Never Mind the Gap!

Digital Differences among Students and Teachers

by

Zoran Tešić

Canterbury Christ Church University

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In loving memory of my mother, Nada (rođ. Gašić) Tešić.

ABSTRACT

Although there has been an increase in the availability of digital technology and related media (DT&RM) in many educational institutions across the UK, it has been frequently suggested that the barrier to the successful development of an effective digital learning environment is teachers' (digital immigrants) lack of technological proficiency to take into account the needs of the new digital generation of students (digital natives). With the aim of contributing to this debate, I investigated the adoption of technology by exploring digital differences between a population of students (n = 444) and teachers (n = 158) in a further education (FE) college in South East England, addressing the research question, In what ways do students and teachers differ in how they relate to digital technology in the context of teaching and learning practices?

In order to understand more about how students and teachers relate to DT&RM, this study utilised sequential mixed methods research with a collaborative approach to data collection. This entailed giving the participants a voice and an active role in some aspects of the qualitative recording of evidence, as well as enabling a reflection on the processes of the study.

The results of the research indicate differences in digital awareness and the ability to use DT&RM among students and teachers. Although observable, those differences are not specific or age- or gender-related. The findings suggest that many participants among students and teachers struggle with and have limited knowledge of technology, and that differences in how they relate to DT&RM are associated with the different roles they play in an educational setting, as well as the role that technology plays in meeting their individual needs. The data also indicates that both groups of participants recognised the potential of using DT&RM in the classroom. Furthermore, they presented critical awareness of technology, seeing the role of technology in education as supportive rather than transformational.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

ANOVA	Analysis of Variance
BBC	The British Broadcasting Corporation
BECTA	British Educational Communication and Technology Agency
BETT	British Educational Training and Technology Show
BIS	Department for Business Innovation & Skills
CAQDAS	Computer Assisted Qualitative Data Analysis
DAB	Digital Audio Broadcasting
DIVSI	Deutsches institut fűr Vertrauen und Sicherheit im Internet
DT	Digital Technology
DT&RM	Digital Technology and Related Media
EdD	Doctor of Education
ESOL	English for Speakers of Other Languages
ETAG	Education Technology Action Group
FE	Further Education
FELTAG	Further Education Learning Technology Action Group
HE	Higher Education
MRI	Magnetic Resonance Imaging
MMS	Multimedia Messaging Service
GenMe	Generation Me
GPS	Global Positioning System
GSMA	Groupe Speciale Mobile Association
HE	Higher Education
JISC	Joint Information Systems Committee
ICT	Information and Communication Technology
IWB	Interactive White Board
IPSOS MORI	A leading UK research company
IT	Information Technology
ITL	Information and Learning Technology
LEX	Learner Experience of E-learning
LPX	Students Experience of Technology
LSC	Learning and Skills Council
MLE	Managed Learning Environment

MoLeNET	Mobile Learning Network
MOODLE	Modular Object-oriented Dynamic Learning Environment
MP3	Digital Audio Format (Moving Picture Experts Group Layer-3 Audio)
LSE	London School of Economics
Nesta	National Endowment for Science, Technology and the Arts
Net-Gen	Net Generation
OECD	Organisation for Economic Co-operation
Ofcom	Office for Communication
Ofsted	Office for Standards in Education, Children's Services and Skills
PISA	Programme for International Student Assessment
PLP	Personal Learning Plan
RSS	Rich Site Summary (web feed format)
SD	Standard Deviation
SMS	Short Message Service
UCLA	University of California, Los Angeles
VoIP	Voice over IP (Internet Protocol)
VLE	Virtual Learning Environment
Web 2.0	Second generation of the World Wide Web
Wi-Fi	Wireless Fidelity

CHAPTER ONE

INTRODUCTION

"It is easier to put a man on the moon, *than to reform public schools."*
—MIT Professor, Jerrold Zachiarias, 1966 (as cited in Cuban, 1986, p.1)

This thesis reports a study of the differences between students' and teachers' adoption of digital technology and related media (DT&RM) in the context of teaching and learning practices in an English further education (FE) college. This chapter provides an outline of the study's context and the problems it addresses, with an overview of the methodology, its professional significance, and its limitations.

The context of this study

This study is grounded in the belief that education is a social process and, therefore, the diffusion and adoption of technology in education should be seen as a system that emerges from the interaction of students and teachers with technology. With the lack of a unified theoretical approach (Harwood & Asal, 2007) and moderate empirical research (Corrin et al., 2010) often based on the view of technology as deterministic in shaping students' and teachers' digital traits (Dede, 2005; Oblinger & Oblinger, 2005; Prensky, 2001a & 2001b; Tapscott, 1998), I approached the digital divide phenomenon between students and teachers with the belief that providing each student and teacher with a computer or any other digital device in education does not automatically mean resourceful and productive use of technology for teaching and learning. When students and teachers use technology in education, it is not technology, but their experience with teaching and learning that stands out. It is not technology for technology's sake; it is technology for education's sake. If students do not learn, or teachers do not see technology as a meaningful way of supporting the learning experience, that technology is meaningless.

In the late 1970s, in the last years of my secondary education, I had an art teacher who would repeatedly assert, "Since the middle ages, the only innovation in schools has been the invention of electricity." This statement referred to the fact that although many areas of human existence have been significantly transformed by the industrial and technological revolution, schools and the education system had seen very little of this progress. This echoes the observation of Seymour Papert, one of the pioneers responsible for introducing digital technology (DT) into the classroom, who, in the late 1970s, was already experimenting with the use of computers to revolutionise teaching and learning. Making a similar point to that of my art teacher, Papert (1992) invites us to imagine surgeons from the early twentieth century visiting the operating theatre of a modern hospital and compares those doctors to time-travelling teachers visiting a contemporary classroom. While an array of new medical equipment, practices, procedures, and electronic devices would be utterly unfamiliar to surgeons from the past, teachers from the past visiting the present-day classroom would certainly be able to understand what was going on and would be able to take over the class without difficulty.

Be that as it may, in recent years, the introduction of DT&RM in English educational institutions has rapidly increased. The successful adoption of digital technology in education has been an important agenda for both politicians and policymakers who believe that educational institutions can operate more efficiently and support better teaching and learning through securing more DT in their classrooms. In 2013, Matthew Hancock, the UK Minister of State for Skills and Enterprise convened the Further Education Learning Technology Action Group (FELTAG) with the aim of improving the learning experience and the effectiveness and efficiency of the FE sector through increasing the use of technology (Hancock, 2014b). In 2014, the group published its report The Digital Future of Further Education recognising the importance of DT in FE as a resource that can be used to the great

benefit of students and teachers. In the report, FELTAG called for a minimum of 10% of all FE courses to be delivered online by 2015/16, with incentives to increase it to 50% by 2017/18. It also urged awarding bodies to aim for a minimum of 50% of vocational assessment to be online, commencing 2018/19 (FELTAG, 2014). FELTAG secured £5 million, allocated by the Department for Business Innovation & Skills (BIS), to upgrade the broadband network in FE colleges in 2014/15; to enable them to introduce cloud sharing technologies; and furthermore, to facilitate setting up the Education Technology Action Group (ETAG) to support the use of DT and replicate FELTAG's model throughout the UK education system.

The FELTAG Progress Report 2015 has reported a "very encouraging" level of engagement by FE providers and individuals since FELTAG was set up in 2013 (BIS, 2015, p. 5). Through BIS funding, almost 100 colleges have upgraded to cloud-based online services, and the adoption of Eduroam service (an international roaming service used by HE and FE education) in FE colleges has doubled to 86 colleges. The UK's Gazelle group of FE colleges, formed in 2011 and set up to develop entrepreneurial attributes through education, organised thirteen projects to increase support for leaders, managers, and academic staff to improve the effective use of technologies for learning (BIS, 2015). Fifteen feasibility projects have been supported by Innovate UK, an executive non-departmental public body sponsored by BIS, to stimulate innovation in educational technology (BIS, 2015). At the British Educational Training and Technology (BETT) Show (2015), ETAG launched 15 key recommendations for further development of technology. Those recommendations included requests for FE providers to provide learners with a minimum level of fast broadband connectivity, with a safe, secure, resilient and organisation-wide Wi-Fi system for use on and off the campus. The report also recommended that colleges build "Bring Your Own" (ETAG, 2015, p. 14) approaches to their immediate and medium-term DT strategies with

access to independent and objective help and advice for the purchase and utilisation of technology. Further, it recommended that the government should make FE providers justify their use of DT through a relevant accountability framework, such as the Ofsted framework for FE and Skills.

This is not the first attempt made to encourage the use of DT in the FE sector. In 1997, the Department of Education founded the British Educational Communications and Technology Agency (BECTA) with the aim of promoting information and communications technology (ICT) in education. Unfortunately, it was abolished in March 2011 in the post-election spending review. Its survey in 2006 (BECTA, 2006a) found that within 388 FE colleges in England, both the number of computers and the number of machines with Internet access more than doubled from only 38% of 160,000 machines (n = 60,800) in 1999 to 95% of 380,000 (n = 361,000) in 2006. Subsequently, the ratio of students per Internet-enabled computer decreased from 31:1 to 4.8:1.

Despite the improvement of technology available in colleges, there have been moderate claims about the transformation that DT&RM has brought to teaching and learning. For instance, the BECTA Harnessing Technology Review (2009) reported that only 24% of practitioners used ICT to create individualised programmes for learners. Furthermore, it reported that less than a quarter of the FE colleges used a Virtual Learning Environment (VLE) to support independent learning. In addition, only 38% of colleges used technology to access education materials (18% inside and 13% outside the classroom). The National Endowment for Science, Technology and the Arts (Nesta), the UK's independent charity set up by the UK Parliament to promote innovation, estimated that in the last three years in England, the educational sector spent over £1 billion on technology, with little evidence of improvement in the teaching and learning experience and educational outcomes (Luckin et al., 2012). Since the existence of the discrepancy between investment in and use

of ICT has been obscuring our understanding of the processes related to the adoption of technology in education right from the beginning, the central question to be asked is, why is DT not being used to its full potential in the education sector?

Technological and media related innovations are not new; we have seen the rise of film (1910s–1940s), radio (1920s–1940s), and television (1950s–1980s), but none of these technologies has radically transformed education (Buckingham, 2005; Cuban, 1986; Harwood & Asal, 2007; Selwyn, 2011). While they undoubtedly did contribute to education as technological aids, they still did not significantly change the way that teachers teach and students learn. According to Cuban (1986), a well-known critic of technology in education who examined it from a historical perspective, technology's failure to achieve a transformation of teaching and learning could be perceived in terms of simple deductive logic: previous technologies have failed; so, as ICT is a form of technology, it will also fail.

In contrast, some authors have viewed the new technology in a completely different light, looking at successful adoption of DT in education from a different perspective. If teachers and educational institutions are failing to adopt the new technology, the new generation of digitally savvy students are certainly not. By the beginning of the 1980s, just a few years after my art teacher's remarks, I was playing the first computer video game on a ZX Spectrum, one of the earliest commercial home computers. This marked a new era in which DT shaped the social and cognitive development of an entire generation born in the 1980s; later, cohorts coined the terms 'digital natives' (Prensky, 2001a & 2001b), the 'N-Generation' (Tapscott, 1998), 'cyberkids' (Holloways & Valentine, 2003), 'the digital generation' (Buckingham, 2005), 'Homo Zappiens' (Veen & Vrakking, 2006), 'the Net generation' (Oblinger & Oblinger, 2005), and 'Generation Y' (McCrindle, 2006), among other terms.

Since then, children and youngsters have embraced DT&RM with great enthusiasm, responding to systems that they can personalise and manage themselves. For example, the latest 10th Ofcom report Children and Parents: Media Use and Attitudes claims that children aged 8-15 are spending online more than double time online as they did a decade ago, reaching over 15 hours each week in 2015 (Ofcom, 2015). This new, interactive technology enables children to be in constant contact with their friends; to explore and express their identities and creative ideas; to explore the world of information at their fingertips; and to facilitate mobility and independence (boyd [sic], 2014; Montgomery, 2007). Since the cost of DT&RM has fallen sharply and it has become more user-friendly, it is now an integral part of the daily social and cultural fabric of learning, play, and social communication (Buckingham, 2008). As such, it has become a way of life for the first generation of the young that have ever mastered tools essential to society before the older generation (Jukes et al., 2010). With their unique digital learning style, this new generation demands not to be lectured; prefers experiential learning with immediate feedback; wants to co-operate with other peers; make decisions; work at high speed and enjoy multi-tasking; have control of their own education in their own time; and use digital tools for learning (Dede, 2005; Oblinger & Oblinger, 2005; Prensky, 2011; Tapscott, 2009; Veen & Vrakking, 2006).

Faced with teachers and educational institutions set in old-fashioned practices of teaching and learning, students born later than the 1980s — those who grew up or are growing up surrounded by far more DT&RM than any member of the older generation — "[were] no longer the people our education system was designed to teach" (Prensky, 2001a, p.1). This empowering description of digital natives is routinely recycled in popular political debates and policy materials in order to justify the quick embrace of DT&RM as a force to be applied to the radical transformation of education (Selwyn, 2009), something that my art teacher could only dream about 30 years ago. As a result, we have seen DT&RM become

common in the landscape of modern classrooms. Yet, while in the last decade DT&RM has become a familiar addition to many classroom interiors, educational institutions have been slow in absorbing the innovative use of DT&RM to transform teaching and learning (Conole et al., 2006; Crowne, 2009; Cuban, 2001; Dede, 2005; Godwin-Jones, 2015; Kolo & Breiter, 2009; Luckin et al., 2012; Papert, 1992; Walker & Shepard, 2011). For Prensky (2001a), this is not a surprise, since the new generation of "native speakers" is in the company of "digital immigrant instructors, who speak an outdated language (that of the pre-digital age)," and who consequently "are struggling to teach a population that speaks an entirely new language" (p. 2). Although popular, as a part of public and political debate, the concept of digital natives/digital immigrants, introduced by Prensky (2001a), has been contested and dismissed, as often challenged for having very little empirical evidence to support those claims. A number of academic researchers have questioned the validity of the model (Bennet at al., 2008; Buckingham, 2009; Helsper et al., 2009; Kennedy, at al., 2008; Livingstone, 2009; VanSlyke, 2003).

However, the accusation that teachers are slow to adapt to the digital revolution in education and, therefore, are responsible for not delivering the desired results often come from compelling sources. Luckin et al., (2012) in their Nesta 2012 report suggest that radical improvement of the UK educational sector has been hindered by teachers struggling to use technology to its full potential for teaching and learning. In his opening speech during the Harnessing Technology: Building on Success national conference in 2009, the chief executive of BECTA, Stephen Crowne stated that only "25 percent of teachers currently use technology to support learning in a broad range of ways". In the study related to teachers' perceptions of technology, Mundy et al. (2012) examined (n = 2,125) teachers' perception of technology use. They claim that teachers lack the proficiency to take advantage of DT in

the classroom experience. Michelle Selinger, Cisco's (a multinational corporation for network equipment) executive advisor on education in Europe indicated:

> Teachers and schools are not aware of the tools the kids use - ranging from Bebo to Second Life, Wikis and blogs - and view them as distractions rather than enablers. Their attitude is to leave them outside the school gates. Because they don't use the technology themselves, they are not confident about technology (as cited in Kennedy, 2007).

Indeed, many teachers are not successfully integrating technology for learning (Walker & Shepard, 2011) and are still not prepared to use ICT (Kolo & Breiter, 2009), as they have difficulties in understanding fully the potential of digital media (Cavalli et al., 2009). Even those teachers who have had formal training, despite well-equipped schools and active encouragement of different government agencies and educational organisations, still demonstrate inadequate integration of technology in their practices (Godwin-Jones, 2015).

Compared to the old analogue technology, DT has changed the form of users' participation in the communication process. It has enabled participants not only to be at the receiving end of the communication process, but also to become powerful and relatively liberated producers in their own right. This undoubtedly has brought new opportunities in education for innovative ways of teaching and learning, engaging politicians and education policymakers to support the potential of DT&RM. In his speech delivered at the BETT 2014 show on 24th of January at the ExCeL centre in London, skills and enterprise minister Matthew Hancock MP announcing the creation of ETAG commented:

> Education technology has immense potential. Used properly - seen as neither a solve-all solution, nor as something to be rejected out of hand - it can raise standards. And most important of all, it can help elevate teaching to the status it deserves. A high-end profession, that focuses on what really matters: the honest, human work of inspiring, leading - and educating - our children (Hancock, 2014a).

The problem statement

Over the last few decades, we have witnessed the unprecedented development of new technology that has grown exponentially affecting every part of our modern world (Kurzweil, 2005). Digital technology opened up endless opportunities speeding up development of every aspect of human progress with potential to change us Homo sapiens for good (Kelly, 2010). As new technology entered the education field with promising results to revolutionise education (Papert, 1992) and to embrace progress, the UK government channelled significant financial recourses to integrate DT&RM into classroom practice with a belief it will resolve all educational and economic problems in the country (Younie & Leask, 2013).

This rationale for integrating DT&RM into educational practice was further reinforced by the evidence that for the first time in the history, young people are those who, before their parents and teachers, embraced technology as part of their identities and youth culture (boyd, 2014; Buckingham, 2008; Ito et al., 2010; Montgomery; 2007; Negroponte, 1995). However, reality has not been up to the promise in terms of the radical transformation of education. There have been suggestions that digital revolution is very slowly affecting educational institutions and not delivering the promise of transforming education and advancing knowledge economy, in spite of significant investments in ICT infrastructure (Younie & Leask, 2013). To illuminate the problem, the varieties of notions have emerged expressing a range of associations with the digital divide, and digital natives' theory, pointing to the digital divide between the new generation of technology-savvy students and teachers who are failing to change their teaching approach to accommodate those new learning behaviors. In the paper Digital Natives, Digital Immigrants, which became the landmark in the argument of a generational divide between students and their teachers and the need for digital transformation of education, Prensky (2001a; 2001b) drew attention to

the development of the new generation of students with innate aptitudes towards digital technology.

Although many of the claims that technology has produced a new generation of digitally superior students (Howe & Strauss, 2000; Jukes et al., 2010; Oblinger & Oblinger, 2005; Prensky, 2001a, 2001b; Tapscott, 1998, 2009) and can generate immediate and desired results in education may be compelling, they should be treated with caution. Initially, studies related to the problem of digital inequalities between students and teachers have conceptualised the issue as a 'generation gap' (Warschauer, 2007), the type of digital divide based on an idea of an 'environment infused generation' (Jones, 2011, p. 31) of young people whose brains are more developed by the use of DT&RM than their teachers. However, founded on age as the primary condition of adopters (Howe & Strauss, 2000; Jukes et al., 2010; Oblinger & Oblinger, 2005; Prensky, 2001a, 2001b; Tapscott, 1998, 2009) those studies — often centred around speculative and anecdotal evidence built upon a common-sense belief (Bennett et. al., 2008) — did not produce evidence that would confirm the existence of a digitally superior generation of young people.

