 2009). This could be interpreted as young learners developing an identity as students that complements the way they see themselves in the physical classroom (Bakhtin, 1986).

The second dimension of analysis presented in Chapter 5 examines interactions in the blended classroom. First, a situated discourse analysis provided fine grained detail regarding the patterns of interactions among agents in the blended space. The examination of language-use in the classroom suggests some similarities with the IRE structure (initiation-response-evaluation), yet clear differences with this model were observed (Christie, 2002; Kamler et al., 1994; Mehan, 1979). The data shows that discursive patterns in the classroom combined an IRE structure with an open and more exploratory pattern of speech communication. By negotiating and giving space for students’ voice, the teacher in the physical classroom was able to reshape an IRE structure. For instance, Claire positioned herself in the role of a “helper”, in addition to the conventional roles of “inquirer”, “presenter of information” and “evaluator”. She also consistently encouraged students’ talk, and her pedagogical presence was sometimes handed over to the students. The analysis of the patterns of interactions in the online space shows how students positioned themselves in roles where they demonstrate agency to answer and frame questions and to seek epistemic guidance from their peers as well as from the teacher. This is consistent with the findings observed in the networked learning analysis (section 5.1.1), confirming distributed patterns of orchestration of activities where interactions were established based on the collaboration between agents in the system, rather than on hierarchy. This is also consistent with teachers’ identity, showing a focus on student-centred/content knowledge practices (see section 5.1.3).

The analysis on interactions in the blended space included also a content analysis technique (Anderson et al., 2001). The content analysis shows how students positioned themselves in tutoring roles by sharing, negotiating and discussing with their peers. For instance, students drew on their own experience to interacting about positive, negative or infinite numbers, percentages, decimals, spelling, grammar or how to construct narrative discourse. This contrasts to practices where students have to conform to established solutions previously designed by the teacher (Shea, 2006). The wide range of possibilities of interactions in the online space, also increase the opportunities that students have to express their knowledge (Brown et al., 1989; Browne, 2003). In line with a sociocultural approach, such processes not only extend possibilities for students to familiarise themselves with, but also to deepen their understanding about content-knowledge through assimilation and accommodation of existing knowledge (Applebee, Langer, Nystrand, & Gamoran, 2011). Dialogue formation and collaboration was consistently observed in the online space. A sociocultural view of learning helps here to visualise how learning processes in this environment were both tool and socially-mediated. Consequently, students' social dialogue was part and parcel of cognitive processes and conceptual thinking as it mediated students' inner private thoughts (Pea, 1993; Smagorinsky, 2001). The evidence of communication in the form of an online thread visually signified how individual representations are linked to text mediation and evolve in time through interactions with others (Gaddis, Guzman, & Muth, 2000, Nieto 2007).

The third dimension of blended learning, new literacies and artefacts, was explored in Chapter 5 (see section 5.3). The data suggests that the use of new technological tools in this classroom allowed students to engage in rich and various multimodal text-production. By drawing on free applications from the web, the use of Internet and laptops, students were experimenting with new forms to represent and make meaning. Whether reading or writing online, designing games or websites, podcasts or videos, students were engaging in new literacy practices. Such literacy skills were built on top of print-based skills (Jenkins et al., 2009). Unlike print-based education, the multimodal education used in this environment allowed a dynamic relationship between students and the text. Such a relationship was not limited to the consumption of pre-set tasks, but importantly included engagement with peers in the form of an audience and with the process of feedback that derived from it. (Magnifico, 2010b). Students' examples of new literacy practices can be seen as complex activities distributed across various tools that open the boundaries of the classroom space (Black, 2009; Ito et al., 2013; Jenkins et al., 2009).

The last part of the findings discussed in section 5.3 examined students engaging in video production (section 5.3). By remixing old and new ways of filmmaking to convey meaning, students demonstrated competency in new literacies (Belshaw, 2012; Gourlay et al., 2014; Littlejohn, Beetham, & McGill, 2009; The New London Group, 1996). Students also actively constructed meaning, through the incorporation of their own perspective in their narratives. In addition, the videos also evidenced how formal scientific content-knowledge can be re-shaped through multimodal production. This was achieved when students incorporated elements that were familiar to, and popular with, a young adult audience. As observed, new literacy practices require not only a set of new competencies to be taught, but also a different approach to teaching and learning (Burke & Hammett, 2009). In this classroom teachers believed in equipping students with new literacies skills, but also giving students room, flexibility and time over lessons to play around with different kinds of tools, practices and representations. Consequently, they allowed more in-practice exercises that built over time and formative assessment, rather than setting up expectations based on discrete literacy skills acquired on a one time basis.

6.2 Study limitations and further research

Before discussing the implications of this study, it is important to acknowledge its limitations. The analysis presented in this thesis is exploratory, qualitative and therefore cannot be extrapolated to other populations (Creswell, 2013). The case study was purposively selected (Yin, 2009). So, the findings reported are embedded in the specificities of a Six Year classroom with innovative teaching and learning views and positive inclination towards technology. Although the characteristics of this classroom and school context make this an interesting target for understanding how blended environments shape teaching, learning and literacy in the primary classroom, Yin (2011) argues that case studies might produce an unwanted degree of bias. Consequently, the practices identified in the findings of this research by no means should be seen as reflection of mainstream school practices.

In particular, it is important to consider that the research was conducted in a fee-paying independent school; therefore children attending this school were likely to come from affluent households. In addition, as stated in Table 5, the school has a socio-economic advantage value above the average. This differs from New South Wales student population

living in non-affluent families, as they are not able to choose which school to attend. Also the student population in this school has a very low ratio of students with a language background other than English or Indigenous students, when compared to the general population of students in NSW (please see Appendix 7 for further details). Consequently, the results of this study are not representative of all schools in the state, but specific to this context. In addition, while the study provides key insights on blended learning (Fielding & Moss, 2011), some analyses included only a small number of participants, so the categories captured the views of few people and cannot be generalised to other participants.