On the contrary, evidence has emerged that the digital divide between students and staff is not as large as suggested (Kennedy et al., 2008) and that not all members of the alleged digital generation are assertive users of new technologies (Corrin et al., 2010; Green & Hannon, 2007; Kennedy et al., 2007; Kvavik, 2005). In addition, there is evidence that digital natives lack abilities and skills to navigate the difficult and dangerous world of information available through DT&RM (Livingstone, 2009; VanSlyke, 2003) and that they are not aware of online safety issues (Hargittai, 2008; Palfrey & Gasser, 2008). There is also evidence that they are not skilled to judge the quality of the information they access (Kennedy & Judd, 2011; Livingstone, 2009; Taylor, 2012; VanSlyke, 2003) and are limited users of interactive and collaborative Web 2.0 technology (Corrin et al., 2010; Kennedy et

al., 2007; Margaryan & Littlejohn, 2008). Other research indicated the potential danger of a younger generation being affected by the rapid increase of DT&RM, causing possible addiction, stress, depression, cyber bullying, and damage to their cognitive development (Car, 2010; Palfrey & Gasser, 2008; Small & Vorgan, 2009; Strasburger, 2006; Strasburger et al., 2012; Takahashi, 2011). Therefore, some authors argue that assertion about the existence of digital natives/immigrants as digitally separated homogeneous groups determined by age is dangerous and misleading. Based on the lack of a rigorous and transparent empirical foundation, they argue that it exaggerates the differences between the alleged groups and understates the diversity within them (Bennett & Maton, 2010; Buckingham, 2009; Bullen & Morgan, 2011; Krause, 2007).

On the other hand, although the arguments about generational differences between digitally superior students and inferior teachers have never been strong and lack empirical evidence, Sheely (2008) suggests that they are not necessarily inaccurate. He argues that although flawed, metaphors of digital natives and digital immigrants have become social constructs that are generally accepted and widely used and talked about in public discourse without reference to Prensky. Once an idea no longer has a point of origin and takes on a timeless quality, it simply becomes an accepted fact. Therefore, no matter that the age-related digital divide has been undermined by the lack of empirical evidence, it points towards the fact that young people are more tech savvy (Bennett & Maton, 2010; Ofcom, 2012); that DT&RM are becoming increasingly embedded in young people's everyday lives (Jukes et al., 2010; Takahashi, 2011); that we live in a unique historical moment witnessing the rapid adoption of digital media production and social media among young people (Ito et al., 2010); and that DT&RM play an important part in the lives of young people and their identities (boyd, 2014; Buckingham, 2008; Ito et al., 2010).

In an attempt to explain how constructs such as digital natives and digital immigrants can become treated as fact in both academic and public discourse despite the lack of compelling evidence, Jones (2011) compares the notion of digital natives and digital immigrants to the pseudo-science of phrenology, which tried to develop a typology of human character and personality traits based on the measurements of individuals' skulls and the shape of their heads. Although flawed, argues Jones (2011), phrenology did point to the idea that different parts of the brain perform different functions. In the same way "Digital Phrenology" (p. 41), with its digital natives/immigrants arguments, "drew attention to the way new technologies are changing young people's behaviour, not in generational ways, but in ways that are significant and require careful observation and assessment" (p. 43).

This means that in the light of the slow integration of DT&RM into teaching and learning in spite of significant investment in the last two decades, we must keep students' and teachers' relationships with DT at the forefront of our conversation about the future of digital learning. However, we must move away from the model of a generational divide between students and teachers to a model that will consider the adoption of technology by exploring the meaning of students' and teachers' relationship with technology. Accordingly, instead of limiting this research by asking questions about the utilisation and possession of DT&RM, this study approaches the enquiry with the belief that technology not only includes technical devices, practices, and knowledge but also the social arrangements formed around those technologies (Lievrouw, 2008), as well as "personal values and individual experience of technology from shared, social meaning" (Pacey, 1999, p. 7). That is to say, the use of technology in everyday situations is different from its use in education and, therefore, in order to identify potential technological gaps between students and teachers, this study will look at the meaning participants attach to DT in teaching and learning educational practices. More specifically, in order to look more closely at the issue, this study attempts to answer

the following principal research question: In what ways do students and teachers differ in how they relate to digital technology in the context of teaching and learning practices? In order to understand the use of technology in education, it is important to challenge assumptions about the generational digital divide between students and teachers and to explore how students and teachers relate to and interact with technology, what technology means to them, and how they embrace all educational possibilities technology offers to them.

Overview of methodology

The research for this study was conducted as part of a Doctor of Education (EdD) study between 2008 and 2013 at an FE college in South East England, where I work as a teacher and media curriculum manager. Taking into account the complexity of the phenomenon as well as my role as an inside researcher, I employed the sequential mixed methods design for data collection (Creswell, 2009; Creswell & Plano Clark, 2011). Combining different types of data acquired by undertaking diverse research activities (Denscombe, 2008) enabled me to produce a more comprehensive description of the research findings.

This study is grounded in the belief that educational reality is socially constructed, where students' and teachers' relationships with technology are constructed by social processes rather than, as some current theories suggest, determined by the technology. This means that we cannot separate the use of technology from the meanings and purposes humans attach to technology and their activities in a particular social and cultural situation, such as education (Guba & Lincoln, 1994). Therefore, in my research, I identified the relationship students and teachers have with DT&RM as a dynamic process influenced by their motivation, and the experiences they are going through in pursuing and achieving specific goals. By looking at how students and teachers integrate particular technology into their practices, I intend to reveal the complexity of the relationships they have with DT&RM.

To identify similarities and differences in how students and teachers relate to DT&RM, three research questions were addressed:

1. What are the distinctions, if any, between how students and teachers use, perceive, and experience DT&RM in their everyday lives and daily educational practices?

2. What are the factors that motivate students and teachers to use DT&RM in their teaching and learning practices?

3. How do students and teachers negotiate their digital relationships with technology; and what kinds of technical requirements, solutions, and moral conflicts emerge as a result of the negotiation?

Professional significance of the study

With the aim of gaining a better understanding of how students and teachers relate to technology in their practices, this study seeks to develop an original research model that will shift the focus of enquiry from the volume of use to the meaning of the relationships that students and teachers have with technological devices and practices. With this objective, the study aspires to contribute to a more pluralistic understanding of students' and teachers' digital traits by comparing and contrasting viewpoints of how students and teachers, as the main actors of an educational endeavour, experience, perceive and relate to the technology. With this approach, the study hopes to produce a more accurate picture of what is going on in educational practice; to help colleges and educators to better manage students' and teachers' technical expectations in the teaching and learning context, and to promote DT&RM in education in the future.

Given the fact that the Treasury under Labour 1997-2010 have invested £5 billion in technology for education (Younie & Leask, 2013), often driven by the debate on digital

natives/immigrants (Bennett & Maton, 2010), and that the argument about digital natives "persists in a popular discourse which is replicated in policy and practitioner literature" (Jones et al., 2010, p. 726), this study seeks a more careful and critical understanding of the digital natives'/immigrants' discourses.

Furthermore, in a direct practice-based sense, the findings from this study invite the community of FE colleges to make empirically-based decisions about investments in digital technology that embrace students' and teachers' perspectives and preferences. This would lead to an implementation and development of DT&RM in the FE sector that will be more meaningful and accessible to students and staff for technology-based teaching and learning.

Limitations of the study

This study was limited to an FE college in South East England. It is a mid-sized college with around 5,000-6,000 full-time students and 400 employees. As data for this study was collected from participants who all worked or studied at the same college, this could limit full generalisation of the findings so they may or may not be applicable to other educational settings, geographic areas, or programmes of study outside the sample of the population studied.

The other noteworthy limitations of this study are my role as an insider research, difficulty in obtaining cooperation from the institution, and sampling strategies. These limitations were considered when designing the research and steps were taken throughout the research process to minimise limitations. This is discussed in further details later in the Methodology chapter.

Organisation of the study

The first chapter of the dissertation provided an introduction to the study and the main ideas of the research topic. The second chapter provides a review of the literature relevant to the subject of the study. The third chapter describes the methodology and research design, methods used to study the research problem, what was learned from the pilot study, reflection on my role of being an 'insider' researcher, ethical considerations, and limitations. The fourth chapter reports and analyses the data and results from the field work. The final chapter discusses the research results, provides the study's key findings, conclusion, and recommendations for further research.

CHAPTER TWO

LITERATURE REVIEW

In this chapter, I will review the literature related to the digital differences between students and teachers and use of DT&RM in teaching and learning practices. The initial section looks into the origins and construction of the digital natives/immigrants metaphor as the digital generational divide model, and its use in rationalising educational reforms as a means to accommodate the needs of a generation of digital learners. Furthermore, it elaborates on the digital native/immigrant concepts by looking at the range of literature and examining the empirical evidence, as well as some alternative ideas. As many models of generational divides are closely related to each other, for purposes of this study, I used the popular metaphor of digital natives/immigrants, first introduced by Prensky (2001a), as the common semantic foundation and the key terms for further enquiry. Also, I examine literature relevant to use of DT&RM in teaching and learning looking at different forms of technology and its effective use in FE context. However, during the literature search phase of this study, a wider range of keywords related to proposed metaphors was used, including 'digital divide', 'generational divide', 'digital generation', 'net generation', 'digital teaching and learning', 'adoption of technology', and 'diffusion of technology'.

Origin of the Idea: Singularity

The digital revolution in education: 'The point of no return'?

Recognising the capacity of DT to influence the way we learn and behave, literature and policymakers see technology as the driving force of the effective reformation of education. This belief suggests that DT will not only provide the skills for the twenty-first-century knowledge economy, but also improve all levels of educational provision,

experience, and management (BECTA 2008b; Collie & Lewis, 2011). The need for the transformation of how we teach and learn has also been justified by the existence of a new generation of students born and surrounded by a digital environment whose needs are not met by current 'outdated' educational practices. In one of the most influential papers, Digital Natives, Digital Immigrants, Prensky (2001a) argues that today's students are superior to their teachers in how they use technology. This has been so significant that it has resulted in a shift in education: "one might even call it a 'singularity' – an event which changes things so fundamentally that there is absolutely no going back" (Prensky, 2001a, p. 1).

To review the literature on digital natives and digital immigrants and understand the origins of this metaphor, I begin by evaluating singularity. A term used by some other authors such as Vinge (1993) and Kurzweil (2005), and not only Prensky, to express the impact of technology on human evolution, singularity embodies an influential paradigm in our understanding of the relationship between technology and humans. Borrowed from physics, singularity defines the point at which the distortion of space and time by gravity becomes so infinitely powerful that the laws of physics break down; and matter, once it crosses the event horizon, can never escape (Hawking, 1988). Therefore, it is not surprising that Vinge (1993), in his futuristic prediction of ultra-intelligent machines taking over mankind, used singularity as a powerful analogy to emphasise an event where the accelerating progress of technology reaches a point beyond which humanity, as we know it, will not be able to continue. Kurzweil (2005), the renowned inventor, transformed Vinge's speculation about singularity as an event in the future into a scientific fact. Using the well-known Moore's Law, which states that computer power doubles every 18 to 24 months, Kurzweil came up with 'the law of accelerating returns'. He suggests the next phase in the evolution of technology will be the 'double exponential' rate, where the rate of exponential growth itself grows exponentially. Confident in his belief, Kurzweil predicts that the

singularity will occur around the year 2045, when artificial intelligence (AI) will surpass human intelligence, rendering 'biological' humans obsolete. Influenced by Kurzweil, Kelly (2010) went as far as to personify technology. For Kelly, technology is alive and "has its own wants" (p. 15); it has its "own agenda"; "it is selfish" (p. 198) and independent from humans. According to Kelly, we humans are just "the reproductive organs of technology" (p. 296), as technology is born from human existence. He also uses the idea of singularity not as a metaphor, but as the actual birth point of technology: 'technium'. Therefore, the technium is born from the big bang and has its origin in the same physical and chemical laws that were responsible for the origin of life. With the confidence that digital technologies have had a tremendous impact on large parts of our social and physical life and belief in the last decade, the UK government is also certain of deterministic powers of digital technology, and in the Building Britain's Future plan for Digital Britain does not hesitate to use big bang (an idiom often used as a synonym for singularity) as a metaphor to articulate a new era. "We are on the verge of a 'big bang' in the communications industry that will provide the UK with enormous economic and industrial opportunities" (BIS, 2009, p. 4).

However, seemingly logical and backed up by mathematical, physical and evolutionary laws, the proposed idea of the singularity, as an inevitable precise point in humankind's future, is to a great extent speculative and involves a high level of abstraction. Even the authors mentioned above are not completely clear about it. While Kurzweil (2005) uses his law of accelerating returns to predict a date for the singularity with extreme precision in 2045, Vinge (1993) appreciates that the singularity will probably not happen at all. Kelly (2010) goes as far as to state that technium is already here, claiming "we can see more of God in a cell phone than in a tree frog" (p. 358). Even though those futurist predictions are very much hypothetical, all the authors' theories share a common aspect: the singularity will occur when machines become more intelligent than humans. This so-called super-humanity,

concludes Vinge (1993), is "the essence of the Singularity" (p. 2). Therefore, Kurzweil (2005) speculates about singularity through the concept of non-biological androids which will take over humankind in the same way as Kelly (2010) believes that we humans are just an intermediary in the evolution of the universe, which is waiting to be filled with the technium as the next phase of universal life in which humanoids will call themselves "the children of God" (p. 358). Considering technology's divine attributes, Kelly concludes that technology should no longer be a noun, for technology is "not a thing but a verb" (p. 41).

This etymological proposal sums up the concept of technology as an unstoppable force that has important evolutionary, social, and cultural impacts on our universe and expresses the deterministic perspective common to many authors who believe in the existence of the generational digital divide between students and teachers.

Digital Natives

Technology is changing the brains of our children – The medium is the message

While we are waiting for the above-mentioned celestial predictions to happen, Prensky (2001a, 2001b) believes that 'the children of God' are already around us. The digital generation of young people – digital natives – are spending their formative years using DT&RM, which may already be changing their brains (Prensky, 2001a; 2001b). As a result, he suggests that we are beginning to observe a significant shift in their attitudes and behaviours. Therefore, for Prensky (2001a), a singularity is already happening. Driven by the needs of digital natives, he claims that the traditional ways of education are collapsing with the birth of new and powerful forces that are steering education beyond the traditional pedagogical values and practices. Without any fieldwork to give credibility to his theory, Prensky (2001b) turns to the science of neurobiology and research on the neuroplasticity of the human brain. As the brain is being continuously remodelled throughout our lives by new

stimuli and experiences, the brains of young people who have grown up with DT&RM potentially develop differently from those of their teachers, who grew up in a different environment.

This argument also relates strongly to an idea from the 1960s that was proposed by distinguished Canadian communication theorist Marshall McLuhan. Convinced by observations that "the effects of technology do not occur at the level of opinions or concepts, but alter sense ratios or patterns of perception steadily and without any resistance" (McLuhan, 1964, p. 33), McLuhan produced his classic work Understanding Media: The Extension of Man, in which he came up with the famous metaphor, "The medium is the message" (p. 23). In the same way as Prensky and previously mentioned authors, McLuhan (1963, 1964) sees technology as a deterministic force that shapes human development. Every tool extends our bodies, senses, and minds, and the change in tools throughout human history has directly altered our way of organising our experiences, determining not what we think but how we think (McLuhan, 1963, 1964). In this way, following McLuhan's argument, the alphabet extended our eyes, transforming tribal man from an oral community member into a literate, visual individual. Now, the new electronic media is changing the industrial man into a digital man.

There is no doubt that in the interaction with DT&RM, we are changing the way we develop, learn, and behave. However, does this mean, as Prensky (2001b) suggests, that the brains of the new generation of students are "physically different" at some biological level from their teachers who did not grow up surrounded by digital technologies? If we look at recent neuroscience studies to answer this question, we will find that although there is empirical support for the claim that the use of DT&RM can improve cognitive skills, evidence that those of youngsters are changing is lacking. A study done by University of California, Los Angeles (UCLA), which used magnetic resonance imaging (MRI) to

measure the brain's neural pathways among volunteer participants in their mid-50s and 60s, claims that any cognitive training can have an instant, favourable effect on people and their ability to complete a given task at any age (Small et al., 2009). Based on transparent empirical evidence of brain functions when exposed to technology, we can conclude that contrary to Prensky's claims, the effect DT&RM have on humans is not something exclusive to the younger generation born surrounded by DT.

However, while there has been no credible evidence that the structure of the brains of young people exposed to DT&RM from birth has radically changed, there has been a strong notion of calling for radical transformation of how we teach and learn to meet the needs and demands of the generation of digital natives (Dede, 2005; Jukes et al., 2010; Oblinger & Oblinger, 2005; Prensky, 2011; Tapscott, 2009; Tapscott & Williams, 2010; Veen & Vrakking, 2006; Warschauer, 2007). This argument, articulated in Prensky's (2001a) assertion that teachers (digital immigrants) "speak an outdated language (that of the pre-digital age)" (p. 2), and therefore, are struggling to teach their students (digital natives) who speak "an entirely new language" (p. 2), has quickly caught our imagination. As such, the terms digital natives and digital immigrants are today widely used to indicate digital inequality between two opposing groups with different generational characteristics. This argument has often been used as reasoning in which the current system of education must change to accommodate the needs of the new digital generation of students (Tapscott & Williams, 2010; Veen & Vrakking, 2006).

Digital natives: The next 'great' generation

The romantic perception of young people born after the 1980s being a generation superior to their parents and teachers can be traced to Neil Howe and William Strauss, two of the most often cited authors on issues concerning generational differences. Howe and Strauss (2000) identify the generation born between 1982 and 2002 as New Millennials, with

notably different generational characteristics than their Baby Boomer parents. They describe the New Millennials as educationally, ethically, and materialistically superior, focused on issues of community and politics, and as such, capable of changing the world. Though this was relatively a small sample (n = 860) cohort study limited to teachers from only two schools in one part of America, Howe and Strauss used findings from their study to brand an entire generation as "the next great generation". Prensky (2001a, 2001b) embraced Howe and Strauss' argument about an exceptional generation, credited DT for its unique characteristics, and named its population 'the digital natives'. Although Prensky's (2001a) paper Digital Natives, Digital Immigrants has often been cited and is considered to be the conceptual framework for the notion of the digital divide, the groundwork for the digital natives/immigrants concept had been laid by several authors before Prensky. Papert (1996), one of the early pioneers in experimenting with the use of digital technology to enhance learning, introduced the concept of "the new computer generation" (p. 1) and the role of computers in their lives. In the same year, Barlow (1996) wrote A Declaration of the Independence of Cyberspace, in which he coined the use of the well-known metaphor of digital natives/immigrants, warning us against being "terrified of your own children, since they are natives in a world where you will always be immigrants" (p. 1). Concurrently, Papert's close colleague Negroponte (1996) observed the generational split between the younger and older generations as being a matter of difference between analogue and digital technologies, concluding that today is a new time of 'digital revolution', where the dominant force of change in not social or economic but generational.

Following Negroponte's suggestion of the profound impact, the new digital generation of young people will have on society, Don Tapscott, a Canadian business executive, advisor on the application of technology and a specialist in business strategy, examined the existence of the new digital generation he named the Net Generation (Net-

Gen). In the same fashion as Negroponte (1996), using the analogy of analogue versus digital technology, Tapscott (1998) claims that digital students process information and learn differently from their analogue teachers. He compares traditional teacher-centred learning with analogue (broadcast) technology, and student-centred learning to the new interactive digital (bitcast) technology (see Figure 1).

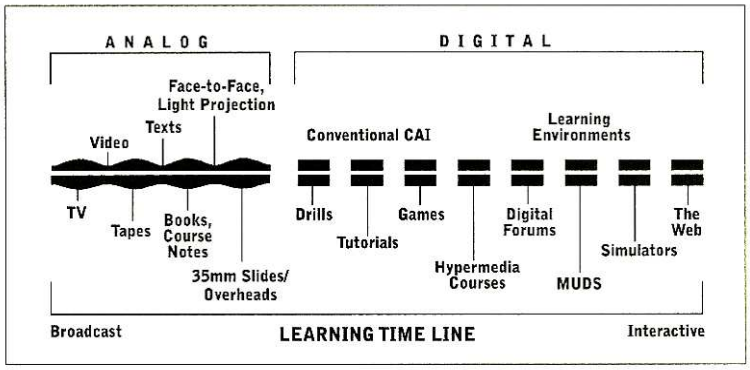


Figure 1: The technology of learning (Tapscott, 1998, p. 139)

Equally, as broadcasting media is hierarchical, authoritarian, and producer-orientated, broadcast learning is teacher-centred. In this pedagogical model in which teachers transmit the information, all students have to do is to 'tune in' to receive the information and store it in an active, working memory, which is later measured by testing. In contrast, interactive learning is student-centred. Teachers are facilitators rather than broadcasters of knowledge; with their support, the Net-Gens are able to access information by collaborating, researching, and evaluating new knowledge over the Internet (Tapscott, 1998) (see Figure 2).

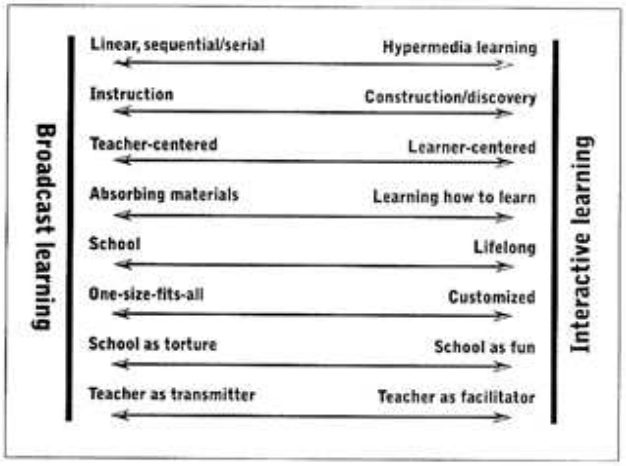


Figure 2: The shift from broadcast to interactive learning
(Tapscott, 1998, p. 143)

Tapscott and Williams (2010) see this inevitable shift of the pedagogical model as the result of "a huge generational clash" (p. 29) between students who demand new pedagogy and teachers stuck in the old industrial model of education. In a later work, Tapscott (2009) is so convinced of the existence of the new generation that he is prepared to present a precise chronological evolution for the generation he earlier defined as the Net Generation. According to Tapscott, those born between January 1977 and December 1997 are "the smartest generation ever" (p. 30). However, based on data of thousands of children and adults using online forums, electronic mails, and computer conferencing all over the globe, Tapscott's arguments were built on research with a moderate degree of generalisation. Founded on claims informed by privately-funded research stemming from self-reported data, rather than behavioural observations, his study does not explicitly describe the method of sampling and biases participants who already had Internet connections and were willing to take part in the research.

The idea of a digital generation was also supported by the group of authors associated with EDUCAUSE, a non-profit organisation with the mission of promoting and advancing the application of IT in HE. Conducting a more methodologically robust research by

sampling a more diverse group and collecting several data types, this group of authors offered a broad description of the Net Generation. In their findings, which have been compiled in an online book entitled Educating the Net Generation, Oblinger and Oblinger (2005) suggest that the generation born after 1980 have specific personal characteristics and behaviours, such as multitasking, social connectivity, a need for immediate feedback, and preferences for experiential learning. While the authors acknowledge the possibility that the emergence of this particular group of students could be a generational (if not technological) phenomenon, they are clear in their claim that "technology has changed the Net Generation, just as it is now changing higher education" (p. 2.16).

Further contributors to the same volume, Roberts (2005), as well as Clayton-Pedersen and O'Neill (2005), who refer to themselves as members of the Net Generation, suggest the failure of colleges and universities to keep up with the rapid change of the technological landscape. To overcome this problem, teachers have to adjust their pedagogical model to suit the new kind of learner. From their own research, Clayton-Pedersen and O'Neill (2005) report that what all teachers do with new technologies is convert their teaching notes into PowerPoint slides, referring to it as "death by PowerPoint" (p. 9.1). Similarly, Roberts (2005) claims that the Net Generation is willing to use technology to support their learning as soon as teachers have enough knowledge and technical and pedagogical skills to be able to operate it properly. The idea of a unique learning style of a digital generation was endorsed by Dede (2005), another EDUCAUSE author who accepts the idea of singularity and the deterministic role of technology. He believes that the learning style of a new generation of students is nonlinear — unlike the old-fashioned use of a textbook — and comes as a direct result of multiple uses of DT&RM. Contrary to this, however, in the same volume by Oblinger and Oblinger (2005), Kvavik (2005) opposes the claims of his editors and colleagues. From a larger study of college students (n = 4,374) from

13 institutions across the United States, he suggests that the description of the Net Generation is over-simplified, as they are not as digital as claimed by his colleagues. Irrespective of the role of technology in their lives, there exist differences among individuals' preferences in learning styles. He concluded that students prefer the moderate use of technology in teaching.

With the mission to provide recommendations for educational institutions and policymakers that are "utterly confused about what to do", Palfrey and Gasser (2008, p. 238) confirmed the existence of digital natives and a gap between them and their parents and teachers. While describing the population of digital young people in line with claims similar to previous authors, Palfrey and Gasser are not comfortable with the use of the term generation. Instead, they propose the use of population as a term, suggesting digital diversity within digital natives. The authors claimed to have collected the data internationally, as part of the Digital Natives project, in collaboration with the Berkman Center for Internet and Society at Harvard University and the Research Center for Information Law at the University of St. Gallen in Switzerland. However, they provided limited information about their methodology, basing their findings on focus groups and interviews with 69 students from the Boston area, and claiming that they did not aim to make large-scale, general statements (Palfrey et al., 2009). Although this makes their argument tentative, the authors observed digital differences among the generation of young people, questioning the myth of a digital generation. They are also uncomfortable with the notion of a digital natives/immigrants division, believing it to be too bipolar and exclusive, so they suggested the third category of digital settlers. In a similar way, Herring (2008) criticises the notion of a generational divide as too general, divisive, and therefore, erroneous, suggesting that adults influence the larger digital landscape, and create, regulate, and profit from digital media and financially control young people's access to digital technologies.

Realising the limitations of the digital natives/immigrants model, there were some authors who tried to overcome its stereotypes. Toledo (2007) is concerned with the digital gap between students and their teachers but insists that teachers are not part of the problem. Just as we have students who do not engage with technology, we have teachers who have ambitions to explore and experiment with technology. To identify this group of teachers, the author suggests the metaphor of 'digital tourists'. Just like tourists, this group of teachers embrace the new digital culture only to function in the new place that they visit, and always at the end of the journey, return to their own culture where they feel most comfortable. Realising that digital competency is not exclusively related to age, eight years later after he introduced digital natives/immigrants, Prensky (2009) proposed 'digital wisdom' as a new metaphor that is not limited to a particular generation but rather encompasses all those who embrace digital technology as a powerful tool to enhance their minds.

Even though through proposing digital wisdom as a new metaphor Prensky acknowledged that since he wrote his well-known paper in 2001 the distinction between digital natives and digital immigrants became less relevant, he still believes that digital technologies give power to our mental capabilities by increasing access to a vast amount of information and turning us into digitally enhanced people he refers to as 'homo sapiens digital' (Prensky, 2009). As information, no matter what, does not equal knowledge acquisition, and someone's ability to access information does not immediately generate judgements or engage people in processes of evaluation, Prensky's argument is still articulating technology as an independent force that drives human development. As the process of learning is founded on the social interaction between teachers and students rather than technology, Stoerger (2009) suggests a new metaphor 'the digital melting pot' with the aim of integrating students and teachers rather than confirming their separation, and she

identifies education and educational institutions as the major players in assimilation processes.

Digital Immigrants

Teachers: Digital immigrants or digital outlaws?

The form of technological determinism in which DT&RM have created the new generation of young people led some authors to call for removing teachers from the stage in the digital classroom. In his call for radical technological transformation of learning, Prensky (2001a) added teachers into his model as the distinctively opposed group of digital immigrants whose "lack of imagination" makes them unprepared to change their "lazy" practice, therefore rendering them "ineffective" (2001a, p. 6) to meet the learning needs of the digital natives. Jukes et al. (2010) warn us that the digital gap between teachers and students "is really more like a huge gulf" (p. 29). They believe that many teachers do not have a real understanding of DT. According to authors, even young teachers who belong to the generation of digital natives have difficulties with DT as they are spending too much time in institutions that are still using digital technology as a second language. This digital gap between teachers and students is so alarming according to Jukes et al. that it will lead to an educational tragedy. In quite a dramatic style, the authors blame teachers for the use of old-fashioned didactic, linear teaching methods, for which new digital learners do not have the patience. As a result of this reality, Jukes et al. (2010) suggest "teachers must move off the stage" (p. 79), advocating active engagement of students, and talking about teachers' authority in the past tense, advising that "you may remember when your teachers were authorities to be respected" (p. 11). Prensky (2011) adopts this statement as a fait accompli and calls for a re-establishment of mutual respect between students and teachers. According to him, teachers have lost the respect of their students due to being technologically illiterate. Contrary to this, however, Prensky does not give any suggestions for students on how to

respect teachers, but instead, recommends large signs in the classroom which would say, "We are all learners, we are all teachers" (p. 18), and ask the teachers to let students teach them. In this new digital vision, education is seen as a genuinely democratic and self-deterministic system where teachers will not be in the role of the authority but rather facilitators of the system governed by students' needs and desires. In this vision, the old form of educational control will be unnecessary as students will be connected into self-regulating networks of learning individuals that will attain and share knowledge without the central control of teachers. This cybernetic idea of a self-regulating education system is parallel to the liberal ideas of self-governing educational institutions, which should embrace the principles of market economy and be regulated by supply and demand.

The relationship between teachers and students has been always a central component of education, and Selwyn (2011) suggests that the use of digital technology in teaching and learning practice has necessitated changes in this relationship and introduced a discussion about the role of the teachers within it. He observes how on the one side of this debate there has been the conviction that technology will put teachers out of work, while the other side of the argument is that technology will not replace teachers but rather support them to provide a better education for the twenty-first-century student.

Let us start with Selwyn's (2011) argument that technology will support teachers to provide a more effective, diverse, and collaborative teaching experience, reduce the cost of education (UNESCO, 2011), and create knowledge in a dynamic and non-linear way (Roe, 2007). Frick (1991) believes that throughout history, technology has transformed education several times. Every time a new technology is invented — starting with spoken and written language, the inventions of paper, the printing press, the radio, television, and then computers — it has made knowledge more accessible. Digital technology, he believes, will free teachers from being information providers and allow them to have more time to plan

sessions for the individual needs of students, allow remote teaching, and improve communication with parents. Scepticism about the positive effect of technology on the teaching profession comes from Sappey and Relf (2010). They argue that literature about technology very often takes two facts for granted: first, that all students are digital natives, and second, that all digital technology has a positive impact on teaching. They claim that with the introduction of digital technologies into education and with 24/7 online access, teachers have had to undertake new roles and embrace a range of new skills and work practices. Hence, argues Watson (2010), technology does not necessarily mean saving time and energy; it involves literacy as well as spending time to consume the information, as more powerful technology means more energy to run it. For that reason, for the effective adoption of DT&RM in education, educational institutions need not only focus on teachers' professional development in technology but also need to focus on new pedagogy, responsibilities, and teaching labour processes.

The argument about teachers being outmoded in the education process has been popular as long as computer-assisted teaching has been considered possible (Selwyn, 2011). Papert (1992), for example, writes that computers "brought psychological as well as bureaucratic risk" (p. 65) for the teaching profession. Derry (2009) warns us that the authority of teachers has been questioned in a technology-enhanced classroom, where learners are believed to 'create knowledge'. This comes from belief in a natural connection between computers and education. As both education and computers are associated with information, Resnick (2002) believes that "the two seem to make a perfect marriage" (p. 32). However, I would argue that marriage is full of challenges. Furthermore, challenges come from the epistemic definition of knowledge, driven by new technologies. Given that information and knowledge are not the same thing (Derry, 2009), by reducing knowledge to information and learning the skills to find information, Standish (2003) warns us that there

is danger in technology distorting the very idea of education. There is no doubt that technologies are enabling us to have greater access to information, but the accessibility of information does not necessarily translate into the acquisition of knowledge. However, it is not only knowledge that has changed. Some authors claim that technology changes not only the nature of knowledge but also the nature of information.

For Bugeja (2005), information in the digital age has changed from a fact to a quantifiable electronic message that can be counted, catalogued, encoded, and decoded. Postman (1985) claims that information became trivialised by the invention of electronic media to the point of dangerous nonsense, where often it turns out to be irrelevant and has nothing to do with those to whom it was addressed. To express the nature of decontextualised information, Postman uses a famous line of the English poet, Samuel Taylor Coleridge, "water, water, everywhere, nor any drop to drink" (Coleridge, 1798). Further, Livingstone (2009) questions young people's abilities to navigate in the sea of information available to them. They can access, download, and even upload information without any knowledge of its source. She argues that although important, this sea of information available over the Internet is not without the dangerous waves. On the Internet, sex, cyber-bulling, violence, crime, paedophilia, and theft of personal information and identity — however often exacerbated — do present a risk to young people. Livingstone questions the integrity of the prevalent myth of the digital native generation and suggests that children and young people, however confident with digital technologies, have fewer skills than are popularly credited to them with which to manage this technology. She also argues that teachers who struggle with the actuality that they are not anymore the only source of knowledge, have an important role to play in recognising what children and young people do not know and cannot do with digital technologies. In addition, their role is to educate them to become media literate so that they can maximise the potential of digital technology. The other perceived challenge to

the teaching profession comes from the fact that digital technologies are seen as a participatory medium which extends our senses and constructs new styles of communication, interaction, and relationships, by connecting us to the entire world which, as prophesied by McLuhan (1962, 1964), will create an integrated global community which he referred to as a "global village". This promotes the idea of digital technology becoming "the front of knowledge in society" (Fox, 2005, p. 97) where the teacher is not anymore the apparent gatekeeper of knowledge. As a result of this belief, there has been an emergence of a new theory of learning connectivism. Connectivism is a theory of personal learning based on the belief that students acquire and share knowledge by taking part in a free, collaborative network environment of Web 2.0, blogs, wikis, social networks, podcasting, file sharing, and so on (Simens, 2004).

However, the notion of digital technology as a collaborative medium is not without challenges. There are some authors who claim that digital technologies are not creating, but somewhat damaging our sense of community. Bugeja (2005) claims that DT places users in virtual environments that are inconsistent with physical ones, divide our consciousness, and diminish the senses, creating a social gap and eroding our sense of community, seeing the generational digital divide as a breakdown in interpersonal communication as technology filters interpersonal cues. Car (2010) warns us that the build-up of a number of links in hypermedia results in an increased cognitive load for our working memory, resulting in 'cognitive overload', which affects our cognitive abilities, reduces our learning abilities, and weakens our comprehension. Lanier (2010) also criticises the anonymity of the Internet, claiming that it dehumanises individuals, as communication is fragmented and anonymous people can get away with being outrageously cruel and rude to each other. Takahashi (2011) conducted a quantitative study of mobile phone use among Japanese youth. He found out that because of 24/7 connectivity and accessibility, young people have created the mobile

Internet community, which makes them "vulnerable to privacy issues and the harmful effects of cyberbullying" (p. 79). Similar messages have been sent by the UK's Parliamentary Health Select Committee (2014), warning us about the social isolation of young people, as well as dangers of violent games, cyber-bulling, and inappropriate content on the Internet and social media. Another challenge for the digital classroom comes from the idea that teachers are not anymore the apparent gatekeepers of knowledge. As effective learning emerges from the well-regulated student-teacher relationship, this relationship is based on teachers' authority to regulate their students' academic life and students' implied consent for teachers' authority (Markie, 2003). This authority is necessary for students' progress and achievement and is based on teachers having expertise in particular areas of knowledge and autonomy in taking students further than meeting the achievement standards, by promoting their ability to think for themselves and by guiding them from ignorance to knowledge.

There might be some truth in the proposed ideas of technological determinism as on a very large scale of reality, technology has undoubtedly played an important part in the history of human development. However, as much as technology shapes our world, our evolutionary development as a species has remained unchanged for the last 50,000 years. Whenever there is a struggle between modern technology and the desires of our primitive genetic heritage, primitive desires win every time. This is what Kaku (2011) calls the "caveman principle". As the caveman within us always demands "proof of the kill" (p. 13), all benefits of the high-tech virtual world will be less desirable over the real touch of the physical world. The face-to-face meeting with a teacher who can help individual students, answer questions, and support their progress is still preferable to online courses.

Other Empirical Research

In addition to the above, there has been further research aimed towards the empirical evaluation of the existence and characteristics of the new generation and its influences on education. Consequently, there exists a body of empirical research focusing on children and young people's adoption and use of DT&RM with results confirming the latter's fluency with and endorsement of the digital technology.

The 2012 study by the German Institute for Trust and Safety of the Internet (DIVSI) Trust and Safety of the Internet in Germany, with a sample of 60 qualitative in-home interviews and sample of 2,000 survey participants, confirms the existence of digital natives. It reports that 98% of all Germans who are online are under 30 years of age. They feel confident and self-assured in dealing with the Internet, which is fully integrated into their lives. "I surf, therefore I am" (DIVSI, 2012, p. 9), the principal researcher sums up about digital natives. The World Internet Project 2012 also confirmed that levels of online use are related to age. In all countries studied, the majority of participants between the ages of 18 and 24 are users of the Internet, and everywhere except Mexico, that percentage of users is over 80% (see Figure 3).