Scholars have argued that there may be inconsistency between what participants say to what they do (Kane, Sandretto, & Heath, 2002). In order to gain perspective in relation to the phenomenon of blended learning, I employed triangulation, which includes the use of multiple approaches to data analysis and different techniques for collecting data (Creswell & Miller, 2000). For instance, what teachers reported in the interviews was contrasted with fieldwork observation of what teachers did in their everyday activities during three terms. Likewise, students' perceptions of technology and Edmodo were compared by analysing how students interacted and engaged in artefact production in the online and physical spaces. Following this procedure, it would be interesting to undertake a comparative study that includes other classroom settings. This would strengthen the trustworthiness of the study.

Because time and resources were limited, observations in this classroom space were only possible during three terms of the school year. Although this complies with forms of trustworthiness as I engaged in continued observation (Creswell & Miller, 2000), an extended period of observation in the classroom would have allowed deeper insight into the process of enculturation of students in that space; particularly, in relation to registering students' acquisition of technological competences as they transition from Year 5 to Year 6. This is indicative of an area for further research, where a longitudinal study could capture how teaching and learning evolves over time in a blended environment.

Moreover, despite the relevance of the design of instructional activities, the inclusion of such analysis was beyond the limit of this thesis. Thus, the examination of how teachers came to design specific tasks and its connection to learning outcomes and content knowledge were only briefly mentioned, yet I acknowledge that this is a central part of teaching and learning. This again emerges as a clear area of interest for further research.

Rather than considering an objective position towards the phenomenon of study, I acknowledge that freedom from bias in naturalistic research is impossible (Chiseri-Strater, 1996; Miles & Huberman, 1994). Thus, I acknowledge my position as a woman, non-Australian, non-native speaker researcher who was external to the culture of the school, and that all those factors might have had an impact in the methodological decisions and analyses I undertook (Chiseri-Strater, 1996).

As directions for further research, and considering the findings on Edmodo in the classroom, it would be relevant to undertake similar research in the context of a real open social network site. This could allow the formation of a natural learning network, augmenting the number of participants in the network and consequently enriching the connectivity among them. Based on the findings of this study, future research could also explore the potential roles of social network sites to support identity formation in young adults across formal and informal learning spaces; and to see how these roles intersect with teaching and learning processes in the classroom.

6.3 Implications of the study

The findings reported in this thesis have implications for academics, teachers, school stakeholders, and policymakers. The digital age encompasses opportunities and challenges for young learners (Collins & Halverson, 2009). The challenge to prepare students for demands and tools yet to emerge is of vital need and implies the need of schools to adopt ways of effectively addressing such changes. An important implication of the study is that blended environments offer students opportunities to engage in knowledge-building (Bereiter, 2002). As explained previously in chapter 3, knowledge-building underlines cyclical processes which shift from individual to social and collaborative aspects of knowledge. In this sense, it contrasts to previous Cartesian epistemologies of learning with a clear distinction between “object-subject”.

Knowledge-building links knowledge to social practices through an iterative process that integrates knowledge and rationality with emotion, symbolic speech and action, as well as with the development of shared objects. In line with Bereiter’s work (2002), the analysis of the data shows how students engaged in cycles of communication, design, production and distribution across the physical and the digital spaces. In this process, peers were able to

include their thoughts and translate them into comments and suggestions, thus making explicit the social aspect of knowledge-building (Brown & Adler, 2008; Lankshear & Knobel, 2011). In addition, digital tool mediation was key for students to transition from individual to collective outputs, which were often modified according to the feedback given by the students. This is a key finding as learning processes in the school often privilege individualistic learning (Gee, 2004; Johnston & Hayes, 2008); which in turn limits opportunities for students to interact and share knowledge during lessons, promoting competitive behaviours amongst students, as opposed to cooperation and collaboration (Barron, 2003). In this sense, the case study reveals that blended learning, when effectively designed, can enable distributed, collaborative and authentic learning processes.

Echoing the process of knowledge-building observed in this case study, the findings also demonstrate that the way educational designers and teachers link space, tools, and importantly, where they position the students, is not trivial. According to the findings, designing blended spaces for learning should adopt distributional and offer more opportunities for symmetric relations between agents in the learning network. In this way, agents in the classroom can capitalise on students' knowledge to leverage learning. A key factor for enabling such characteristics is related to modelling how to navigate such types of environments and overseeing interactions over time. This is particularly important in relation to modelling interactions online. For instance, the role of the teacher is central to anticipate risks and to prepare students for appropriate types of behaviour, netiquette and ways of searching when they are online. This contradicts research that presupposes a higher level of expertise of young learners with digital technologies (Prensky, 2001, 2006). Although young learners might be more dextrous in manipulating new technologies, the findings suggest that this does not imply that they are skilful in using technologies effectively for learning. Likewise, students are often unaware of the risks involved when online, such as the digital footprint or copyright issues. Again, the findings are clear in the need for schools to purposefully model ways of being, interacting and creating identity online. Also it is important to note how the teaching of technology traversed school subjects; hence it should be incorporated as part of regular classroom activities, rather than isolated in technological modules. Again, this calls for the need to design tasks that embed technology, pedagogy and content knowledge as every day practices (Harris et al., 2009).

An important implication of this study relates to the notion of literacy and new literacies. This study takes seriously the idea that language is a resource for making meaning (Halliday, 1978). The findings suggest that learning to be literate in a blended learning space gives students opportunities to engage in a wide range of meaning making experiences using traditional and new communications technologies, including spoken language, print, and multimedia (Luke et al., 2000). With this approach, students are given opportunities to understand the rules of grammar, text function and canonic standards, but also to understand and practice how linguistic resources can be used to, for instance, evoke feelings, describe facts, tell stories, or position “the other” in spaces of empowerment or disempowerment. In addition, making language class activities authentic, meaningful and focused to an audience, allows students to understand the relevance of language learning. This also connects literacy learning with students’ own interests (Barron, 2006). For instance, through multimodal production, students were able to explore the scientific logic of inquiry in conjunction with incorporating their favourite music, colour and font. Students were also able to link school activities with skills required in some workplaces such as editing, script-writing, or filming. Such approach to meaning making is linked to a long-term call for the need of schools to connect content with authentic practices and real competences expected in out-of-school contexts (Brown et al., 1989; Greenhow et al., 2009; Resnick, 1987). The analysis of this case study reveals that digitally-mediated technologies can be used in the classroom to close the gaps between un-authentic, individual, test-driven learning and indexed, shared and purposefully driven learning. By extending the notion of one canonic language to multiple, multifaceted, and multimodal ones, other languages that students may be familiar with are then also validated and recognised in the classroom. For instance, communicative repertoires from cartoons, videos, or online-games may also find a venue in the classroom and can be used as another way to effectively engage students in literacy practices. These results are consistent with research that shows that allowing diversity of texts in the classroom is an important factor to motivate disengaged learners, specially boys (Magnifico, 2010a; Steinkuehler & King, 2009).

The inclusion of a social network technology contributed to shape teaching and learning in the school context. Thus, as observed, students engaged in new literacy practices, dialogue formation, peer teaching, and demonstrated a sense of authoring and audience formation, while supported by this tool. These findings are in agreement with research identifying the power of social media tools in education (Dunlap & Lowenthal, 2010; Greenhow & Gleason,

2012; Kilinc et al., 2012) and are in alignment with culturally situated approaches of learning (Vygotsky, 1978; Wertsch, 1985). Moreover, the findings suggest that social media tools are not “effective” or “ineffective” (Laurillard, 2012; Luckin et al., 2012). Ultimately, such technologies have affordances that can assist the development of certain competencies, yet can constrain others. Because of that, the use of social network tools needs to be carefully modelled and linked to desired outcomes. The present findings are also consistent with studies suggesting that the integration of social media tools expand students’ understanding of learning outside the walls of the classroom space (Boyd, 2007; Evans & Klilincm, 2013; Greenhow & Gleason, 2012; Greenhow, 2011; Selwyn, 2009).

It is important to bear in mind that the interactions and the nature of dialogue and literacy practices were not naturally developed, but guided, stimulated and scaffolded by the teacher, evidencing the key role of the teacher in mediating students’ learning across the physical and the digital space. The learning activities occurring in this social network were also attached to, and I argue, potentiated by, the existence of an established community of students and the teacher in this Year Six class, along with the wider community of the school and family. The findings also show how the use of Edmodo affords certain patterns of communication, different from the ones occurring off-line. In agreement with the literature when modelled appropriately, this can extend the amount of text that students read and write online, and accordingly augment their possibilities to scaffold students’ language learning (Evans & Klilincm, 2013; Holland & Muilenburg, 2011; Sanders, 2012).

The findings identified that teachers’ beliefs and cultural values are not static constructs. Instead, they can vary from a focus on transmitting information to meeting students’ needs. The findings suggest that resistance to technology integration and new ways of teaching in the classroom can be diminished by allowing failure to occur as part of teachers’ everyday design for learning. This allows the renovation and implementation of good practices based on experience (Collins & Halverson, 2009). Also, the findings suggest that opportunities for teachers to learn through vicarious experiences increase when teachers teach in pairs or are able to teach in a space that enables simultaneous teaching (Hansen, Nangle, & Meyer, 1998; Kim & Baylor, 2006). Therefore, support should be given in order for teachers to work in teams, and in turn to collaborate and understand the teaching process as a shared endeavour. In addition, the data suggests that, due to the interrelated nature of teaching and learning, school administrators and principals should focus on supporting teachers as a team, rather

than individual performance. Finally, the findings suggest that a key strategy to productively integrate technology in the classroom, is to have the support of school leaders crystallised in periodic professional development as well as a non-judgmental school culture towards experimenting with new tools. Such findings confirm previous studies on professional development suggesting that workshop style, un-authentic and one-time professional development is detrimental for a sustainable integration of technology in the classroom (Curwood, 2011, 2013; Ertmer & Ottenbreit-Leftwich, 2010; Mouza, 2009).

6.4 Concluding thoughts

The success of integrating digital technologies in the classroom and preparing young learners for the future poses great demands on teaching today. This research has examined how teaching and learning are shaped by technology in a primary blended environment. Notably, the link between space, tools and agents is not neutral for learning. Based on the evidence of this case study, it seems that building connections that draw on analogous and digital technologies as well as social media tools can assist teachers to navigate and support the design of pedagogical tasks that face the complexities of teaching and learning in the 21st century. Importantly, this study has identified key elements of blended learning that can leverage learning. In particular, a distributive approach seems to be core for capitalising the affordances of technological tools and in turn augmenting the possibilities of interactions and learning.

This study shows that blended learning allows different entry points for learning activities. The potential of that is that either through acquisition—in a scenario that could involve students becoming active participants or peripheral participants—as well as through knowledge-building activities, students are offered opportunities to experience variance for engaging in learning processes. This variance in the scope and nature of activities is especially relevant in order to engage students in authentic learning practices and is supported by the inclusion of multimodal texts.

Hence, in order to capitalise on blended learning, teachers need to value and thus facilitate a student-centred classroom. Otherwise, tool use could be just replicating teacher-led discussion and information transfer approaches (Jahnke, Mårell-olsson, Norqvist, Olsson, & Bergström, 2014; Trigwell, 2011). When empowering students about their capacities to

discuss and mutually assist each other to go through the tasks of the class, a community of practice might emerge (Wenger, 1998). Here students can support each other by sharing responsibilities about their learning, interacting and helping each other and progressively building self-worth in each other (Palloff & Pratt, 2007).

This study provides a thick description of the ways in which spaces, tools, and social interactions shape teaching and learning in primary blended environments. The findings reported in this thesis give rich insights into the theoretical work in the field of primary education, educational technology and learning networks. The data presented reveals the nexus between activities, tools and culture in young learners (Brown et al., 1989) and, it is hoped, provides solid evidence for future design for blended learning in primary classrooms. The work of Hutchins on distributed cognition (1995, 2000), explained earlier in this text, serves as an analogy to understand and conceptualise school practices as an interdependent process where all agents in the network permit the function of the system. This implies the need to integrate teachers' expertise and students' conceptual thinking in a shared and distributive way to potentiate students' learning.