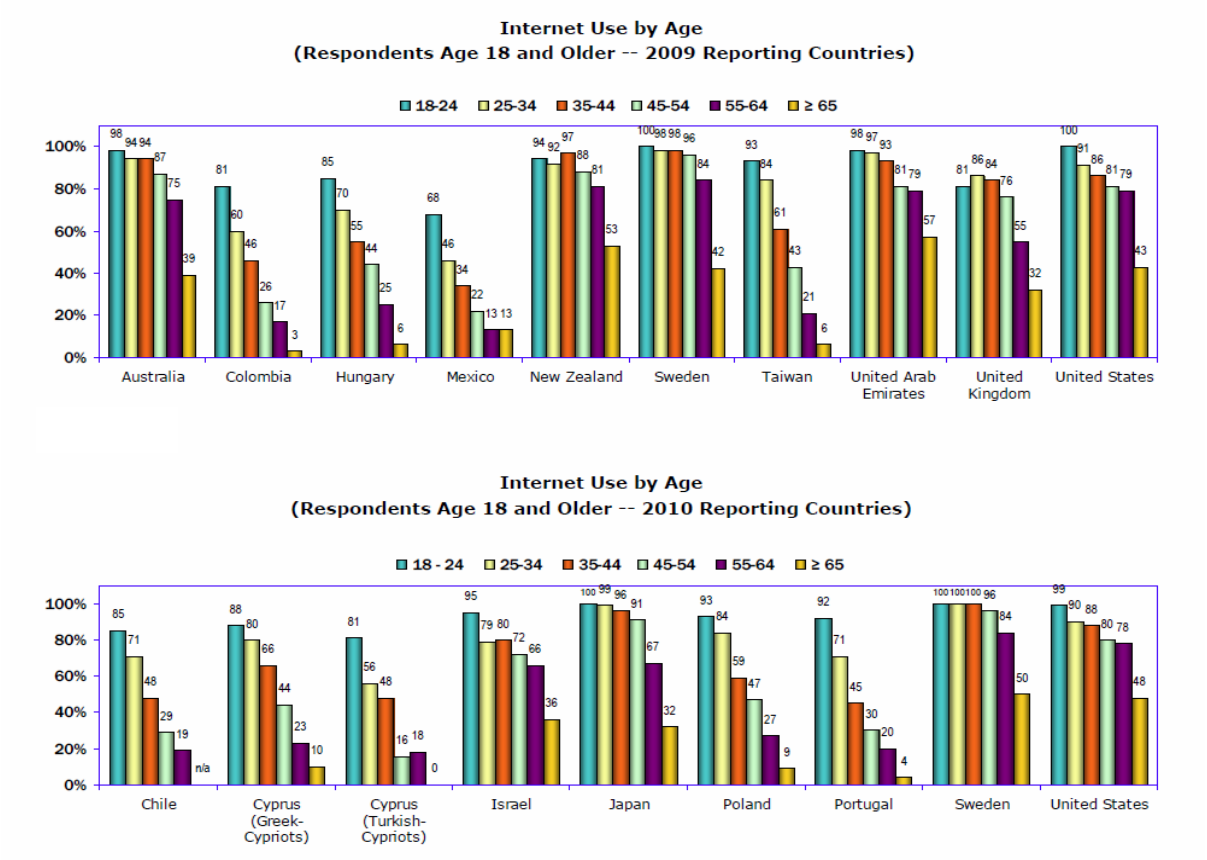


Figure 3: The World Internet Project, Internet use by age (Cole et al. 2012, p. 56)

In the UK, the Ofcom (2014) research report Children and Parents: Media User and Attitudes Report, based on a sample of 1,660 participants, recorded a big increase in new media technologies used by children aged 5–15 from 2013 to 2014 for all socio-economic groups. In just one year, the use of tablet computers jumped from 42% in 2013 to 62% in 2014, ownership from 19% in 2013 to 34% in 2014, and access to a tablet computer from 51% in 2013 to 71% in 2014. The research also reported that 54% of children aged 8–11 and 75% children aged 12–15 own three or more digital media devices themselves. In a nationally representative research The Learner and Their Context initiated by BECTA in 2008 — before the agency was abolished in 2011 — in support of the UK Government's Harnessing Technology strategy between 2008 and 2011, researchers from Oxford University examined the experience of learners aged 8–22 from primary school up to FE and

HE institutions. Using a range of research methods, the study looked at how young people use DT in their own context away from education. The data was gathered from a population which consisted of a survey of 1,063 young people aged 8–19 (Eynon, 2009), interview with 132 young people aged 8–22 (Davies, 2010), 35 case studies visiting students aged 8–18 at their homes (Davies & Good, 2009a), and 14 individual case studies of young people's use of DT in the context of their family lives (Davies et al., 2009). The study confirmed relatively high usage of DT among young people. 95% of young people in the UK aged 8, 12, 14, and 17–19 use computers, of which 99% of 12- and 14-year olds use computers at home or school. 88% of young people aged 8–19 use the Internet, of which 97% are 12-year olds and 98% are 14-year olds (Davies & Good, 2009b; Eynon, 2009). Similarly, the Oxford Internet Survey (2011) of 2,057 participants aged 14 or over reported that 99% of 14–17 year olds are Internet users (Dutton & Blank, 2012). In 2010, the Kaiser Family Foundation conducted a study called Generation M²: Media in the Lives of 8 to 18-Years-Olds about media use (TV, computers, movies, video games, music, reading newspapers, magazines, and books) at five-year intervals, by means of a nationally representative survey of 2,002 grade 3 to grade 12 students aged 8–12, and a subsample of 702 volunteers who completed a 7-day media use diary concerning non-school related media use. Their findings reported that over the past five years, there has been an increase of 1 hour and 17 minutes in the daily consumption of media among young people. They spent 7 hours and 38 minutes daily, 7 days a week, engaging in media activities. Taking into account that often young people use more than one medium at a time, this time increases to 10 hours and 45 minutes, which is much more than adults spent at work each day (Rideout et al., 2010).

The Joint Information Systems Committee (JISC) published a report in 2008 of qualitative and quantitative research based on a sample of first-year university students aged 17–19 years (n = 2,222) affirming that "students are still 'digital natives'" (JISC/IPSOS

MORI 2008, p. 7), not because they use more ICT, but because they expect to use their ICT equipment at university. The existence of students who are sophisticated users of digital technology was also confirmed by two parallel projects funded by the UK JISC, the Learner Experience of E-learning (LEX) and Students Experience of Technology (LPX). Both projects provided empirical evidence of students' extensive use of personal technologies for a wide range of different tasks (Conole et al., 2008).

All of the data presented above, based on large studies, is consistent with findings that the most notable users of DT&RM are the youngest generation of participants. It is common practice amongst students to use DT&RM skilfully for their learning and social needs, as they do not see technology as anything exceptional; however, looking at the data above, we can conclude that access to and use of DT&RM are not an issue for the young generation anymore. The low price of DT&RM and popular digital culture among young people have made access and digital hardware widely available, but this is still not enough to lead us to the conclusion that children and young people are a generation of digital natives with a unique way of learning. A thought-provoking account of the new generation of young people as a unique phenomenon comes from a study with an original research approach done by an author who claims affiliation to the examined generation. Investigating records from 12 different studies, Twenge (2006) collected data on generational differences in personality, attitudes, and behaviour from 1.3 million young Americans, covering the period from the 1950s until the 2000s. She compared a large amount of data collected at various times, enabling her to compare data of baby boomers when they were adolescents with that of youngsters today. Focusing on the generation born after the 1970s, she acknowledges the difficulties of trying to stereotype an entire cohort of people by date of birth; however, she believes that on average, we are all products of time and culture.

Twenge's views on today's youth generation noticeably differ from those of Howe and Strauss (2000). She goes as far as to criticise Howe and Strauss' idealistic vision of the new generation as the latest generation with hero potential. Twenge argues that there is no evidence that the new generation of youth is attached to civil duties or community, and quite the opposite, the two most noticeable characteristics of the new generation are individualism and absence of political engagement. To express this, she creates a name for the new generation, Generation Me (GenMe), by combining the name of the Microsoft operating system Windows' Millennium Edition (Windows ME) and individualism as prominent characteristics of the generation born after the 1970s. The GenMe feels a strong sense of entitlement and, therefore, it is not surprising that they no longer feel that they have to earn grades or respect teachers. Twenge also criticises what she calls the "new democracy in education" (p. 29), where the curriculum lacks the central authority of the teacher, and subsequently, young people are seen as autonomous when it comes to learning. This has led to the point where GenMe does not only question authority, argues Twenge, they "disrespect it entirely" (p. 28). This is a generation that abdicates any responsibility, blaming all academic failings on teachers and others, while at the same time, they believe that any individual can be anything if they only follow their dreams. As a consequence of this, GenMe is feeling lonely, depressed, and stressed, claims Twenge (2006) pointing to a rise in mental health illness in the last 10 to 15 years. However, Twenge does not directly blame technology but rather the attitudes it promotes; she claims that technology facilitates dishonesty as it enables students to cheat, raises unrealistic expectations, and encourages materialism, consumerism, and individualism.

Another pair of authors with an attention-grabbing observation about the effect of technology on the new generation of young people come from the world of neuroscience. Gary Small and Gigi Vorgan (2009) adopt Prensky's digital natives/immigrants metaphor

claiming that "we are witnessing the beginning of a deeply divided brain gap between younger and older minds – in just one generation" (p. 3). Asserting that regardless of age, human brains are so rapidly changing when exposed to digital technologies, they worry what is happening to the brains of the young generation who are on a regular basis exposed to technological stimuli. The overstimulated mind of digital natives is not making young people an exceptional generation, believe these authors, but rather preventing the full development of their frontal lobes. This is the region of the brain that is related to abstract thinking and planning skills, making them have shorter attention spans, be less efficient at their schools and work, read less, have less human interaction and, therefore, damage their communication, social, and reasoning skills. Although Small and Vorgan's claims that evolutionary development of the brain is happening in front of our very eyes may be backed up by an MRI study, they cannot be counted as evidence for our genetic change in just one generation. Their argument that the brain can be rewired by external stimuli regardless of age, and that the generation of young people born surrounded by digital technology is being endangered rather than enhanced by technology goes against claims of the advocates of the theory on digital natives.

Hargittai (2010) surveyed the entire first year of undergraduate students (n = 1,060) in a US urban public research university focusing on the diversity of web usage among digital natives and used the dataset for several publications. She argued that knowledge and expertise are not directly linked to more exposure to the use of the Web but rather students' socio-economic background and level of their parents' education, concluding that the users from more privileged socio-economic backgrounds benefit more from the Internet that those in less advantageous positions. This raises concerns about increased inequalities among Internet users across the population (Hargittai & Hinnant, 2008; Hargittai, 2010). She also reported that although the population of students she studied exhibited characteristics of a

truly wired generation, they still lacked critical skills to appraise information they found on the Internet. When asked how confident they were about "knowing the difference between http and https" (Hargittai, 2008, p. 11), only 18% young people confirmed confidence, while an overwhelming majority of 57% admitted to not knowing the difference. This is a considerable finding as https indicates that users are visiting a secure site and, therefore, demonstrates that our Internet-savvy generation of digital natives is not fully aware of how to be safe online.

Taylor (2012) suggests an information literacy problem, drawing his claim on the longitudinal study of the search behaviour of the new millennial generation from a university in the US. The millennial generation, however much surrounded by digital technology from early childhood, is not very concerned with the validity of the information they access. They treat information as just another commodity and are not critical about what they find on the Internet. Looking at academic related search practices of undergraduates, Kennedy and Judd (2011) found that however familiar they were with web technology and the Internet, in the great majority of cases, students always relied on using general search engines such as Google and Wikipedia, which are not optimised to support scholarly information-seeking. Kennedy et al. (2007) conducted a large cross-institutional study surveying 2,588 first-year students at the University of Melbourne, the University of Wollongong, and Charles Sturt University, looking at students' use of 41 different digital applications in their study and everyday lives, with a particular focus on the use of Web 2.0 technologies as learning tools. Their findings indicated that first-year University students at three Australian universities were nowhere near as frequent users of new technologies as some authors may have suggested. Also, patterns of technology use were much more diverse among students than asserted by the existing literature. Furthermore, there is no evidence of widespread use of Web 2.0 technologies. A year later, Kennedy et al. (2008) published a paper comparing the

differences between staff and students' use of digital technology, suggesting that Prensky's claims about inequalities between digital natives and digital immigrants are overstated as the gap is relatively small and that teaching staff and students, rather than being on opposite sides of the digital divide, find themselves united in their lack of knowledge and understanding of new and fast-developing technologies.

In a small-scale study of undergraduate students (n = 168) and lecturers and support staff (n = 8) in two British universities, Margaryan and Littlejohn (2008) looked at the nature of DT use. They found a limited use of technology for learning and socialisation, as well as low levels of use of Web 2.0 technologies and tools. They observed students looking to teachers for help on how to use technology and suggested that educators cannot assume that all their students are digital natives. Margaryan et al. (2011), using the same data, argue that they did not find evidence of young people exposed to DT having different learning styles. Students prefer traditional passive and linear methods of learning and teaching and, therefore, it would be misleading to call for the transformation of education on the grounds of the arguments proposed by the endorsers of the digital natives theory.

Drawing on a research project with a focus on proficiency in use of technology in an Australian university, Corrine et al. (2010) conducted research that suggests that the majority of 470 university students "classified their ability with technology as intermediate (67%) with only 23.2% rating themselves as advanced users and 8.5% as beginners" (p. 645). They also claim that everyday usage of digital technology among young people does not positively correlate with the usage rate of technology for academic study.

A similar diversity of young people's abilities to use digital technology was reported in Green and Hannon's (2007) qualitative research study of children and young people from primary and secondary schools around England. They encountered a defined "hierarchy of

digital activities" (p. 41) among young users, suggesting four types of different users among children and young people:

- Digital pioneers, who are a smaller group of young people that is pushing at the boundaries of conventional practice;
- Creative producers, who are building websites, posting movies, photos, and music to share with friends, family, and beyond;
- Everyday communicators, who are making their lives easier through texting and instant messaging; and
- Information gatherers, who are Google and Wikipedia addicts, and for whom "cutting and pasting" is a way of life.

The similar proposition that digital natives are not a homogenous group was suggested in another large cross-country study conducted in the countries which are members of the Organisation for Economic Co-operation (OECD). In this study Pedró (2009) confirmed that even though age positively correlates with the usage of DT&RM among young people, it would be misleading to recognise all of them as a generation of learners that correspond to the description of new millennium learners.

In a recent study, boyd (2014) aimed to describe and explain the networked lives of teens. Over eight years she interviewed 166 teenagers in 18 US states. Although finding that social media plays a central role in the lives of young Americans, she concluded that technology is not changing youth and that the more things like technology changed, the more teenagers stayed the same. However, most commonly, young people used DT to stay connected with their friends, and social media became an important public space. Therefore, suggests boyd (2014), in the same way as the drive-in in the 1950s was the place where teens were spending most of their times, and this changed to the mall in the 1960s, social network

sites and social media are places where present-day teenagers hang around. An earlier large three-year ethnographic MacArthur Foundation project study that aimed to document young people's informal everyday engagement with digital media showed similar findings (boyd, 2010). In her discussion of how young people use digital media to develop and maintain friendships, boyd (2010) argues that young people's' "special" relationship with digital media as a social and cultural form is something we can trace through the last century because of young people's tendency to segregate their social activities from adult society.

Buckingham (2006) questions the use of perceived membership of an age cohort as a suitable approach in defining the traits of an entire generation. He claims that an attempt to define and study any generation is highly problematic, as a generation is something that is constantly negotiated, changed, defined, and redefined according to many social, economic, historical, and cultural circumstances, rather than a universal state of being. Buckingham (2005, 2008) argues that in recent times, young people have been characterised through the activities of the commercial market and that categories such as 'teenager', 'middle youth', 'kidults' and 'adolescent' complicate and distort distinctions between children, youth, and adults. Therefore, he claims that the new digital media forms, for example video games, are specifically targeted at children and young people. For that reason, even with its potential educational value, we must not ignore that the Internet is a highly commercialised and unregulated medium, and as such, cannot be seen as an unbiased channel for information. Subsequently, video games that seek from the players' acquisition of some skills and knowledge are, in fact, an act of consumption. Buckingham (2009) also claims that the generational divide overstates digital differences between students and teachers, ignoring age and social diversities within these groups. It is a myth that the digital generation of young people is a more intensive user of DT&RM than its parents and teachers. There is a paradox in describing young people as technologically competent, while at the

same time, saying that they are missing out on important skills or expertise that they supposedly require in order to survive in the alleged knowledge economy. For Herring (2008), this is not a surprise as she claims that a digital generation is an adult's concept created through "adult values and adult fears" (p. 75). Even though digital media are often presented as a technology that gives children and young people autonomy, it is just an illusion, as their experience in the media landscape is controlled and mediated by adults and adult institutions. Adults produce youth entertainment media, target young people as customers, control access, and financially profit from DT&RM; at the same time, academic research tends to present young people as a unique and exceptional generation. For all these reasons, observes Herring, a digital generation is an adult construct rather than a genuine phenomenon.

Use of DT&RM in FE Teaching and Learning Practices

After the recent government announcement to cut £249 million from the adult skills budget of in 2015-2016 (Eduserv, 2015), the FE sector has found itself in the position of a highly uncertain future. Historically, the sector has been renowned for its diversity and breadth of educational provisions with its broad offer of vocational, academic, adult, and HE courses. Every year, it educates and trains three million people in the UK encompassing a large number of students from a variety of social and economic backgrounds, ages, prior achievements, experience, and aspirations (Chowcat et al., 2014; Lumby, 2001; Sharpe & Browne, 2015). Since the incorporation of FE colleges in 1993, the sector has been exposed to market forces, which replaced traditional professional and public sector values with those of management and the private sector substantially shifting its culture (Lumby, 2001). This brought to the sector a notion of a tightly controlled and directed education system with a focus on the mechanisms of funding, performance targets, quality assurance processes,

audits, inspections, and measured outcomes. In this regard, complexity of the sector, as well as a large number of challenges of responding to various stakeholders such as government agencies, funding bodies, industry and community needs, students, parents, teachers etc., present a difficulty for drawing conclusions that can be easily generalised about the learner experience in FE (Pavlakou & Sharpe, 2014). Yet, there is an inclination in the research reports of the sector to describe learners as assertive users of technologies, while at the same time present teachers as lagging behind technological progress. A consortium drawn from 26 of the UK's largest FE Colleges, the 157 Furthering Education & Skills Group in the report Further Education in 2020, has highlighted that FE sector is ignoring the opportunities of embracing technologies into their teaching and learning practices. This neglecting of technology is largely due to their teachers who are seen as 'technology fossils' (Sherlock & Perry, 2013, p. 14), not prepared to use technology for teaching and learning (Sharpe & Brown, 2015). Concurrently, the colleges who are struggling to meet the demand of skilled and technologically enthusiastic students (Sharpe & Brown, 2015) are invited to embrace generation of students whose digital skills are 'the greatest resource available to FE' (FELTAG, 2014, p. 5).

Although nowadays students have widespread access to DT&RM, using digital technology and social media as part of their everyday lives (boyd, 2015) and have high exceptions of technology, they are struggling to use it in an academic context (Eduserv, 2015; Sharpe & Benfield, 2012). Their use of DT&RM is often passive and dependent on their ability to transfer their personal and social uses of technology to learning context, with digital learning experience very dependent on the confidence and capabilities of their teachers (Sharpe & Brown, 2015). Drawing their conclusions on surveying 613 FE professionals, City & Guilds (2015) reports argues that overall teaching in FE sector have a positive attitude towards technology, with 79% of teachers believing that technology has the

power to positively impact on teaching and learning, and 66% agreeing that technology improves teaching and learning. The reports also find, contrary to popular belief that older teachers are not less capable of their younger colleagues and are very often more confident using technology to its best effect.

In recent years, the FE sector has been picking up with the rest of the UK education offering students a wide range of opportunities to use technology in their learning practices (City & Guilds, 2014). However, empirical studies have indicated that access and familiarity with technology do not always explain patterns of digital practices (Sharpe & Benfield, 2012). Over the years, new technologies were emerging, coming in and out of fashion often not in the coherent or linear way, making a different impact on the educational experience of students and teachers (Chowcat et al., 2014). For example, looking at the research reports about popular e-learning resources in FE, the picture is far from being clear and consistent.

Interactive White Boards (IWBs)

IWBs, also known as SmartBoards or e-boards, combine a computer, interactive software, and a multimedia projector turning traditional whiteboards into an interactive surface. However, at first created for office use, its interactivity quickly found a way into educational setting promising benefits for teaching and learning (Greiffenhagen 2002). Recognising the potential of IWBs in promoting interactive teaching and learning, the UK was one of the first countries in the world to adopt IWBs in education with the UK government investing £50 million in IWBs by 2004 (Younie & Leask, 2013). The former secretary of State for Education and Skills, Charles Clarke, was reported as saying 'every school of the future will have an interactive board in every classroom, technology has already revolutionised learning' (as cited in Smith et al. 2005, p. 91).

As soon as IWBs started to be adopted in the educational institutions, the research indicated that IWBs have been welcomed enthusiastically by large number of students and teachers with unprecedented rapid take-up in classrooms (Somekh, et al., 2007; Moss et al., 2007), highlighting a range of potential benefits IWBs add to teaching and learning. IWBs support interactive whole class teaching (Smith et al., 2006), by encouraging dialogue, discussion, and critical thinking (Hennessy & London, 2013). IWBs capture and hold students' attention more than other classroom resources (Smith et al., 2005). The findings demonstrated that The IWBs increase learners' motivation and teachers' job satisfaction. Learners perceive lessons with IWBs to be more varied, which led to increased concentration, improvement of learners' behaviour, and participations. When connected to the Internet, an IWBs acts as a gateway to a wide range of resources giving teachers the opportunity to increase interactivity in the classroom (Somekh et al., 2007; Tanner et al., 2005).