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APPENDICES

Appendix 1: Teacher interview protocol

TEACHER INTERVIEW PROTOCOL

Questions
<ol style="list-style-type: none"> 1. Could you reflect on how you see yourself as a teacher? 2. Could you reflect on the role that technology has in your teaching? 3. Could you describe the type of literacy practices students engage in the classroom? 4. How do you assess students' learning? 5. How do you try to enable learning in your classroom? 6. What skills do you consider key in preparing students for their future? 7. Due to the constant state of flux of technology, what do you think about the idea that "teachers are perpetual novices in the process of technology integration" (Mueller et al.2008)?

Closed-ended questions

1. How old are you?

20-30 ____

31-40 ____

41-50 ____

50-60 ____

2. Years of teaching experience

3. How competent do you feel with your ICT abilities?

Really
competent


Competent

More less
competent

Not competent

☐
☐
☐
☐

4. How would you rate technology usage in the classroom?



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Excellent

Good

Could be improved

Insignificant

☐
☐
☐
☐

5. How well the school supports me in my professional development?

Very well

Good

Could be improved

Not at all

☐
☐
☐
☐

Appendix 2: Student interview protocol

STUDENT INTERVIEW PROTOCOL

Questions
<ol style="list-style-type: none">1. What do you think about Edmodo? Show me your Edmodo profile? How do you manage your online profile?2. How do you see yourself as a student?3. How would you describe a day at the school?4. What literacies have you learnt at school?5. With which modes (written, visual, kinaesthetic, audio) do you prefer to express your ideas?6. What is the role of technology in your learning?

Thank you 😊

Appendix 3: Student survey

STUDENT SURVEY

Dear student:

The following questions are about your learning, use of technology and motivation. Your participation in this survey will help researchers at the University of Sydney to understand how motivation and the use of technology in the classroom can support learning. Please circle one number on each line. Thank you!

Name: _____ Age: _____

Strongly agree	Agree	Disagree	Strongly disagree
1	2	3	4

	Strongly agree	Agree	Disagree	Strongly disagree
1. Everyone in my school can get good marks if they do their very best	1	2 3		4
2. In my school everyone is encouraged to do their very best	1	2	3	4
3. Teachers want me to gain a really good understanding of the subjects, not just memorize them	1	2	3	4
4. Trying hard (participating, doing the required tasks, etc.) counts a lot at school	1	2	3	4
5. Teachers pay too much attention to grades and not enough attention to helping students learn	1	2	3	4
6. Teachers treat students who get good marks better than other students who don't always get good marks	1	2	3	4
7. Teachers pay more attention about the smart kids	1	2	3	4
8. Students are encouraged to compete against each other for marks	1	2	3	4
9. I often get to decide where I can sit in class	1	2	3	4
10. I often get to decide who I can work with for collaborative/group tasks	1	2	3	4
11. I often feel I can participate in improving class' tasks	1	2	3	4
12. I often feel I'm allowed to move around the room during class	1	2	3	4
13. I often feel free to share my ideas and talk about my work in class	1	2	3	4
14. Often my ideas and suggestions are listened to and used during classroom discussions	1	2	3	4
15. In this school, there is a lot of discussion about learning	1	2	3	4
16. I feel I can count on my teacher(s) to help me out when I have a personal or social issue at the school	1	2	3	4
17. I often talk to teachers about how things are going in my life	1	2	3	4
18. I often feel that teachers really understand how I feel	1	2	3	4
19. I often feel that teachers support me in my learning	1	2	3	4
20. I feel I can ask the teacher(s) questions about things I haven't understood or things I would like to know more about	1	2	3	4

	Strongly agree	Agree	Disagree	Strongly disagree
21. I often have trouble in school because it is hard for me to sit in my seat for a long time	1	2	3	4
22. I often start daydreaming or thinking about something else when I'm in class	1	2	3	4
23. I often find that it is hard for me to get my homework done	1	2	3	4
24. In general, I like school a lot	1	2	3	4
25. I would recommend other kids to go to this school	1	2	3	4
26. I often feel like I'm part of the school I go to now	1	2	3	4
27. I have to do well in school if I want to be a success in life	1	2	3	4
28. I learn more useful things from my friends, family and relatives than I learn in school	1	2	3	4
29. I often feel I can make my own choices when I'm doing school work	1	2	3	4
30. I often try to relate what I'm studying at school to other things I know about and enjoy	1	2	3	4
31. I often try to plan my homework before I get started	1	2	3	4
32. I often check my homework to make sure it's done correctly when I finish it	1	2	3	4
33. I often feel that technology makes my work at school more fun	1	2	3	4
34. I often think that technology allows me to work better at school	1	2	3	4
35. I often feel that technology helps me in sharing my work with other students	1	2	3	4

Open-ended questions

If technology were a food what would it look like? Why?

If Edmodo were a food what would it look like? Why?

Thank you 😊

Appendix 4: Student metaphors about technology

STUDENT COMPLETE RESPONSES ABOUT TECHNOLOGY (METAPHORS)