Similar findings on IWBs were reported from research done specifically in the UK's FE, in a mixed method case study of six FE colleges, funded by the DfES, conducted with the aim to examine the way e-learning was being incorporated in FE colleges. The data was gathered from over 70 staff with different roles at the college (managers, teachers, IT support, and technical staff) and about 500 students. The process of data collection involved interviews, surveys and focus groups, documentary evidence, and was supplemented by a survey of 508 tutors from over 100 different colleges. The findings highlighted that the use of DT&RM had an effect on students' intermediate outcomes suggesting that use of technology has a positive impact on students gaining knowledge and skills and becoming independent learners. Evidence suggested that use of technology facilitated a better understanding of the subject, motivated students to learn, and helped students develop self-esteem and take more responsibility for their own learning (Finlayson et al. 2006). Positive

results were reported in Maxell & Finlayson (2007) study on the impact of IWBs on learning outcomes in FE. The authors suggest three overlapping effects: the first directly relating to learning, the second to motivation, and the third to students' readiness to be independent learners. The use of IWBs had a strong impact on students' concentration, attention, and memorising. This made students more engaged and open to learning, producing better learning outcomes, and development of skills.

Despite the emerging arguments that use of IWBs has a positive impact on learning, motivation, and engagement, there is no conclusive empirical evidence on long-term students' achievement. No positive link was identified between the use of IWBs and improved retention and achievement results (Maxell & Finlayson, 2007; Higgins et al. 2007; Moss at al. 2007; Digregorio & Sobel-Lojeski, 2010; Schuck & Kearney, 2007; Glover et al., 2005; Somekh et al., 2007). Some authors suggest that increased motivation and positive attitudes associated with IWBs may be due to the novelty factor (Smith et al., 2005; Higgins et al., 2007). A wide range of interactive facilities of IWB is fully used by only a small number of teachers with previous experience in using technology. At the same time, IWBs are often used as a backboard replacement or data projector IWB reinforces the didactic style of teaching (Greiffenhagen, 2002; Digregorio & Sobel-Lojeski, 2010; Higgins et al., 2007; Tanner et al., 2005; Smith et al., 2005, 2006; Somekh et al., 2007; Maxwell & Finlayson, 2007). There is very little evidence on what constitutes good practice (Moss et al., 2007; Somekh et al., 2007) and to effectively use IWBs to their full potential, wider professional development is needed, as well as providing teachers with ongoing support, time to train, plan, and set up technology (Hennessy & London, 2013; Higgins et al., 2007; Maxwell & Finlayson, 2007).

Although there is evidence that IWBs have a positive impact on many aspects of learning, lack of data supporting positive impact of IWBs on retention and achievement can

be associated with the difficulty of the separating impact of good teaching from the impact of technology on end results. 'Good teaching is good teaching regardless of technology' (Higgins et al., 2007, p. 217), with good planning technology can enhance teaching and learning; however, it must not become an end in itself.

Virtual Learning Environment (VLE)

VLE is a web-based learning environment that facilitates collaboration between students and teachers. Often a part of a managed learning environment (MLE), which is an institution's broader information system which links, library, student records, e-tracking of students' progress, the Internet, e-register etc., VLE enables the student to manage all systems seamlessly with one login (BECTA, 2003; JISC, 2006). Designed to enhance students' learning experience, VLE can be accessed from anywhere with an internet connection. It provides a flexible and adaptable set of tools designed to help students track their progress (Van der Veen, 2013), facilitates learning via self-assessment quizzes, threaded discussions, and chat rooms (Stiles, 2007). There is a range of popular commercial VLEs software product oh the market: Blackboard, WebCT, Lotus LearningSpace, Moodle, eFront etc. (Van der Veen, 2013). Bringing together various tools into a package that enables students and teachers to communicate and interact, create upload/download learning content, use social media, which later can be accessed by students at home or at school, VLEs are also referred to as learning platforms (LP) (Younie & Leask, 2009, 2013).

However, 'Blackboard' has been used since 2000 and 'Moodle' (Modular Object-Oriented Dynamic Learning) since 2001, as two most popular LPs, the computers were utilised to facilitate learning by the UK's Open University since the 1970s (Barker & Gossman, 2013). Right from the beginning, there has been recognition by the UK government that the use of DT&RM has great potential for benefits of education. This

resulted in substantial investment and a steady embedding of the technology in the classroom (Livingstone, 2012). For example, the percentage of schools and colleges in the post-compulsory sector that adopted VLEs rose sharply from 58% in 2003-04 to 92% in 2008-09 (Sero, 2009). In 2008, Ofsted evaluated the development of VLEs in 41 educational providers, (18 colleges, six primary, two secondary schools, three work-based learning providers, three adult and community learning providers, and local authority). In the Ofsted (2009) publication Virtual learning environments: an evaluation of their development in a sample of educational settings that resulted from the assessment, it was reported that though there has been a great deal of development, in particular, FE colleges, the use of VLEs was not widespread and 'resembled more of a cottage industry than a national technological revolution' (p. 4).

Van der Veen (2013) believes that she found an answer in Prensky's digital natives/immigrants arguments. Being an FE practitioner, she bases her argument on her personal experience of using Moodle as a learning resource. According to Van der Veen, less than 3% of 260 Moodle courses use it for truly collaborative activities. Many tutors, including herself, are not sure how to use resources like Moodle. This popular digital platform, she claims, is often used by teachers as digital junk where they upload their teaching resources that are not regularly updated as they do not have time or interest in doing so. However, use of Moodle as a digital repository has also been highlighted by Ofsted (2009). The Van der Veen claim is supported by the uncritical adoption of Prensky's popular digital natives/immigrants metaphor. What is more, in the Ofsted (2009) report, Van der Veen often quoted in her paper stating that 'There was no obvious link between use of VLE and age' (Ofsted, 2009, p. 16), and that teaching staff had enough computer skills to manage VLE content. This exposes Van der Veen use of Prensky's popular metaphors just as decoration in very superficial biased research based on personal experience of using Moodle.

However critical about the limited use of VLEs, the Ofsted (2009) report confirms that use of VLEs improves students' motivation, gives them opportunities to reinforce or catch up missed lessons, supports individual learning pace, and helps teachers and students to better control assessment and feedback processes. The report recognises that VLEs are in an early stage of development with not evident impact on learning. The findings indicate that there is no consistency in the use of VLE across different curriculum areas, there is no direct relationship between staff digital competency and VLE development, and that effective use of VLE is linked to the enthusiasm of particular individuals. The great majority of surveyed educational institutions lack VLE strategy and quality assurance system, which will ensure that material on VLE is up to date, relevant, and appropriate.

The impact of VLE's on learning was investigated by Barker and Gossman (2013). They used an online survey to collect data from 248 second year students in an English Six Form College. The study reported a range of positive impacts VLE has on learning. Students who use VLE have the opportunity to study at their own place, pace, and time. This encourages them to take ownership of their learning, increasing their motivation and inspiring independent learning. Based on a small sample from only one educational institution, the data from this study does not provide evidence that VLE has a direct impact on students' academic performance. A similar finding was reported in a study, which looked at the impact of VLE on the academic performance of final year students of the BEng Civil Engineering course at Loughborough University. In this study, Demian and Morrice (2013) tried to link students' academic performance with VLE use over the duration of two modules of the course. The data demonstrated very little evidence of a link between the level of VLE use and students' academic performance.

The Organisation for Economic Co-operation and Development (OECD) for International Student Assessment (PISA) collected quantitative data from 30 member

countries about 15-year-old students looking at the correlation between access to computers at home and at school, the frequency of use, and students' academic performance. The data suggests that students do use computers frequently at home and at school for many functions including entertainment, education, and communication. However, the usage identified as most dominant was playing games. Students use computers for looking up things on the Internet, and for word-processing; however, the only small number was reported to use computers frequently for educational purposes. The study also found that students' performance is not directly proportional to the frequency with which students use technology. Students who use computers most do not perform better than others (OECD, 2006). This suggests that technology is not a simple answer to the complex educational process. Higgins et al. (2012) conducted meta-analysis combining the findings from studies, which looked at the impact of digital technology on learning. They linked the provision and use of technology with attainment trend concluding 'We do not know if it is the use of technology that is making the difference' (p. 3).

Mobile phones

The data from Ofcome (2015), The Communications Market Report, shows that mobile phones have become the most widely owned internet-enabled device with 90% of people aged between 16 and 24 owning a mobile phone. Being cheap in comparison with other digital devices, mobile phones are more than the traditional phone communication. Apart from traditional voice calls, the mobile phones can be used to send SMS and MMS (multimedia messaging service), as Global Positioning System (GPS), to record events by way of inbuilt camera and microphone, to browse the Internet, share information through Wi-FI, Bluetooth or infrared, for gaming, as a calculator, to download various visual and audio materials, use of cloud storage to store files, record and play multimedia, and to use

social network sites. Unique technical features of mobile phones and broad usage have brought a vast number of possibilities that can be utilised in various educational practices and have potential to provide a suitable learning platform for classroom activities, termed mobile learning (Guy, 2009).

From current research in the UK's post-compulsory education, there is still no clear indication of the extent to which mobile phones are embedded in the current practice (Wishart & Green, 2010), but only some individual illustrations of innovative practice are seen. For example, Teachers at City College Southampton, one of the largest providers of English for speakers of other languages (ESOL), found that use of mobile phones enabled ESOL students to extend knowledge, encouraging meaningful communication, and enhancing their numeracy and literacy skills. They used mobile phones to make visual and audio recordings for their project, which later they were able to publish on the web (JISC, 2005). Similar use of mobile phones was documented at the University of Nottingham. The mobile phones were used as a blogging tool to help Chinese students to familiarise themselves with the new place, culture, and community (Shao et al., 2007). Use of mobile phones to send students notifications through SMS messaging has been effective in Derwen College. The staff of the college found the use of messaging particularly helpful in reminding students with learning difficulties and physical disabilities about their daily tasks (JISC, 2008). Use of SMS reminders to help students learning time management skills was reported at the University of Bath. The university used a bulk texting service (Edutext) to remind and guide first-year sports students about follow-up activities located in the VLE, deadlines, and administrative changes. In this study, students reported that the use of mobile phones helped them with time management, smooth transition to HE, and reduction of perceived distance between their peers and their tutors (Jones et al., 2008). While the above-mentioned ways of utilising mobile phones in education demonstrate their effectiveness as a communication

tool, use of mobile phones for teaching and learning purposes is much more limited. Mtega et al. (2012) reported that students and teachers use mobile phones in the traditional way (SMS messaging and voice calls), and fail to utilise their full potential as a multimedia learning tool. The study found that both students and teachers were unaware of the technical capabilities of mobile phones, compatibility of applications and services between different mobile phones and their providers, the applications available for their phones, and how to find and download applications to their mobile devices. Limited mobile storage space, small screens, and the cost of downloading multi-media content was also reported as a constraint, which limited use of mobile phones for learning purposes.

Another limitation for the adoption of mobile phones in the classroom is the view that they are disruptive (GSMA, 2011). Moreover, this comes from the very top of the English educational establishment. Her Majesty's Chief Inspector of Education Sir Michael Wilshaw told The Telegraph that any teachers worth their salt should ban mobile phones (Espinoza, 2015). In June 2015, The UK Department of Education appointed behavioural expert Tom Bennett to lead a review into the impact of mobile phones on behaviour in lessons (Gibb, 2015), after a study from the London School of Economics (LSE) reported that mobile phones have the potential to reduce students' attention and be detrimental to their learning (Beland & Murphy, 2015). The LSE research combined a survey data from high schools in four large cities in England (Birmingham, Leicester, London and Manchester) with administrative data on student achievement. The study observed that following a ban on mobile phone use, students test scores improved by 6.41% of a standard deviation in schools that ban mobile phones use (Beland & Murphy, 2015). Suggesting that technology, however transformative, can be also disruptive, Bennett has already begun his enquiry into mobile phones with the aim to help the UK's schools to better deal with discipline in the

classroom and ensure students are better focused on learning, after which mobile phones could be discouraged from the classroom (Ross, 2015).

Video Games and Learning

Video games constitute one of the most controversial interactive digital technologies. Media attention and negative press have caused adults — parents in particular — a great deal of concern regarding the possible negative effects of video games. At the same time, however, many authors such as Papert (1996), Prensky (2007), Gee (2003), Shaffer (2006) and McGonigal (2011) see great educational potential in video games as they have a special appeal for youngsters. Papert (1996) claims that they provide challenges, foster creativity, curiosity, and discovery learning and that in many cases, children's dislike for school comes from finding it boring, rather than difficult. While playing games, they feel a sense of doing something challenging and important, and however hard, they still find playing games enjoyable and fun. Prensky (2007) endorses Papert's idea of games as 'hard fun' and proposes the idea of a digital game-based revolution. Prensky believes that digital game-based learning can bridge serious learning and entertainment in a new learning paradigm of 'edutainment'. On the other hand, Gee (2003) supports the use of video games for the evolution rather than the revolution of learning. He compares the learning principles of video games to learning in a classroom and concludes that challenge and learning are part of what makes video games motivating and entertaining. Similar to Gee, Shaffer (2006) sees the power of video games to be the enabling of new thinking about learning, proposing a new epistemology of creative innovation vital for a post-industrial global economy. Through epistemic games (games where players learn about ways of creative thinking in simulated real-world situations), education enables students to learn to think in innovative ways so they can meet the challenges of innovation in a global market economy. A controversial argument

about the influence of video games on the economy, society, and education has been proposed by McGonigal (2011). She believes that games can reinvent human civilisation and change the world into a better place, and for that to happen, all we need to do is to play more video games. For McGonigal (2011), the evidence of the existence of the 'born-digital kids' who 'crave gameplay in a way that older generation do not' (p. 129) is in the hours they spend playing video games. An average American child born after 1980 would have spent ten thousand hours playing computer video games by the age of 21, which McGonigal suggests by using Gladwell's (2008) ten-thousand-hour rule[1] will make them not good but extraordinary at gaming. These potential gaming experts are suffering from traditional classroom practices and, therefore, in the same way as Prensky (2007), McGonigal (2011) calls for dramatic game-based reforms of education as '[t]he ideal school is game' (p. 128). The new, emerging digital practices not taught at school and referred to as accidental learning or learning by doing, directly linked to never-ending innovations in the field of digital technology and acquired by children and young people outside mainstream education. Green and Hannon's (2007) claim that the skills that young people are learning, for example by playing video games, are very useful for the future economy, and we need to accommodate them through our school systems. Playing World of Warcraft, they suggest, has many skills, such as organising, evaluating, and recruiting new members, which are welcome in the modern workplace.

All those assumptions of video games changing education, the world and benefiting our future are based on belief in the existence the new generation of digital native students who prefer playing video games (Prensky, 2007, Oblinger & Oblinger, 2005). This is called

[1] The ten-thousand-hour rule was proposed by Malcolm Gladwell (2008) in his book Outliers: The Story of Success. He quotes neurologist Daniel Levitin, stating that, "ten thousand hours of practice is required to achieve the level of mastery associated with being a world-class expert – in anything" (p. 40).

into question by Bourgonjon et al. (2010) who reported in their study, involving 858 secondary school students, that only 25.3% students were frequent video games players, 35.9% preferred to play games moderately, while 26% were rare games, and 12.8% did not prefer to play games at all. The study also documented gender differences among students reporting that male students demonstrated a more positive attitude toward the use of video games in education than female students. In a one-year study aiming to explore an overview of teachers' and students' use and attitudes towards commercial off-the-shelf computer games in schools, Futurelab study Teaching with Games (Standford et al., 2006) also reported gender differences between students where 50% of male students were regular players compared with only 21% of female students. The study also pointed at a generational divide between students and teachers with 72% of teachers not playing video games for leisure, compared with 82% of students who play video games outside of the lesson. These findings question the view of young people as a homogenous group of digital natives who are immersed in digital video games, as well as raise potential gap between students' and teachers' attitudes towards video games.

Douch et al. (2010) explored the way in which digital video games can be used to support teaching and learning. They based their report on thirty-five case studies from the Mobile learning Network (MoLeNET), the learning initiative funded and supported by Learning and Skills Council (LSC) to support, expand and promote mobile learning, primarily in the English FE sector. They reported that video games can be valuable for supporting learners with learning difficulties or disabilities, learners with literacy and numeracy needs, and motivating disengaged learners. The study also pointed to benefits of using digital video games for teaching and learning. The digital video games were found to provide teachers with a non-threatening assessment tool, which encourage self and peer assessment and enables effective and immediate feedback. Due to their flexibility, digital

video games support students to learn in various locations outside of the college and at different times. The study also reported that games motivate and engage students with learning, encourage ownership of their learning, increase confidence and self-esteem, improve attendance, achievement, and their behaviour. Similar benefits were reported by Ya-Ting (2012) who argue that game-based learning supports effective development problem-slowing skills, help students grow confidence and motivation, as well as stimulate their curiosity. Woo (2014) investigated 63 second year Art and Design university students exploring the relation between learning motivation and related game characteristics. The data suggests that some characteristic of the games, such as fantasy, fun, curiosity, and role-playing, as well multi-media features of the games attract player's attention and affect his/her performance. However, those characteristics are not necessarily directly relevant to learning. For video games to be effectively used in the classroom, they need to be perceived by students as useful, relevant to learning and easy to use (Bourgonjon et al., 2010).

Though studies above are consistent in providing evidence that video games have a positive impact on students' motivation, engagement and problem solving, the Perrotta et al. (2013) meta-analysis found no credible evidence of video games having a measurable impact on students' achievement. Annetta et al. (2009) indicated in their quasi-experimental study of four general biology study classes from a single high school that despite being engaged and motivated, the students who played computer-based games related to the subject did not demonstrate a greater understanding of the subject. A similar finding was reported by Fengfeng (2008b) who, in his mixed method study, compared the impact of computers video games on mathematical learning outcomes against paper-and-pencil drills. While studies indicated that computer video games had a positive impact on student motivation, there was no evidence that students who used computer video games outperformed the paper-and-pencil drills experimental group of students.

Some studies warn us about potential problems and risks video games can present to classroom learning and young people. For example, Fengfeng (2008a) warns us that the entertaining elements of the game can be destructive for learning. Huizenga et al. (2009) experienced technical issues with games used by the student during the study. This unexpected incident highlighted the importance of reliability of the games before they were employed in the classroom as some students were distracted by the incident. In a recent report by the UK's House of Commons Heath Select Committee (2014), there was a warning that increased screen time and Internet activities can have a negative impact on young people's emotional health. The health warning also comes from a clinical psychologist in the UK, Tanya Byron. She was commissioned in 2007 by the UK government to review the risk of children's and young people's engagement with the internet and video games. Byron (2008) in her review, recognised the learning opportunities that games and the Internet provide to children and young people; however, many of them do not have sufficient awareness, knowledge, skills or maturity to manage potentially harmful or inappropriate contents they are exposed to while playing games or when being online. To deal with the issues of children's safety, Byron suggests that we should not blame technology but rather empower children and young people to know how to manage the risk. In her recommendations, Byron (2008) calls for a collaborative effort of parties responsible for children's e-safety, such as the tech industry and providers, parents, and government agencies (education and legal) to work on the issues of e-safety. In her second review, Byron (2010) looked at the progress that has been made since her recommendation in 2008. She reported significant improvement in children and young people's safety; although, she points out that schools and colleges block children's and young people access to technology rather than developing their knowledge and skill which will help them manage e-safety in and outside of educational institutions.

The literature about the use of IWBs, VLE, mobile phones, and computer video games as most popular e-learning resources, agree that all of these learning technologies bring a range of potential benefits to education. They motivate students to be independent learners who take responsibility for their education, improve their participation and engagement. However, none of the studies above provided convincing evidence that any of those technologies improves students' achievement, retention, and success. Therefore, it is not the technology that makes a difference, but the way it is used to support teaching and learning and we must not forget that technology is a supplement rather than a replacement for traditional teaching (Higgins et al., 2012).

Conclusion

This chapter has reviewed the literature regarding the distinctions between so-called digital natives/immigrants, looking at the origins, limitations, and consequences of the proposed model, as well as literature on the use of DT&RM in teaching and learning practices. It opened with the powerful idea of the world changing forever into a utopian dream run by technology. The singularity – the moment when it is all going to happen – presents a metaphor for the ideas and ideologies that underpin a deterministic vision of technology as an evolutionary force beyond humankind. It is the vision of the world and the universe in which we humans are just a transitional form, from lower to higher technological existence. This cybernetic dream has attracted groups of authors, who brought together a belief that digital technology has the capacity to change almost every aspect of our contemporary lives and the enormous popularity of digital technology among children and young people into a vision of a new digital generation. Echoing the singularity model, this theory predicts that digital natives are so unique and different from their immigrant teachers that they will stretch the education system to the point of no return so that it will have to change forever.

The review has illustrated that the presented arguments have been built on the speculative over-simplistic utopian theory of technological determinism and the enormous popularity of DT among young people and their alleged digital needs. Frequently funded as small-scale research with selective samples, self-reported rather than field observations, and often anecdotal evidence, the generational divide model has gained surprising popularity. It has been widely used in public and academic discourses with calls for the radical transformation of education, as well as further academic research into the existence of the generational phenomenon. Even though the idea of an exceptional digital generation was challenged by more methodologically sound empirical evidence, it left us with more questions than answers. The evidence prompted new arguments suggesting significant diversity among members of the alleged digital generation. The digital natives were not portrayed as affectionate and confident users of new technologies; rather, they were not so different in their digital skills from their digital immigrant teachers and not aware of safety issues. In fact, they may be affected by digital technology in a way that is changing them into a depressive, unmotivated, and cynical generation with a pessimistic view of the future. The review also found that digital technologies were not always recognised as an evolutionary force of good. A vision of digital education as a self-deterministic system, where teachers will not be in the role of authority but rather facilitators of the system governed by students' needs and desires, has been questioned, as has the relationship that students and teachers have with DT&RM.

In the light of the limitations of the generational divide model, the importance of new issues raised by new empirical evidence and a lack of similar research in the UK FE sector, I argue the need to further examine the digital characteristics of students and teachers from their own perspectives in order to provide a more complex representation of the digital relationships that students and teachers have with technology.

CHAPTER THREE

METHODOLOGY AND RESEARCH DESIGN

In this chapter, I provide an overview of the methodology of this research, the characteristics of mixed methods research, and how this choice aligns with my study. Following this, I discuss my position as an insider researcher, reflecting on the personal and professional experience of balancing the dual role of employee and investigator. In addition, this chapter contains a discussion about participants, research design, and data analysis.

Methodological considerations

The methodology involves the decision-making process of explaining and justifying the choice of particular research methods within three different research traditions that are related to forms of data collection: quantitative, qualitative, and mixed methods. The way to outline the extent to which those traditions vary between them is to look at the basic philosophical assumptions the researcher brings to the study, types of research strategies used, and the specific methods engaged in conducting these strategies (Creswell, 2009). The quantitative research tradition was adopted from natural and physical sciences and evolved from the belief that to achieve an accurate measurement of reality, the investigator has to be independent of the object of enquiry. By quantifying the data, the research findings can be validated against well-established hypotheses and tested with defined measurement units. This enables quantitative research methods to produce reliable data that can potentially be generalised to a large population, free from values and biases that can influence outcomes (Guba & Lincoln, 1994).

Nevertheless, what happens when we need to measure what cannot be measured? Pacey (1999) observed that there are some aspects of humanity (such as happiness,

relationships, meanings, or feelings) that are too ambiguous to be measured by quantitative methods. While a quantitative process of research involves using objective research procedures to collect numerical data and statistical procedures to uncover discrete features of the phenomenon, the qualitative inquiry explores the meaning that individuals or groups ascribe to the phenomenon of the study by interviewing, observing, and interacting with the objects of the study (Creswell, 2009). However, along with quantitative and qualitative research, mixed methods research has been recognised as the third major research tradition (Johnson et al., 2007). Identified as a research practice which uses different methods of data collection, the mixed method is more than just a process for gathering multiple types of quantitative and qualitative data; it anticipates viewing and analysing gathered data to answer our research questions engulfed in a larger research framework of creating knowledge (Creswell, 2009).

In relation to combining qualitative and quantitative research methods, there arises the question of compatibility between them. Often referred to as a "paradigm war" (Gage, 1989), this incompatibility thesis, argues Howe (1988), is related to the belief in the existence of the close links between paradigms and research methods. Therefore, if the paradigm as a set of basic beliefs in how we experience and think about the world (Guba & Lincoln, 1994) and research methods as the set of procedures under which the researcher meets the object of inquiry (Clough & Nutbrown, 2012) conflict with one another, there are assumptions that the methods related to those paradigms are mutually exclusive and cannot be mixed (Morgan, 2007; Teddlie & Tashakkori, 2009). On the contrary, mixed methods research is based on an alternative principle, stating that paradigms and research methods should be evaluated in terms of what works for the research practice (Cohen et al., 2011; Howe, 1988). For example, there is no incompatibility between looking at the students' and teachers' relationship with technology by looking for numerical relations between classroom practices

and students' and teachers' attitudes towards technology, and at the same time looking at the students' and teachers' "thought processes and meaning-perspectives" (Gage, 1989, p.7) related to the same research topic. Therefore, educational research as an applied social/behavioural science concerned with teaching and learning practices, which are inseparable from intentions, motivations, and goals that give them meaning, is less concerned with practical application of scientific concepts of some hard, natural sciences, and as such, more likely to use qualitative instruments and adopt methods by design (Alise & Teddlie, 2010). Consequently, in dealing with the day-to-day complex life of educational practices, Howe (1988) argues that we should use everything at our disposal. The existence of two research methods, he believes, should be treated just as having two sets of tools. In the same way, Teddlie & Tashakkori (2010) believe that mixed methods research closely resemble "human problem solvers" (p. 273), who in everyday decision-making situations, examine a variety of evidence. Therefore, they argue that the incompatibility issues of different research paradigms are irrelevant.

Another issue regarding differences between quantitative and qualitative research traditions is generalisability. Generalisability is often defined as the degree to which research results can be relevant to a wider population, case, or situation beyond those examined in the study (Cohen et al., 2011). Bing situated in a specific context of one FE college in a particular geographic location in England, which might not have the same demographic and economic characteristics as other locations in the country, my study can be perceived as limited in terms of having an external validity of its results. However, this view on generalisability is usually associated with quantitative research tradition (Briggs & Coleman, 2007). In contrast to this view, generalisability in qualitative research is often ignored. While for quantitive tradition, external validity is of great importance, in qualitative research, the population sample is really randomly selected; research is often influenced by individual

attributes and perspectives of the researcher with no intention to replicate findings in the similar or even same situation (Schofield, 2011). Therefore, Guba and Lincoln (1981) argue that nation of generalisability in social sciences is not straight forward as it does not 'apply to particulars' (p.110). Therefore, while quantitative research seeks to draw generalisable findings to a defined population, qualitative research is more focused on understanding nature of social practices in greater depth from the point of participants' experience (Denzin & Lincoln, 2008). For that reason, Guba and Lincoln (1982) call for replacing generalisability with a new concept 'fittingness', which refers to the degree to which the phenomena studied are transferable to other similar studies; it also refers to the clear description of the phenomenon, situation, and population studied. For the reason that my study is set up in one setting and involves the qualitative part of the study looking at the attitudes and behaviour of small group of participants, to achieve fittingness and transferability in the rest of this chapter, I will provide substantial amount of information about research perspective, design, and research techniques to provide information which makes it possible for a reader to make an informal judgement about whether findings from this study are useful in understanding similar studies (Schofield, 2011).

The research perspective

To evaluate the relationship teachers and students have with digital technology, for the purpose of this study, I chose the mixed methods research design. As we have seen in the literature review, some current theories suggest that technology has inner logical momentum and that it is a powerful force that shapes the traits of entire generations. I believe that to take full advantage of technology in classrooms, we need to try to overcome this approach and look at students and teachers as everyday users of technology, whose actions shape technology and its adoption in educational processes. It is not a question of how they are different, but what makes them different in how they use digital technology. For this

reason, I needed a research design that would help me to avoid falling into a trap of measuring access and usage of technology by the participants as the only evidence of their relationships with technology. For instance, access to a mobile phone and its usage would not necessarily tell us what relationship we have with our mobile phones. A teacher, for example, can be an avid user of a mobile phone, but at the same time hate it and perceive constant calls and messages as a stressful experience. On the other hand, a student, another avid user, can have a very close and intimate relationship with his or her phone due to it being an important way of connecting with friends and family. For that reason, I will look at students' and teachers' use and adoption of DT&RM in this study as a manifestation of their meaningful experience of technology rather than a mechanical response to it. This is to say that to research meaning, I will have to make sense of human behaviour, looking to answer why students and teachers use or do not use technology in their everyday educational pursuits, rather than merely looking at what technology they use and how.

Therefore, by looking at why students and teachers adopt a particular technology in their teaching and learning practices, I intended to identify the complexity of the relationships they have with DT&RM. As a result, while a quantitative approach to data collection gave me findings that could be presented in an objective and verifiable way, it could not measure the meaning participants bring to the technology, and, therefore, would not be valid. Considering that interaction with the subjects of the research, which in the social sciences are usually people, "is often a more plausible description of the inquiry process than is the notion that findings are discovered through objective observation" (Guba & Lincoln, 1994, p. 107), I needed a research approach that would allow me to be closer to my participants and enable me to elicit data by interacting with them and co-operatively reflecting upon the phenomenon. For this reason, I selected the mixed method design. According to Bergman (2010):

> Mixed methods research is eminently suited for exploring variations in the construction of meaning of concepts in relation to how respondents, for instance, make sense of their experiences or report on attitudes in interviews or questionnaires, respectively (p. 172).

Thus, I decided to develop a mode of enquiry that would facilitate participants in articulating their voices and views and creating knowledge through engaging them in the various stages of the study. This shaped my decision to adopt a sequential mixed method research design that allowed me to maximise the advantages of both quantitative and qualitative methods of data collection.

The research design

To pursue objectives of the study and address research questions, the research design was accomplished in two distinctive stages of data collection, each with its specific objective and research method (see Figure 4). The first stage was to conduct a pilot study in which participatory photography was tested as a qualitative research practice and to articulate the focus of the research further. The second stage involved a mixed method design, which consisted of two sequential phases. The first phase was quantitative and used an online survey with the aim of creating a general picture of participant's perceptions, attitudes, and experiences of the use of DT&RM across the college. This was followed by the qualitative phase, which used participatory video production to collect visual data that was used to conduct more in-depth interviews with participants.

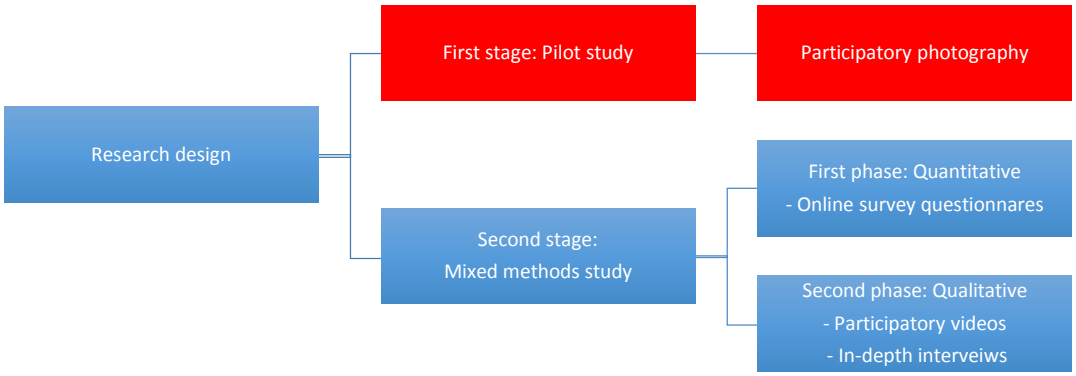


Figure 4: Research design

The qualitative phase of the mixed methods research design was a collaborative phase of the study where I encouraged participants to take an active role in recording video footage as a means of generating data for the purpose of further evaluation (Pink, 2007). The main goals of this phase were: to give students and teachers voice by encouraging them to document researched phenomenon from own perspective (Lunch and Lunch, 2006), and use recorded video footage as a starting point for semi-structured interviews with participant-collaborators to further discuss video recordings and examine 'how they situate themselves as viewers of the footage' (Pink, 2007, p. 112). The emphasis of this research strategy was on process rather than the video production itself (Benest, 2010). This approach to data collection allowed me to promote critical dialogue with my participants, giving them freedom and encouraging them to take an active part, with not only the data collection but also selection of participants, choice of the issues they are going to record, and the reflection process.

To develop this collaborative research strategy, I conducted a qualitative pilot study using participatory image making with the aim to further develop and test the adequacy of my research instrument and design protocols (van Teijlingen & Hundley, 2002). For more

information about the process of using visual images in the collaborative process of image making see Appendix A, (p. 169).

The research participants: Sampling strategy

The sample population comprised teachers and students from an FE and HE college in South East England. The total number of students enrolled in the 2012–13 academic year was approximately 5,500, while the number of full-time academic staff employed at the college in the same academic year was 400. The total number of participants who took part in the study was n = 602 (n = 444 students and n = 158 teachers). My sampling strategy involved combining three different sample sizes: a larger quantitative sample for the survey questionnaire stage and two smaller qualitative samples for the pilot and the second qualitative phase of the study.

In the pilot study, I used convenience volunteer sampling (Teddlie & Tashakkori, 2009). With the aim of testing participatory photography as a research instrument, I drew a sample of n = 6 participants from the group of students and teachers who visited the Computer Video Game Show organised by Play.com in March 2008 at Wembley Arena, London. These were selected from the group of second-year BTEC National Diploma in Media (Games Design Pathway) students (n = 3) and teachers (n = 3) who accompanied us on the trip. All volunteers had a long-established interest in playing computer video games and opted to go on the trip. The sample was selected for the purpose of testing research instruments with the acknowledgement that they do not represent the general population.

The second main stage of the study facilitated mixed methods and multi-purpose sampling and employed different sampling techniques due to the complexity of the research design and the issues examined (Teddlie & Tashakkori, 2009). During this stage of the study, I used three sampling strategies to select participants in the two different phases of the study. With the aim of gaining a representative sample from within a reasonably large population

of participants in the quantitative phase of the study, I used the self-selection sampling strategy where participants were free to determine whether they would or would not take part in a self-reported online survey questionnaire (Bethlehem, 2008). For this purpose, I used SurveyMonkey, an online cloud-based survey tool that was administered through the college intranet, e-mails, and social media (the college Facebook and Twitter pages). A total of n = 572 participants opted to respond to the questionnaire. After removing incomplete data, n = 546 were used for further analysis (n = 415 students and n = 131 teachers). This method of data collection has its limitations in that the researcher is not in control of the selection process and, therefore, cannot know how biased the sample is (Bethlehem, 2008). As my goal was to capture the general sense of participants' relations with DT&RM and set the scene for the next research phase rather than generalise across individuals, the next qualitative participatory video-making phase gave me the opportunity to gain an in-depth understanding of the quantitative data of the first phase (Cohen et al., 2011).

For the qualitative phase of the main stage of the study, I used two different non-probability sample strategies: convenience and participant-driven snowball sampling. The convenience sampling method was used to choose the initial group of participant-collaborators who volunteered to take part in the research. To determine the representativeness of the sample, I selected four participants (two female and two male) from each population group under study (students and teachers) who were willing to collaborate in video-making. Following the principle of the participatory video, which involved collaborating with participants in collecting their own video data (Lunch & Lunch, 2006), respondent-driven snowball sampling gave freedom to collaborators to select participants of their own choice who were going to be involved in research (Cohen et al., 2011). As such, I gained access to a wider group of participants who were not selected by me. To ensure homogeneity and equivalence between different participants, I provided the same

instructions to all collaborators, instructing them to interview only those participants who belonged to their population group (students interviewed students and teachers interviewed staff employed at the college). The total population of participants selected for the qualitative second phase of the main study consisted of n = 50 participants (n = 26 students and n = 24 teachers). For more details about the sample size for each part of the study, see Table 1 below.

Table 1: Sample size for each part of the study

	Pilot study		Online survey questionnaire		Participatory video-making, in-depth semi-structured interviews			
Sampling methods	Convenience		Self-selection		Convenience (participant-collaborators, in-depth, semi-structured interviews)		Snowball (number of participants interviewed by participant-collaborators)	
	Female	Male	Female	Male	Female	Male	Female	Male
Students	-	3 (100%)	178 (42.9%)	237 (57.1%)	2 (50%)	2 (50%)	10 (45.5%)	12 (54.5%)
	n = 3		n = 415		n = 4		n = 22	
TOTAL number of student participants	n = 444							
	n = 190 (female) (42.8%)				n = 254 (male) (57.2%)			
Teachers	-	3 (100%)	62 (47.3%)	69 (52.7%)	2 (50%)	2 (50%)	9 (45%)	11 (55%)
	n = 3		n = 131		n = 4		n = 20	
TOTAL number of teacher participants	n = 158							
	n = 73 (female) (46.2%)				n = 85 (male) (53.8%)			
Total per study	-	6 (100%)	240 (44%)	306 (56%)	4 (50%)	4 (50%)	19 (45.2%)	23 (54.8%)
	n = 6		n = 546		n = 50			
					n = 8 (16%)		n = 42 (84%)	
TOTAL number of participants	n = 602							
	n = 263 (female) (43.7%)				n = 339 (male) (56.3%)			

The pilot study: What I learned and changes made in advance of the main study

The pilot study was conducted during an educational trip to the Computer Video Games Show at Wembley Arena in London. Designed to facilitate further development and fine-tuning of participatory data collection as the primary research method used in the main study, the pilot study used participatory photography as research practice. It also provided an opportunity to evaluate the potential digital differences between students' and teachers' attitudes towards computer video games among a small sample of participants addressing the following question: *What are the differences, if any, between students' and teachers'* attitudes towards computer video games as one of the new cultural forms of digital technology? (For more information about the pilot study, see Appendix A, p. 169). Using participants to gather visual data for further analysis and research enabled me to interpret and form assumptions regarding their relationships with DT&RM (Collier & Collier, 1986).

The results from the pilot study indicated some observable digital differences between students and teachers. These differences suggested that the two groups of participants maintained different kinds of personal experiences of digital video games that consequently influenced their preference for certain types of digital video games and activities at the show. The results obtained from the pilot study helped further articulation of the issues and focus of the research and determined if a larger study was necessary.