1. I reckon technology would be a cake that is lightly burnt on the outside and near the center is not cooked. I think this because technology like the middle and some parts of the cake can be tasty and have good intensions but it can be used for evil and bad purposes.
2. It would look like a 20 layer cake. I t would like this because of how complicated it is but also because of the endless amount of possibilities where you can have fun. It would be very complicated to make but easy to operate like it is hard to make but easy to eat if you knew how to make the cake.
3. Everything would be square and white or light grey and it would taste tangy
4. If technology were a food then I think it would be a very complicated dish.
5. Technology would look like pizza because it would be warm and fuzzy like a computer
6. If technology was a food I think it would be an apple. I think it would be an apple because it helps me a lot in class
7. If it would be like a food I could eat it if I wanted to and maybe if I felt like that food but don't think it would be my very favourite food. It would be more of a hit and miss with me, sometimes I would love it and sometimes I would hate it. It would look like a 5 star dinner you could love or hate.
8. It depends if I feel like eating it, sometimes at school I feel like going on my laptop to work/technology when sometimes I just feel like picking up a book and a pen and working just with that. Overall If technology was a food I like it.
9. I think technology would look like a strawberry because the seed are all the computers and the berry is connecting to all the seeds.
10. It would be like cherry pie because it's nice but is not good for you.
11. It would look like a watermelon because it's big and can roll away. Which means technology can be uncontrollable and can go away
12. Technology would look like a steak with a couple of chewy bits. It is mostly good but not all of it.
13. It would be like ravioli because that is my favourite food and technology is good
14. If technology were a food it would look like a big burger. Because you can find anything in it and its full of a lot of things.
15. I think technology would look like a cake. It is widely popular, but often 2d and 3d world countries can't get it. It, like cake, was extremely revolutionary when it came out.
16. If it were it would taste like lumpy mash potato, hard backed beans and a raw sausage.
17. A platter of knowledge waiting to be used. Why? Because we used it then stop using it (putting it back)
18. It would taste nice. It would be fun to have for school.
19. It would look like a flashing sandwich with screens as meat and keyboards as bread.
20. If technology was a food it would be a piece of wheat because it is something you use in everyday life but sometimes you don't even know it is there
21. It would look like something yummy but healthy because technology is fun to use and helps me to learn.

22. Technology would look like a healthy finger food buffet because it is interactive, fun and helpful.
23. Cake, because is nice although can be bad if you eat too much
24. If technology were a food would look like a brownie. I think that it would be like a brownie because when its burnt it is something you hate, when it is to liquidy it will just not cooperate but sometimes it is perfect and nice and something you want.
25. I think that technology would look like a healthy super food because it is helping you with your learning and giving you answers. On the other hand, if we were using it at home or on the weekend and not for learning then I think that It would look like a hamburger.
26. Technology would be a very yummy but at the same time not natural. It would look very yummy and very inviting but at the same time if you have to much of it it would be bad for you.
27. If technology were a food it would look like an ever-changing hamburger.
28. Technology would be like chilli because it makes almost everything better but if it dominates it's not very nice. Too much of it and we get to used to it it becomes dull and unentertaining
29. If technology was a food it would like gears in a machine
30. If technology were a food it would be a coconut because sometimes, it's hard to crack open and figure out and other times, when you get past the outer shell, the rewards are great

Appendix 5: Student metaphors about Edmodo

STUDENTS COMPLETE ANSWERS ABOUT EDMODO (METAPHORS)

A (17 references)	B (4 references)	C (5 references)	D (3 references)
<p>It would be a big hamburger that you could transfer thoughts in and when other people eat it they would get your thoughts</p> <p>If Edmodo were a food I think it would be a cake that was backed by many and eaten by many.</p> <p>Edmodo would be like grape because there are lots of kids (grapes) on the one page (vine)</p> <p>If Edmodo was a food it would be a chocolate because you could break it up to share with others</p> <p>If Edmodo were a food it be super yummy and my favourite food because it helps me to talk to other students for help and keep up with assignments. It would look like chocolate to me.</p> <p>If Edmodo was a food I would like it because it would help me thrive in my everyday life just like it keeps me on track on technology</p> <p>Edmodo would look like an icecream because it helps me a lot with my work.</p> <p>If Edmodo were a food it would look like marvelous creations chocolate, because everyone can have some and each piece/discussion</p>	<p>If Edmodo was a food it would be Jaffa cakes. Why? Because they both are great for some people but bad for others. Some people use Edmodo differently and some people might eat Jaffa cakes differently, like with milk or mixed with something else.</p> <p>Edmodo would be a broccoli because it is good but it is not my absolute favourite</p> <p>Edmodo would look like a mango because you love to use it and boast how good it is but in certain subjects/seasons it is not useful even if you want it.</p> <p>If Edmodo were a food it would be a passionfruit. It can get messy and all over the place at times. It is also a little bitter-sweet at other times</p>	<p>Raw fish with off oyster and every are asking why Im eating it</p> <p>If Edmodo was a food it would look like an undercooked steak, you don't want to it it but most of the time you have to eat it so you have to so you just shove it down your</p> <p>Edmodo would be a piece of slightly uncooked bacon. This is because it has good intensions but it manly has problems and annoyances.</p> <p>It would be raw fish because I find that it is complicated to upload and to keep and know what I'm doing.</p> <p>It would be a pineapple because I don't like the, and I don't like Edmodo</p>	<p>Eggplant because Edmodo is blue and begins with "e".</p> <p>It would taste like Edmodo with chilli sauce</p> <p>I think it would look like a pie because everyone likes pie and we can learn from pies because it is related to maths.</p>

<p>is different and exciting.</p> <p>A muesli or fruit bar. It is only a small part of school (food) and is useful for work (energy).</p> <p>If Edmodo was a food it would have to be a cake because it brings everybody together</p> <p>If Edmodo was a food it would look like healthy because Edmodo is a great learning tool and it helps me to learn. It also helps me because I can ask people questions about work. I really like using Edmodo.</p> <p>Edmodo would be like a healthy sweet ice cream because Edmodo helps me and is fun and easy.</p> <p>Soup, because soup can fill gaps and its nice</p> <p>I think Edmodo would look like an apple because it would help you in your work and gives you challenges to complete at school and at home for work.</p> <p>Edmodo would look very colourful and healthy for my body. It would also look very yummy and have lots of variety along with vvery different tastes.</p> <p>If technology were food it would be a knowledgeable chip.</p> <p>It would look like bright juicy fruit with different ideas bursting out</p>			
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Appendix 6: Discourse analysis transcript

DISCOURSE ANALYSIS (INCLUDING DESCRIPTION OF NON-VERBAL/SPATIAL CUES)