Although using still photography as a research instrument produced visual data that I used as a reflective tool for further research and data analysis, I found its use as a method of data collection limiting. The primary limitation was closely related to the aim of the study. As the aim of the study was to compare students' and teachers' relationships with DT&RM, still photography produced data that was limited in terms of nonverbal cues and visual information about human relationships with technology, which were only later fully explained in photo interviews with participants (Collier & Collier, 1986). Therefore, by

moving from still images and encouraging participants to use a video camera, I was able to evaluate their relationships with technology more directly and create a more detailed picture of the sample. As participants were free to produce video data of activities and interviews of their choice, this enabled them to have a voice, and me to have more straightforward data of their relationship with technology (Banks, 2001).

The second limitation in the process of recording data was related to the role of participants in the process of recording images. Pink (2007) argues that by using a digital camera, each participant creates specific meaning unique to his or her personal experience, knowledge, and cultural background. In addition, Schwartz (1989) suggests that we need to consider the role of participants in the process of recording images, as some may perceive taking photographs as a mechanical recording of events rather than a symbolic articulation of their views. Although the use of a video camera by participants for data collection still has the same problems of the individual's interpretation of the event being recorded, the advantages of visual data produced in time and space through the processes of conversation and negotiation between collaborators and the subjects offer a deeper understanding of the social aspects of human behaviours and their relationships with the reality around them (Collier & Collier, 1986).

Data Collection and Data Analysis

Online survey questionnaire

This phase of the study was guided by a specific research question: What are the distinctions, if any, between how students and teachers use, perceive, and experience DT&RM in their everyday lives and daily educational practices? The data collection method used for this phase of the study included online survey questionnaires administered to students and teachers.

Instrumentation

The survey was developed with the aim of gaining a wider understanding of students' and teachers' relationship with DT&RM, by exploring use, experiences, attitudes, and perceptions of technology in the context of everyday teaching and learning activities. There were two types of questionnaires: one aimed at students, and the other for teachers. Each was divided into four sets of questions. The first set of questions assessed general usage of DT&RM in the context of the type of digital devices used and the frequency of use. The second and third sets of questions captured trends and patterns of students' and teachers' beliefs, attitudes, perceptions, and self-perceptions in relation to the use of DT&RM in everyday teaching and learning practices. The final set of questions captured demographic data relevant to the research topic. All questions were self-reported and designed to capture both categorical and ordinal data using the Likert-type rating scale. The data from the questionnaires was analysed and presented using descriptive statistics, tables, charts, and graphs. Table 2 illustrates the brief review of specific survey questions with research constructs and respective measurement items. A full copy of the questionnaires is included in Appendix B (p. 178).

Table 2: Specific research questions with research constructs and respective measurement items

Specific research question: What are the distinctions, if any, in how students and teachers use, perceive, and experience DT&RM in everyday life and daily educational practices?		
Set of questions	**Specific survey question**	**Measurement scales and items**
Access and use of technology	• Which of the following digital technology items do you use? (including desktop/laptop computers, tablet computers, standard mobile phones, smartphones, e-books, computer video games, digital video cameras, MP3 players, DAB digital radio, Internet-enabled TV)	• Categorical variables: binary question (1 = yes / 0 = no)
	• How often, on average, do you perform the following activities related to specific DT&RM? (including Web 2.0, smartphone functions, computer video games, other media activities)	• Ordinal variables: Frequency – 8-point Likert-type scale 8= Several times a day 7 = Daily / Almost daily 6 = Several times a week 5 = About once a week 4 = Several times a month 3 = About once a month 2 = Rarely 1 = Never
Beliefs and attitudes	• What are your beliefs regarding the attitude that most of the teachers/students have towards the use of the DT&RM? (students asked to identify *teachers' and teachers students' attitudes*) • What is your attitude towards the use of DT&RM?	• Ordinal variables: Beliefs – 5-point Likert-type scale 4 = Very true 3 = Somewhat true 2 = Somewhat untrue 1 = Very Untrue 0 = I do not know
Perceptions	• What is your perception of the benefits of DT&RM in the classroom? • What is your perception of the barriers to DT&RM in the classroom?	• Ordinal variables: Level of agreement – 6-point Likert-type scale 5 = Strongly agree 4 = Agree 3 = Neither agree nor disagree 2 = Disagree 1 = Strongly disagree 0 = Do not know
	• How do you perceive yourself and your skills in relation to DT&RM?	• Ordinal variables: Level of expertise – 6-point Likert-type scale 5 = Expert 4 = Advanced 3 = Average 2 = Beginner 1 = Sceptic
Demographics	• Gender	• Categorical variables: binary (1 = male / 0 = female)
	• Age	• Ordinal variables: o Students: 4 = 16–19 3 = 20–25 2 = 26–31 1 = 32–45 o Teachers: 5 = 16–25 4 = 26–31 3 = 23–45 2 = 46–55 1 = 55+

Internet surveys are very popular and are relatively new forms of collecting data. The main advantages of internet surveys in comparison to other methods of data collection, such as telephone interviews, face-to-face interviews, and mailed questionnaires are an easy distribution across a large area with no or extremely low cost and speed of data collection. However, internet surveys have similarities with mail surveys as they are also self-reported, anonymous, and can have a visual aid; online questionnaires have several advantages over them. Internet distributed questionnaires may include skip patterns allowing participants to skip questions that are not relevant to them; a visual aid can be more advanced and can include not only pictures but video clips, animations, pop-up instructions, and even audio (Czaja & Blair, 2005).

Disadvantages of web-administered questionnaires are access to The Internet, as well as the level of digital literacy of the targeted population, which can produce a biased sample and low response rate, which is usually lower than mail surveys of similar populations (Couper et al., 2001). Compared with mailed questionnaires, online questionnaires have to be relatively shorter to avoid high rates of nonresponse (Couper, 2008). In addition, researchers conducting online surveys do not have control over participants, where and who is answering the questions (Czaja & Blair, 2005).

Data analysis

After the research results had been collected, the first step in the analysis was "to ensure that data was 'clean'" (Kumar, 2005, p. 220). This process of cleaning, referred to by Kumar as editing, involved examining the collected data and looking for possible errors, incompleteness, and gaps in the information. In the case of survey questionnaires, the exclusion criteria included incomplete or erroneous questionnaires.

The quantitative phase of data collection was aimed at ranking participants by the frequency of self-reported statements. Descriptive statistics were used for data analysis to determine how much variation exists within the specified population of teachers and students. The first step in the data analysis was the compilation of raw data. The data was then grouped by common themes that described the participants' motivations, perceptions, and attitudes towards the use of DT&RM in education. After the data had been organised by modal frequency, it was possible to identify further dominant patterns in the data (e.g. trends in motivations, attitudes, digital practices, and ownership/access). Also, it was possible to map the dispersion of these trends among students and teachers. To summarise and analyse this data prior to making descriptive statistics, means and percentages were used. The purpose of this was to classify the participants, and in doing so, determine how digitally savvy they were in order to prepare for the second stage of the research. To compare and analyse the data between students and teachers, cross-tabulation was used. A table was generated to indicate how two given categories of students and teachers are related to certain variables.

However, since individual participants within identified groups can have very different ages, to control age as an important variable, it was essential to make distinctions within the same group of those participants who were above the age where they could have been born surrounded by digital technology. Therefore, in accordance with the definition of the digital immigrants and digital natives metaphor (those who are born before or after 1980 respectively) I adopted the age range for digital natives between 16 and 31, and that of digital immigrants between 32 and 55+. When interpreting results, efforts were made to determine whether the data differed as a function of participants' age. Table 3 shows the range of participants' ages according to the digital natives/immigrants definition.

Table 3: *Adopted range of participants' age according to digital natives/immigrant*s metaphor

STUDENTS RESPONDED, BY AGE

Digital natives			**Digital immigrants**
16–19	20–25	26–31	32-45
16–31			

TEACHERS RESPONDED, BY AGE

Digital natives		**Digital immigrants**		
16–25	26–31	32–45	46–55	55+
16–31		32–55+		

Participatory video

This stage of data collection addressed the second and third research questions:

- What are the factors that motivate students and teachers to use DT&RM in their everyday teaching and learning practices?
- How do students and teachers negotiate their digital relationships with technology, and what kinds of technical requirements, solutions, and moral conflicts emerge as a result of the negotiation?

Instrumentation

During this stage of the research, two methods of data collection were used: participatory video production and in-depth, semi-structured interviews eliciting further responses from participant-collaborators about their experiences of the filming and specific issues raised in the video material. This part of the research was conducted in four separate stages of a collaborative video production process.

1. Meeting with participant-collaborators
2. Video production
3. Preparation of video material for screening
4. Screening of the footage and interviews with participant-collaborators

A very important part of engaging participants in video production was meeting with them and making sure they had a clear understanding of their roles, what is expected from them, the focus on the project and research questions, and how to use video equipment.

At this stage, I met individually with eight participants (n = 4 students and n = 4 teachers) who I engaged to co-operate in the production of video data. Their roles were those of collaborative researchers. I met each of the participants individually, providing them with a Video Recording Guide that consisted of the objectives of the project, as well as basic principles and guidance about participatory video production (see Appendix C, p. 196). The meeting was initiated with the question, 'What are the issues that are important to you' (Gubrium & Harper, 2013, p. 95)? In doing so, I stimulated discussion and helped participants to understand the phenomenon being investigated and to stimulate their creative approach to video-making. During initial discussions, notes were taken whilst participants were given more specific guidelines for the project and the technical aspects of video production.

Once the eight collaborators (n = 4 students and n = 4 teachers) who co-operated in the production of video footage completed their video recordings, the data were handed back to me. The recorded material consisted of video data and semi-structured interviews that followed the video recording guide. The video material, I received, was not edited or manipulated; however, I placed it on a timeline in order to screen the footage to individual participants for further analysis (Heider, 2006). While organising video material for screening, I looked at the data as a whole, analysing, connecting, and contrasting patterns, as well as writing down the questions stimulated by data for detailed analysis. Following the initial viewing of the footage, I organised separate sessions with the participants who filmed the video footage. After a one-to-one viewing of video material with the participants, I conducted in-depth, semi-structured interviews. The interviews were recorded with a video

camera, and footage was later used for further analysis. During these sessions, further field notes were made relating to participants' comments on their role and experience in video-making.

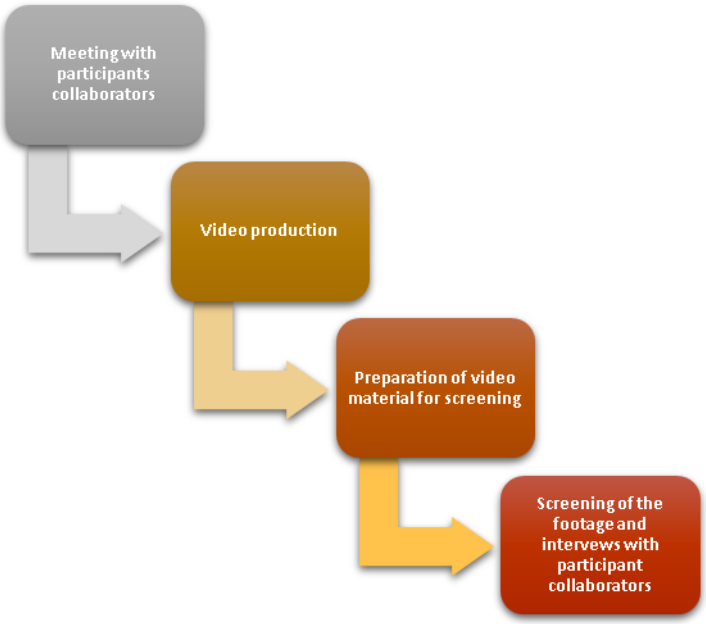


Figure 5: Participatory video production

Data analysis

The video footage provided not only a complete record of interviews (verbal, non-verbal expressions, material inventory, contextual relationships, general feel of the scene) making possible a closer examination of the data, but was also used as a tool to engage participants in data analysis (Mitchell, 2011; Pink, 2007). To process the video data and to organise qualitative research, Computer Assisted Qualitative Data Analysis (CAQDAS) was used. The acronym CAQDAS refers to a wide range of software packages concerned with analysing "text, visual and multimedia forms of non-numerical data" (Lewins & Silver, 2007, p. 7). It assists the qualitative analysis of data by enabling thematic coding and retrieval of coded data without losing information on the source of the data (Gibbs, 2007). For the purpose of this study, the CAQDAS software package I used was ATLAS.ti6, its advantage

being that it facilitates multiple methods of data collection. As such, it allows processing of any digital format of data, including video footage.

Prior to importing video data into ATLAS.ti6, I used Adobe Premier Pro CS6, a video-editing software. This allowed me to create compilations of short video clips that were later presented to individual participant-collaborators for analysis during the semi-structured interviews. During this process, I did not edit video footage but rather structured it by placing the video clips into a timeline by categorising and coding the segments that related to the common themes identified in the video interviews. For example, if participants were talking about barriers experienced in using DT&RM, all participants' answers were placed under the title Barriers. As such, during the process of viewing, both analysis and coding of data occurred simultaneously in preparation for further analysis. Coding as the method of data processing enabled me to organise data into categories by attaching tags or labels so that it could be easily retrieved for further understanding and analysis (Gibbs, 2007; Kumar, 2005; Miles & Huberman, 1994).

Codes can take different forms, from simple to more complex categories. In qualitative research, coding can be stratified into three distinctive types: descriptive, categorical/topical, and analytical. Descriptive coding — the simplest and most basic level of coding — involves attaching basic attributes about participants or topics of inquiry by their attributes, for example, students, teachers, age, gender, etc. (Gibbs, 2007). Categorical/Topical coding is still a descriptive type of coding, but in this type of coding, we need to move away from simple descriptions to codes that involve "little interpretation" (Richards, 2009, p. 97). This type of coding is done mainly by identifying and allocating parts of data to topics, giving an interpretation of what has been coded. For example, "this is about students' use of social media" clarifies what is contained in the text. Analytical coding — although some degree of analysis exists in the two previous types of coding —

involves moving from describing the data to making an interpretative judgement and adding a layer of meaning to data coded by previously described types of coding (Miles & Huberman, 1994).

As Gibbs (2007) suggests, these different types of coding often represent different levels and stages of data analysis, so I have used them at various times of the qualitative phases of the study. Therefore, as part of the initial coding process during the editing stage, video data was labelled by the use of descriptive and categorical codes and organised for viewing and further participant analysis. Once I imported the data into ATLAS.ti6, I used a coding scheme generated by employing a mixture of deductive and inductive approaches to code construction.

Lewins and Silver (2007) outlined the way of generating codes for further data analysis by describing a deductive and inductive coding approach. In deductive coding, the development of codes precedes coding of the data. The codes are generated by looking at the theoretical ideas, research topics, and previous research with the aim of empirically testing their applicability, often starting in a descriptive way. This involved viewing video footage created by collaborators and categorising the video segments by codes that relate to existing generational divide theories, the previous quantitative phase of the study, and research questions. The codes created in this manner have been presented in Table 4. Each code presented in the Deductive Coding Scheme had two descriptive categories: students and teachers.

Table 4: Deductive Coding Scheme

Codes
Use of DT&RM
Benefits
Barriers
Motivation to use DT&RM
Forms of negotiation
Limitations
Confidence
Perceived issues with technology
Generational divide
Digital divide
Confidence with DT&RM
Future
Would like to add to existing DT&RM

The next coding method considered in this study involved inductive coding procedures. These procedures involve a bottom-up approach characterised by a thorough inspection of the data starting from organising raw data, through grouping the data towards a higher level of abstraction. The codes were generated by capturing the key themes, patterns, and categories important to the research objectives. Lewins and Silver (2007) go further and distinguish three inductive coding procedures (originating from Glasser & Straus, 1967): open coding, axial coding, and selective coding. Open coding, often referred to as in vivo coding, was used during the viewing and transcribing of video data, generating a large number of codes based on the language used in the data (Lewins & Silver, 2007). On completion of this phase, in the second run through the data, I used the axial coding procedure, redefining already existing codes by merging, relating, and grouping similar

codes into a coding hierarchy, and then subdividing them into more detailed codes (Gibbs, 2007). Please see Figure 5 for codes organised into a code hierarchy.

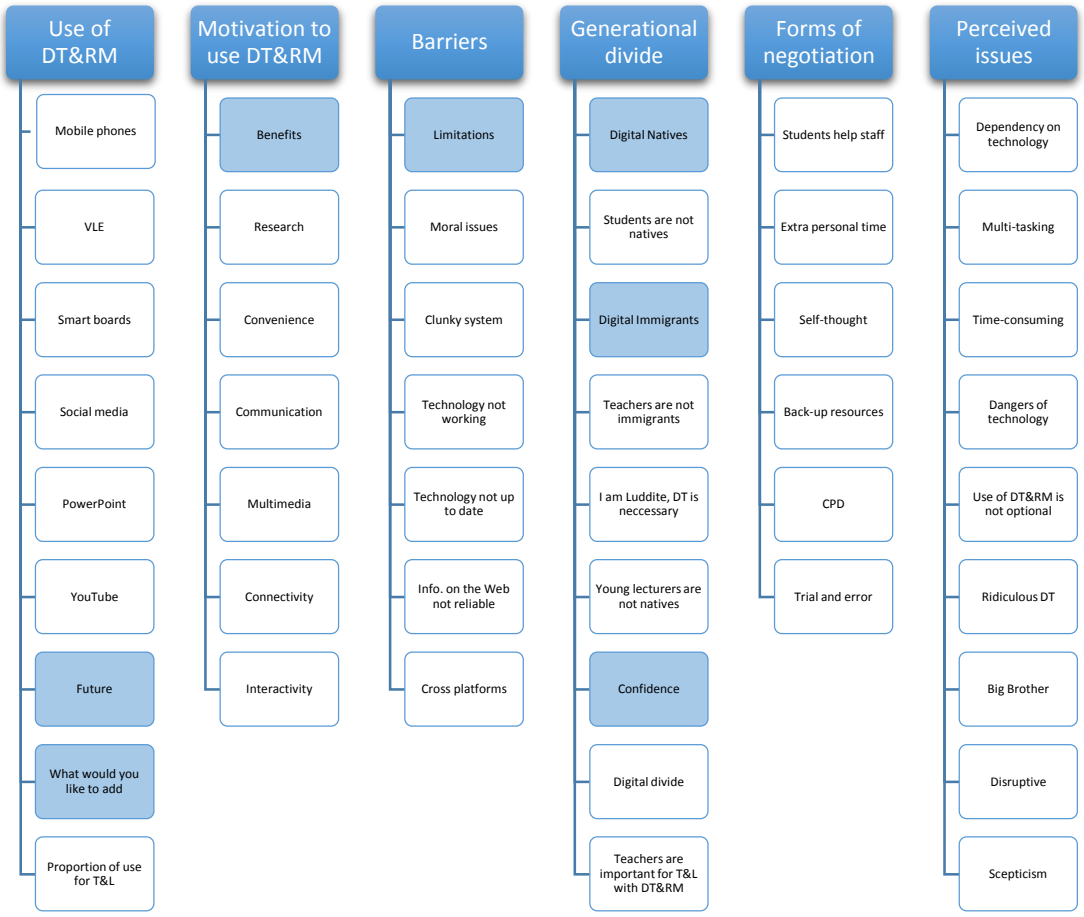


Figure 6: The code hierarchy

Therefore, my analytical lens for the qualitative phase of the research began with a deductive approach generating descriptive and categorical codes from research literature, research questions, and results of the quantitative phase of the research, followed by inductive groups of codes emerging from detailed analysis of qualitative data using the CAQDAS software package ATLAS.ti (see Figure 6).