Extract 1

<i>Speaker</i>	<i>Message Unit</i>	<i>Description of non-verbal/spatial cues</i>
		Students enter the classroom, chat, take their novels and sit down either on a circle or on chairs (facing different angles)
Claire	[*]	Claire hands out post-its Claire stands up close to the screen and observed the students
Claire	1.shhhh	Teacher puts her hands together in signal of quietness
Claire		Claire moves her arms, counting, while the rest of the students are reading or talking.
Claire	2. Kim and Tobias can you hand over the notebooks please?	Kim and Tobias stand up to get the notebooks and hand them out to their peers
Claire	3. Ana, sit down please <this is the third time I have to remind you about what we are doing>	
Claire][Claire moves towards her laptop
Claire	4. Shh silence][
Claire	[]	Claire grabs a book from her desk and sits down next to a student on the circle. Students are sitting and reading quietly, scattered over the classroom space. After 10 minutes the teacher stands up.
Claire	5. I would like you to take a moment in that piece of paper < I gave you>	
Claire	6. I would like you to write down <three people> that you are choosing to be in your group [*]	Claire moves into the space of the circle.
Claire	7. Write your name obviously on the top and then one two three	
Claire	8. So your name at the top and then one, two, three in order of preference	
Claire	9. >Actually not in order of preference< and then <bring it up to me and then come into the circle-	
Claire	10. Try to number the people who you are choosing so it is easier for me to know who you are	
Claire	11. Thanks	Teacher receives the pieces of paper, and does this repeatedly
Claire	12. Once you have done yours, give it to me and come to	Students are moving around

	the circle	handing in their pieces of paper.
Claire	13.> Don't fold it up, don't fold it up < just give it to me	
Claire	14. If you have already given me your note ↑ I would like you to quick read what we were doing yesterday in maths so we are good to go -	Students handing in the paper and sitting on the circle (facing the whiteboard).
Claire	15. Well done↑	
Claire	16. Those people having some initiative like Max here is having a look through his numeracy book and checking what we are up to yesterday ^}	Students opening their notebooks
Claire	17. We are still waiting for some people to come into the circle of goodness	After that call, some students sit on the floor, in the circle of goodness.
Claire	18. Let me go over the plan we have for today	
Claire	19. So we are going to finish our math lesson from yesterday	
Claire	20. And then what is going to happen is in learning session two you will be going into your writers' workshop groups	
Claire	21. So we can talk more about this not now ><but at the recess time it is the last day in <u>your particular writers group</u> (?)	
Claire	22. Tomorrow we have an option if you wish to write a <description> and then we will regroup you in term 3	Two students raising their hands.
Harry	23. (?)	
Claire	24. Most of you have already done it	
Patrick	25. (?)	
Claire	26. Yes	
Claire	27. Learning session three today↑ (interrupted)	
Claire	28. If people didn't put their laptops on the seats↑< then people would have more space>	
Claire	29. We actually don't need laptops so you can actually put them down	
Claire	30. We have due time today and I actually< really love> if some people publish their poems from yesterday	Claire moves her hands.
Claire	31. Then after I actually have set you an assignment to do on Edmodo	
Claire	32. >It won't get it finish today< is due tomorrow	
Claire	33. Basically in a nutshell what it would be is that you have to go through the Edcanvas I have given to you	
Claire	34. And we are making a <u>concept map</u> about different websites	Students raise their hands.
Claire	35. <u>Concept map</u> is different to a mind map and you need to look (interrupted)	Patrick puts his hand up.
Claire	36. Why are you putting your hand up listen to the instructions	
Claire	37. A concept map is different to a mind map	
Claire	38. You need to look at the instruction to make sure you are doing a concept map -	
Claire	39. It doesn't say whether you have to do it handwritten or in your PDDs so it's actually up to you to choose	
Claire	40. Second part of that task is that there are two other websites	
Claire	41. One is <u>interactive websites</u> were you look at rides and the science behind that	
Claire	42. And you will <u>need to add that information</u> and you can link that website to your <u>concept map</u> ↑	Claire moves her hands reinforcing her words.
Claire	43. And there is another website were you need to	

	actually <u>design a rollercoaster</u>	
Claire	44. That works	Claire opens hands to illustrate.
Claire	45. It would take you a few goes to most of you-	
Claire	46. to me a few goes	
Claire	47. And then once you <u>do</u> have that you need to screenshot it and then <u>add that</u> to your upload-	
Claire	48. It won't finish tomorrow	
Claire	49. >Then the last learning session< we will have CIA	
Claire	50. Quick questions about this	
George	51. Amh two questions	
George	52. For that task it is individual?	
Claire	53. <u>it is</u> individual yes-	
George	54. So the rollercoaster that we have to design has to be (?)	
Claire	55. No	Clair puts her hands together.
Claire	56. Any other questions?	Claire looks at the whole class.
Claire	57. Cool, that's easy	Claire takes her jacket off;
Claire	58. Let's take our minds back to yesterday where we were looking at the activity about space	she moves to the middle of the circle.
Claire	59. And where we are actually trying to work out using your math stuff ahm	
Claire	60. <Which one did hold the most liquid>	Looks at the screen where a video about the activity is on pause.
Claire	61. Hands up how many of you <u>did come</u> to a conclusion yesterday?	Two students raised their hands.
Claire	62. Ok	
Claire	63. Hands up if you still need more time to work it out?	The majority of the class put their hands up.

Extract 2

<i>Speaker</i>	<i>Message Unit</i>	<i>Description of non-verbal/spatial cues</i>
	[*]	Students are working in their groups but close to each other so it looks like a big group. Andrew and Sam are sharing their results standing up next to Claire who is writing their process on the white wall.
Claire	64. Who has a different answer to <u>that</u>	Claire is pointing at what is written on the white wall and looking at the class.
Students	65. Several students raised their hands	
Claire	66. And feeling confident about that-	
Claire	67. Ok	
Students	68. Several students raised their hands	
Claire	69. Let's have Dorothea and Mia	Looks at the students raising their hands.
Claire	70. Let's give those boys a clap	Claire claps follow by students' claps.
Claire	71. Thank you	Claire's gaze looks at the boys and the class.
Claire	72. Ok let's have Dorothea and Mia	Only Dorothea stands up and

		stays next to the screen.
Claire	73. And Mia, you didn't join Dorothea?-	
Claire	74. Ok	
Dorothea	75. Ok I time height by width-	Dorothea looks at her notebook.
Dorothea	76. Which equals 30.25 and then time 10 which equals 302.5 cm ³	
Claire	77. Ok <u>excellent</u> thanks	
	78. I just wanna talk about this	Claire is showing with one hand the problem while talking to the students.
Claire	79. Dorothea and I talked about this	Moving her hands adding.
Claire	80. So it's <u>not</u> <wrong> but it's not a hundred percent <u>right</u>	
Claire	79. <u>What</u> hasn't been accounted for in that calculation?	Claire looks at all the class and waves the board pencil while talking.
Students	80. Several students raised their hands	
Claire	81. So this would be the <u>next</u> step for you	Claire is pointing at Dorothea
Claire	82. Diego?	Claire selected one of the students to answer the question.
Diego	83. The pi	
Claire	84. The pi	
	85. <Because> if I take those dimensions I am actually counting a rectangular prism rather than what we are trying to find which is a cylinder	Claire is drawing a cube on the whitewall.
Claire	86. (?) <u>And</u> to be honest >even if it wasn't a hundred percent correct< she could probably still determined which one holds the most liquid by doing it that way	
Claire	87. Wouldn't she?	
Claire	88. >She could determine the answer which is the most important<	
Claire	89. Ok ahh	Claire is erasing Dorothea's calculation.
Students	90. <i>Several students are raising their hands</i>	
Claire	91. Let's have <u>Peter</u>	
Claire	92. Did you do it solo Peter?	
Peter	93. No I did it with Nick and Martin	
Claire	94. Do you guys wanna come up and help him?	Nick and Martin stand up next to Peter.
Peter	93. We started off with the white tall glass	Peter is pointing at the glass on the screen.
Peter	95. And we half of that is the radius so we (?) and that turn out to be 2.25	Peter is looking at his notebook Nick and Martin are note involved in the explanation, although they are standing there.
Peter	96. And then we time that by Pi that equals 14.3	
Peter	97. And then we time that by 10 and that equals one hundred and forty one point three	Claire writes on the whiteboard.
Claire	98. Ok <u>interesting</u>	Claire looks at the result on the whiteboard.
Claire	99. Ok who have something	Claire looks at the students
Claire	100. Let's give them a clap	Claire smiles at the students and clap
Students	101. <i>Students clap</i>	
Claire	102. It's <u>really</u> hard to have the courage to come and talk	Claire emphasise this with hands

	about something that you are <u>maybe</u> <not a hundred percent sure>	and gestures on her face
Claire	103. But you know <u>is great</u>	
Claire	104. So we have a significant difference in the answer <u>here</u>	Claire points at the last answer
Claire	105. I think we have to work out at what happened here ^}	Claire looks at the students while pointing a part of the students formula
Claire	106. Anyone wants to tell me what happens here why this is so different to <u>this</u> ?	
Claire	107. Ben	
Ben	108. (?)	
Claire	109. So this should be .75 but there is something else that	Claire's gaze confirms that Ben is correct
Students	110. Square :::	
Claire	111. <u>Yes</u> square	Claire adds the square on the whiteboard
Peter	112. (?)	Peter clarifies his answer
Claire	113. 2.75 square times 3.14 equals 14.3 I don't think so	Claire makes a gesture with her eyes
Peter	114. (?)	Peter clarifies his answer
	115. So it looks like here you have done radius times pi squared	
Peter	116. (?)	Peter clarifies his answer
Peter	117. Ohh I see	
Claire	118. >Yup yup< ok	Claire raises her hands in sign of enthusiasm
Claire	119. Alright let's go onto Tom and then I'm might show <u>you</u> the solution-	Claire erases the previous wrong answer
Claire	120. Does anyone come up with an actual measurement in <u>onzes</u> ?	Claire gives emphasis with her hands
Students	121. Yes	A group of students answered
Claire	122. <u>You guys do</u> ? Ok I'll do you next and then I we'll go through the solution	
Tom	122. So ok we did length times C which equals the radio <and>	Tom constantly looks at his notebook
Matthew	123. 2.75square which equals 1.658 times height and times pi	Tom looks at Matthew, who continues with the answer
Claire	124. <u>I'm</u> feeling a bit cautious about the fact that 2.75 equals 1.658	
Claire	125. Do 2.75 times 2.75-	Matthew looks at the notebook and the result on the calculator Tom shows the teacher a wrong number
Claire	126. >Someone can do this using calculators< 2.75 times 2.75?	Looking at the students
Students	127. Seven point five	Several students answered
Claire	128. Seven point five	
Claire	129. <u>Because</u> since I look at <u>that</u>	Pointing at the whitewall
Claire	130. I thought <is that is <u>that</u> > reasonable?	
Claire	131. <u>Because</u> there is a square <that doesn't seem reasonable>-	Shakes a bit her head as in thinking –is that reasonable-
Claire	132. >Ok so< do you wanna hold it and have another go-?	
Tom and Matthew	133. Ok	
Claire	134. Let's have Diego and?	

Diego	135. (?)	
Claire	136. Ok let's just press <u>pause</u> everyone	
Claire	137. <u>Who</u> would like to < <u>pause</u> >	Pause is accompanied with a hands movement while Claire is moving next to the students
Claire	138. Have another <u>go</u> of getting a more accurate <u>result</u> ok []	Claire opens her hands adding emphasis
Claire	139. Wave at me if you wanna have a more accurate result	Claire waves
Students	140. Several students wave	

Extract 3

<i>Speaker</i>	<i>Message Unit</i>	<i>Description of non-verbal/spatial cues</i>
		Students move positions and arranged the chairs into a circle Kim and Tobias are collecting the notebooks and putting them back into a box After 1 minute everyone is sitting on the circle
Claire	141. <u>So what</u> we have learnt today is actually a different form of <u>tasking construction</u> [*]	Claire moves her chair to be close to the students on the circle
Claire	142. Much more <u>broaden</u> type of tasking construction,	Claire moves her hands in broader
Claire	143. Rather than me >giving you a problem and you kind of highlighting or whatever<	Claire moves her hands illustrating a highlighting movement
Claire	144. We actually <u>use</u> questioning skills to deconstruct the task to find the answer-	Claire moves her hands side by side
Claire	145. We are going to go around in circle and say one thing that you have liked about maths we have done over today and yesterday-	
Claire	146. I'll give you a moment to <u>think</u> we are going to start from Danielle	
Claire	147. Everyone think one thing that <they have <u>liked</u> > about maths today and yesterday	Claire closes her eyes and put her hands together expressing that this is a moment of retrospection
Students	148. (?)	All the students in the class one by one express their ideas around in circle
Claire	149. I'd liked ahh the <u>organic</u> communication that <u>happened</u>	Claire moves her hands enthusiastically
Claire	150. Don't think you guys realised but organically	
Claire	151. A lot of people just got up and <u>where</u> "ah o heard you guys talking about this it's blah"	Moves her right hand mimicking students' behaviour to talk with their peers about the maths problem
Claire	152. And then just kind of that cross-pollination that I	

Claire	have talked about 153. Where <u>bees</u> go and get a bit of <u>honey</u> from different places taking it back to their groups and sharing in the hive so >I see a lot of that happening<	Claire moves her hands mimicking the movements of bees going everywhere
Claire	154. >Which is something that happens quite organically just happen naturally I didn't have to talk to you or tell you move groups or share	Moves her hands adding emphasis
		Students looking at Claire Once all have a go, Claire continues with the instruction
Claire	155. What would you change from this activity?	
Students	156. (?)	All students one by one expressing their ideas going around in circle

Appendix 7. School context

This appendix complements the information stated in the Methodology section (see 4.1.2) in relation to the school context where the study was situated. The name of the school is not disclosed to protect the identities of the participants in this study.

According to the School Annual Report, this school is fully registered and accredited by the NSW Board of Studies and offers courses from Kindergarten to Year 12 leading to the award of the Higher School Certificate. In 2014, there were approximately 1256 students attending the school.

Students mostly come from English speaking families (Annual Report, 2014). In NSW, 28% of students come from a language background other than English (NSW Department of Education and Training, 2009). In contrast, only 9% of students in this school have a language background other than English.

In 2014, the school reported no Indigenous students (myschool.com.au). To contextualise this data is important to situate the school in relation to the student population of NSW. According to a study by the NSW government, 49,308 students in NSW public schools were identified as Aboriginal or Torres Strait Islander out of a total student population of about 755,000 students (Aboriginal students in NSW, 2014). This corresponds to 6.53% of the total population of students in NSW and shows a clear difference between this school and the Indigenous student population in NSW public schools.

School fees are another relevant indicator to be considered, in order to situate this school in relation to other schools in Australia, and in particular in NSW. The fees for students in year 12 were \$ 12,110 AUD. This cost is notably lower than the cost of elite non-government schools, with fees usually around \$30,000 AUD. For instance, in 2014 Sydney Grammar School reported fees of \$31,419 AUD and SCEGGS Darlinghurst of \$34,327 AUD. (<http://www.exfin.com/private-school-costs>). In contrast, government schools in Australia are free, though they can request contributions to parents to enhance their educational and sporting programs or may charge students for elective subjects (NSW, 2015). This data shows a large variance in cost between government and non-government schools, and also across non-government schools.

To sum up, data related to the school context provides an insight about the particularity of the school population where this study was conducted, considering students with language background other than English and Indigenous students within the school and in comparison to the NSW broader context. In addition, the cost of this school fees suggests that though the school cannot be considered an elite non-government school, it equally differs from fee-free government schools. This short overview also shows the diversity of school contexts in the Australian educational system.

Appendix 8. HREC approval



Research Integrity

Human Research Ethics
Committee

Tuesday, 22
January 2013

Dr Alyson Simpson
School Development & Learning; Faculty of Education &
Social Work
Email: alyson.simpson@sydney.edu.au

Dear Alyson

I am pleased to inform you that the University of Sydney Human Research Ethics Committee (HREC) has approved your project entitled **“Examining multiliteracies and social skills in young 21st century learners through technology”**.

Details of the approval are as follows:

Project No: 2012/2832

Approval Date: 21 January 2013

First Annual Report Due: 31 January 2014

Authorised Personnel: Simpson Alyson; (De) Carvalho Lucila; Thibaut

Patricia; Documents Approved:

Date Uploaded	Type	Name
07/01/2013	Recruitment Letter/Email	Parents invitation letter
14/01/2013	Participant Info Statement	PIS children v4
14/01/2013	Participant Info Statement	PIS parents v4
14/01/2013	Participant Info Statement	PIS teachers
07/01/2013	Recruitment Letter/Email	Teachers invitation letter
Submitted 21/11/2012	Parental Consent Form	Parental Consent Form
Submitted 21/11/2012	Teachers Consent Form	Teachers Consent Form
Submitted 21/11/2012	Interview protocols	Interview Protocol (Students and Teachers)

HREC approval is valid for four (4) years from the approval date stated in this letter and is granted pending the following conditions being met:

Condition/s of Approval

- Continuing compliance with the National Statement on Ethical Conduct in Research Involving Humans.
- Provision of an annual report on this research to the Human Research Ethics Committee from the approval date and at the completion of the study. Failure to submit reports will result in withdrawal of ethics approval for the project.
- All serious and unexpected adverse events should be reported to the HREC within 72 hours.
- All unforeseen events that might affect continued ethical acceptability of the project should be reported to the HREC as soon as possible.
- Any changes to the project including changes to research personnel must be approved by the HREC before the research project can proceed.

Chief Investigator/Supervisor's responsibilities:

1. You must retain copies of all signed Consent Forms (if applicable) and provide these to the HREC on request.
2. It is your responsibility to provide a copy of this letter to any internal/external granting agencies if requested.

Please do not hesitate to contact Research Integrity (Human Ethics) should you require further information or clarification.

Yours sincerely



**Professor Glen Davis
Chair
Human Research Ethics Committee**

This HREC is constituted and operates in accordance with the National Health and Medical Research Council's (NHMRC) National Statement on Ethical Conduct in Human Research (2007), NHMRC and Universities Australia Australian Code for the Responsible Conduct of Research (2007) and the CPMP/ICH Note for Guidance on Good Clinical Practice.