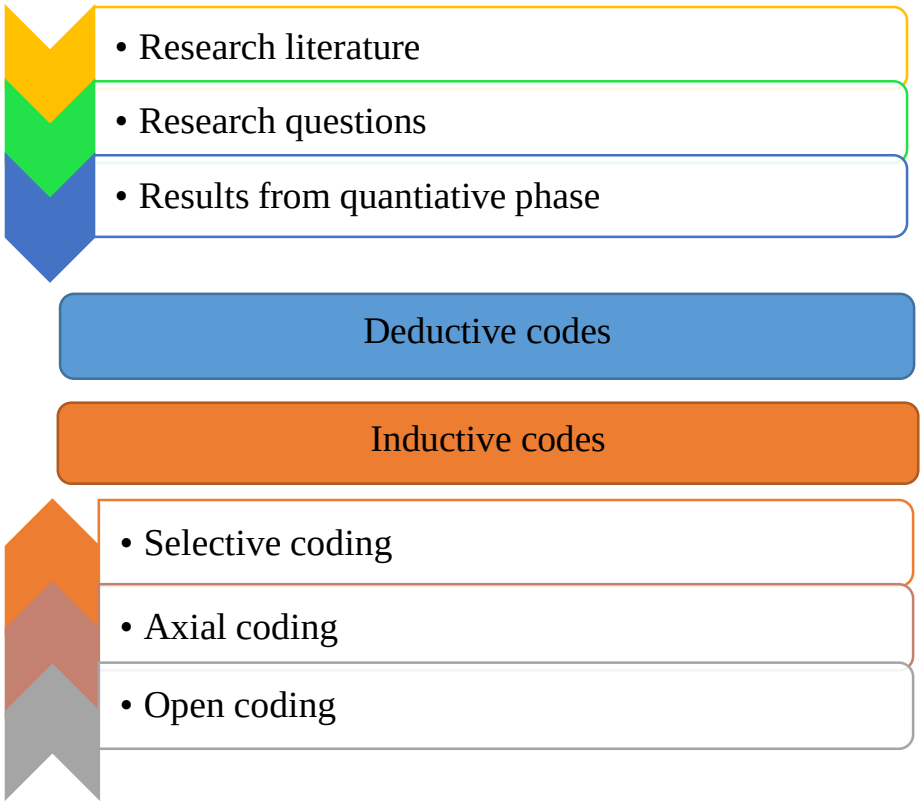


Figure 7: The deductive and inductive approaches to generating codes

Besides coding and retrieval of codes, functions common to all CAQDAS software, ATLAS.ti also offers the creation of quotations, hyperlinks, and memos, as well as a hierarchical category system showing relationships among codes and categories. CAQDAS software offers flexibility in handling and capturing a vast amount of code and other useful information for data analysis; however, it cannot generate interpretations or conclusions. (Lewin & Silver, 2007). Therefore, a methodical approach was used to make sense of and analyse the data and to present findings. Cohen et al. (2007) noted that there is not one single or correct way to do this, and therefore, suggest "abiding by the principle of fitness for purpose" (p. 461). As this study is looking to address in what way students and teachers — as two distinct social groups — differ in terms of how they relate to digital technology in the context of everyday teaching and learning practices, I was looking to identify commonalities, differences, and similarities between them. As such, I applied constant comparisons between

the codes, themes, and patterns, and triangulation of different types of data collected during different quantitative and qualitative phases of the study. This continuous comparative approach began right from the first pilot stage of the study and continued through all stages.

Reflection on my role as an 'insider' researcher

I studied the relationships and experiences that teachers and students have with digital technology in everyday educational practices at an FE college, where I have worked as a teacher and the curriculum manager of the media department for the last 15 years. It is an FE and HE College in South East England founded after the Second World War, with a population of students of different ages, ethnicities, class backgrounds, and learning abilities. As a media teacher and a person with professional media experience, I am an avid user of many technological devices and applications and have a passionate and developed interest in technology. This passion and the professional interest in the integration of DT&RM in everyday teaching and learning activities have been the main drivers of my interest in the diffusion of digital technology in education and influenced my choice of research topic.

Although the preceding description places me firmly within an insider research perspective, insider and outsider perspectives are not mutually exclusive research positions. Mercer (2007) questions the dichotomy of "insiderness and outsiderness as an 'either/or'" (p. 13), concluding that we cannot judge "one as better than the other" (p. 13). As it is difficult to have someone who can be classified according to only one attributing status, we are all insider researchers, even if we are conducting the research outside of our places of work or familiar communities. For example, even if I had chosen to do the research outside of my place of work in another FE college, I would still have common attributes with other members of FE staff, which would never truly make me an outsider researcher. For this reason, Dwyer and Buckle (2009) believe that in our choice of the place and research

subjects, we will be closer to either an insider or outsider position; however, we will never be able to occupy only one of these positions.

Being an insider researcher at one's own place of work, suggests Westberry (2011), can have certain benefits and place an investigator in a unique position to have the degree of access to participants and institutions that would be difficult to obtain for an outsider researcher. Concurrently, argue Costley et al. (2010), the investigator will be in a position to study a specific issue in depth and with special knowledge. However, while these benefits might be an advantage, they can at the same time be seen as challenges with a number of ethical and practical considerations that might not apply to an outsider researcher.

In this particular study, the primary challenge in the context of being an insider researcher was the problem of holding two roles, one as a researcher and the other as an employee. While the role of the insider researcher promises advantages regarding access to the institution, participants, and work practices unlikely to be obtained by an outsider researcher (Westberry, 2011), the challenges an insider researcher faces often have very specific methodological and ethical implications. For instance:

- "Ethical issues around disparities of power" (Trowler, 2011, p. 3): Issues of bias and asymmetric power in my relations with my colleagues;
- "Ethical implications of sharing insider knowledge with outsiders" (Westberry, 2011, p. 1290): Problems with confidentiality, anonymity, and informed consent; and
- Challenges of "gaining access to research participants" (Costley et al., 2010, p. 48): The differences between gaining access and gaining co-operation as two distinctive activities.

Bias and asymmetric power relationship

Since my role as curriculum manager implies the existence of influence and power in relation to staff and students I have direct responsibility for, as well as pre-existing rapport and relationships, in my role as researcher, I encountered issues of power and bias. Although some authors indicate that familiarity and close relationships between researcher and participants can encourage openness and honesty of subjects and, therefore, enrich findings (Breen, 2007; Costley et al., 2010; Dwyer & Buckle, 2009; Rooney, 2005), this itself can create pre-formed expectations so that subjects feel obliged to participate, or in their response, agree with the researcher in a way that can change their responses and, therefore, can be considered as bias (Trowler, 2011), leading the insider researcher to feel that his/her perspective is far more widespread than it actually is (Mercer, 2007). In order to minimise this particular type of bias, I recruited participants from departments in which I did not have power and authority over staff or students. Although this removed any interaction with colleagues and students, I was directly related to my workplace; there was still a problem of familiarity with the workplace, insider's knowledge, and personal experience, which could lead to a loss of objectivity (Breen, 2007). In an effort to further reduce subjectivity, I adopted the idea of collaborating with participants in the collection and analysis of the data.

By choosing participatory research as a process of generating knowledge through a collaborative process in which the different experiences and skills of each participant are critical to the outcome of the work (Brydon-Miller, 2013), I wanted to have a model of enquiry in which, by transferring power to participants, I ensured that the collection and data analysis were not imposed autocratically by pursuing my own agenda: private or academic priorities (Costley et al., 2010). This, suggest Costley et al. (2010), creates an ethically constructive model in which elicited data is shared, and founded on participants' experience.

Problems of confidentiality, anonymity, and informed consent

Due to the nature of my position as an insider researcher as well as the chosen principal method of data collection for my study (i.e. a collaborative approach), anonymity and confidentiality presented a particular ethical problem (Guba & Lincoln, 1994). Since researchers are committed to documenting and making their findings public, Wiles et al. (2006) argue that in social research, confidentiality is difficult to attain, being easier to promise than achieve. What the researcher can do is anonymise data as much as possible within the type of their research so that participants' identities are protected and cannot be identified by the information provided (Cohen et al., 2007). In the same way, as confidentiality requires anonymity, anonymity asks for informed consent. Informed consent, Christians (2013) claims, arises from the respect of individuals' right to freedom and includes two necessary conditions: one which involves subjects' rights to self-determination and, therefore, voluntary agreement about participation, and the other by which voluntary agreement must be based on the full and open information.

Adopting a participatory method of data collection, in which I was collaborating with participants, to minimise the impact of the potential biases of an insider researcher, ethical issues of confidentiality, anonymity, and informed consent were more complex than in a traditional model of research in which the researcher is directly involved in researching participants. This shift in power dynamics, suggest Gubrium and Harper (2013), holds huge implications as we have participants in the project with different levels of participation, from those who are collaborating as researchers to those who are the subjects of the research. To deal with this, I addressed the issue of informed consent at various stages of the research. Thus, as the research design had two distinct stages, and consent to the participatory project should at no time be a one-time process (Gubrium & Harper, 2013), I ensured that participants were informed about the research process at all times whilst assuring them that

all efforts had been made to protect their identity during the research and after, in the research report and other forms of dissemination. Therefore, I discussed issues of consent with my participants at each stage before data was collected. I asked them to sign the consent form once they fully understood the aims of the study and the research activities, giving them written confirmation that their anonymity would be protected at all times (Gubrium & Harper, 2013). Specific consent was given for video data, indicating that video footage would be used only for purposes of further analysis, and that information from visual data would be represented in the final research report through a written description of video footage. At all stages of the research, participants were informed that their contribution and involvement in the project was voluntary and that they were free to withdraw at any time without any consequences. Furthermore, participants were assured that all data was coded in such a manner that no individual could be identified and that the data would not be used or disclosed for purposes other than those identified in the research project.

Sharing power and information with participants reduced personal risk to them as they had full control over the level of involvement in the project, but the use of participants as collaborative researchers made anonymity and confidentiality difficult to obtain. Placing participants in the role of researchers meant that it was difficult to have direct control over their choice of subjects and their outcomes. To ensure that all subjects involved in the research participated with fully informed consent, I provided participant researchers with a separate consent form to be given to all subjects who participated in their investigation, ensuring that all of them were fully informed about the project and their involvement in it.

Differences between gaining access and gaining co-operation as two distinctive activities

Being an employee of the college, I did not anticipate difficulties in gaining permission from the college gatekeepers to administer my research. I was led to believe that as an insider researcher, the necessary step to obtain permission for access to participants was that of writing a formal letter with a description and details of my project. In my letter to the college, in order to establish the credibility and legitimacy of my research (Shenton & Hayter, 2004), I drew attention to the fact that the study had been granted ethical approval after review by the Canterbury Christ Church University Research Ethics and Governance Committee, affirmed the safety of participants, explained the methods and phases of the research, offered anonymity and confidentiality, cooperation, and openness to suggestions, and promised to share any findings with the organisation. The letter was discussed at a senior management meeting, and the general approval of the study was granted with access to the participants made consequential on questionnaires being approved by the Principal prior to their final administration.

After gaining conditional access, my next step was to gain full co-operation from internal gatekeepers and participants for the practical task of data collection for my study. However, what I was about to experience was that gaining access to conduct research did not automatically mean gaining co-operation from gatekeepers. While the words are often used as synonyms, gaining access and gaining co-operation from gatekeepers are "two distinct processes" (Wanat, 2008, p. 191). My experience during this project very much echoed this. In my role as the curriculum manager of the media department, I have also been a member of a small ILT Steering Group with the aim of developing a stimulating learning environment by use of DT&RM. To secure a wider population sample and ensure their co-operation, I used the advantage of being a member of the Steering Group. Believing that a common goal among multiple individuals would spontaneously spark co-operation, at the

next meeting of the group, I presented my project and asked its members for constructive feedback and active support in working with participants and collecting data. In return, I offered to share my findings and to be open to further suggestions and suggested that any discoveries from the research could be used for the purposes of further development and use of technology at the college. The project was welcomed by all members of the group, my proposal was noted in the meeting's minutes, and all points of action were recorded. I was requested to send my survey questionnaires to all members of the group for feedback and further suggestions. This particular outcome was very encouraging, and on a personal level, signified that co-operation between myself and the college had commenced. However, what I was to learn next was that a general abstract agreement of individuals is not sufficient for concrete co-operation (Ratner, 2013). Therefore, it was not a surprise that I did not receive any responses to my e-mail containing survey questionnaires from members of the Steering Group. After another futile attempt at sending a casual e-reminder to my colleagues from the group, I decided to visit them and hold face-to-face discussions about the questionnaires. In the end, it took me several months of lobbying my colleagues and the chair of the group to finally look at my questionnaires so I could pass it to the Principal for final approval and move on with the project.

The experience I have described above was in contrast to the claims that the insider researcher has easier access to information and participants, and that data collection consumes less time (Mercer, 2007). However, Costley et al. (2010) argue that even though access might seem simple and not particularly problematic, as organisations are dynamic places, there are many issues to be considered which may vary between different institutions. The problem I experienced in gaining access as an insider researcher was not in getting general permission from the senior management team but rather going through internal college procedures. While the negative impact of those procedures on my study was not

intentional, and it could be argued that what was asked of me was reasonable, it reflects an absence of trust and the view of research as lacking in value. This is the result of cultural changes in which, due the incorporation of FE colleges in 1993 to bring them more into line with the organisational structure of the commercial sector, they have to compete as a business in the vocational education and training market (Harper, 2000). This has brought to the FE sector the bureaucratic model, where under the government's pressure to evaluate FE performance through targets and performance measure and the constant threat of government interventions and restrictions (Pring et al., 2009), FE colleges are forced to manipulate the system and adopt strategies which will secure their continued existence (Lumby, 2001).

Consequently, in the context of interests as the prime motivators of action, my colleagues from the ITL Steering Group, have been lost between economic imperatives of post-incorporation practices focused on measured outcomes as primary indicators of success and the daily demands of their educational production "based on reflection, active enquiry and creative synthesis" (Lester, 2011, p. 7). This limits the co-operation, creativity, and the tendency to take risks of academic staff, forcing them into playing a game rather than concentrating on the true purposes of the educational endeavour (Bottery, 2003).

Summary

This chapter presented the methodological considerations, described the research design and sampling strategies, and outlined the stages of mixed methods research used in the study. Finally, the chapter closed by looking at my role as an insider researcher, as well as the ethical considerations and practical problems I experienced in terms of gaining access to and co-operation in research. The next chapter presents the findings of the quantitative and qualitative phases of the study.

CHAPTER FOUR

FINDINGS

Introduction

The purpose of this research study was to answer the principal question: In what ways do students and teachers differ in how they relate to digital technology in the context of teaching and learning practices? In this chapter, the results of each of the research stages have been presented and summarised.

Quantitative Data

Online survey questionnaires

This phase of the study was guided by a specific research question: What are the distinctions, if any, between how students and teachers use, perceive, and experience DT&RM in everyday life and daily educational practices? The self-reported web-based survey questionnaires were designed with four sets of questions related to access and use of technology, attitudes, perceptions, and demographics. All questions were self-reported and designed to capture categorical and ordinal data using the Likert-type rating scale. The data from the questionnaires was analysed and presented by using descriptive statistics, i.e. tables, charts, and graphs.

Description of population

The sample size was n = 546. The student population consisted of n = 415 (male n = 237, 57.1%; female n = 178, 42.9%). Over-representation of a male population in the students' study sample was statistically significant since the proportion of males was different from the anticipated 50%: $\chi^2_{(1)} = 8.39$, P = 0.004 (for statistical significance P < 0.05). The remainder of the sample was made up of teachers n = 131 (male n = 62, 47.3%; female n = 69, 52.7%). In this group, deviation from the anticipated 50% ratio of male to

female was not statistically significant: $\chi^2_{(1)} = 0.37$, P = 0.541. Similarly, gender comparison between the student and teacher population was also not statistically significant: $\chi^2_{(1)} = 3.46$, P = 0.063.

From the total number of students (n = 415) who responded to the survey questionnaire, the majority (80%) of students were in the age range between 16 and 19 years, and if I add to this percentage students aged between 20 and 31, which would still be considered as the digital generation, the percentage of the digital natives group increases to 96.4%. Teachers' largest population ranged between 32 and 55+ years (75.5%), leaving 24.4% of teaching population who are less than 32 years of age and young enough to be considered as part of the digital natives generation. For more details about population distribution by age, see Tables 5 and 6 below.

Table 5: Total number of students who responded, by age

16–19		**20–25**		**26–31**		**32–45**	
n	%	n	%	n	%	n	%
332	80	58	14	10	2.4	**15**	**3.6**
16–31 (natives)						**(immigrants)**	
n		%					
400		**96.4**					

Table 6: Total number of teachers who responded, by age

16–25		**26–31**		**32–45**		**46–55**		**55+**	
n	%	n	%	n	%	n	%	n	%
6	4.6	26	19.8	41	31.3	37	28.2	21	16
16–31 (natives)				**32–55+ (immigrants)**					
n		%		n		%			
32		**24.4**		**99**		**75.5**			

Usage of DT&RM devices

With the aim of providing a single snapshot of participants' general access and use of technology, the first part of the questionnaire related to access and use of technology began with two types of questions, identical for both students and teachers. One type measured categorical variables of access and usage of technology, and the other measured ordinal variables in terms of average time spent on related activities involving specific technology, presented by means and standard deviations for scores of the Likert-type point scale.

The first set of questions began with 11 simple binary agree-disagree questions. The students and teachers were asked to answer the question, Which of the following digital technology items do you use? The percentage of students and teachers who used digital technology items was sought under Question 1 and was calculated. A comparison of the same between students and teachers was carried out by using the Chi-square test with Yates's continuity correction (for more information on the Chi-square test with Yates's continuity, please see Appendix D, p. 199). Table 7 illustrates participants' response to the question showing the use of different digital devices among students and teachers as separate groups of participants relative to each other. A statistically non-significant test result (meaning that both students and teachers have similar proportions or means) was reported with '^{ns}' within the test statistics. Test results at a 5% level of significance ($0.01 < P < 0.05$) were indicated with '*' within the test statistic. Test results significant at a 1% level ($0.001 < P < 0.01$) were indicated with '**', and test results significant at 0.1% were indicated with '***' ($P < 0.001$).

Table 7: Use of DT&RM items by students and teachers

DT & RM item	Students (n = 415)		Teachers (n = 131)		$\chi^2_{(1)}$	P-value
	No.	%	No.	%		
Desktop/Laptop	414	99.8	131	100	0.0	1.0^{ns}
Tablet computer	230	55.4	76	58.0	0.18	0.674 ^{ns}
Mobile phone	191	46.0	65	49.6	0.38	0.536 ^{ns}
Smartphone	345	83.1	80	61.1	26.8	< 0.001***
E-book	70	16.9	62	47.3	48.8	< 0.001***
Video games	350	84.3	41	31.3	135.2	< 0.001***
Digital video camera	237	57.1	91	69.5	5.83	0.016*
Digital still camera	254	61.2	114	87.0	29.0	< 0.001***
MP3 player	312	75.2	77	58.8	12.3	< 0.001***
DAB digital radio	156	37.6	87	66.4	32.3	< 0.001***
Internet-enabled TV	264	63.6	62	47.3	10.0	< 0.001***

*** P < 0.001 (significant); * 0.01 < P < 0.05 (significant at 5%); ^{ns} P > 0.05 (not significant).

As depicted in the bar chart in Figure 8, with the exception of one student, all participants in the study used a desktop or laptop. Similar percentages of students and teachers were using tablet computers and standard mobile phones. A statistical difference was noted in the use of all other equipment. While students used DT&RM items like video games, smartphones, MP3 players and Internet-enabled TV for entertainment more often than teachers, teachers were more frequent users of still cameras, video cameras, DAB digital radios, and e-books. The e-book was the item used least by students (16.9%), and video games were used least by teachers (31.3%).

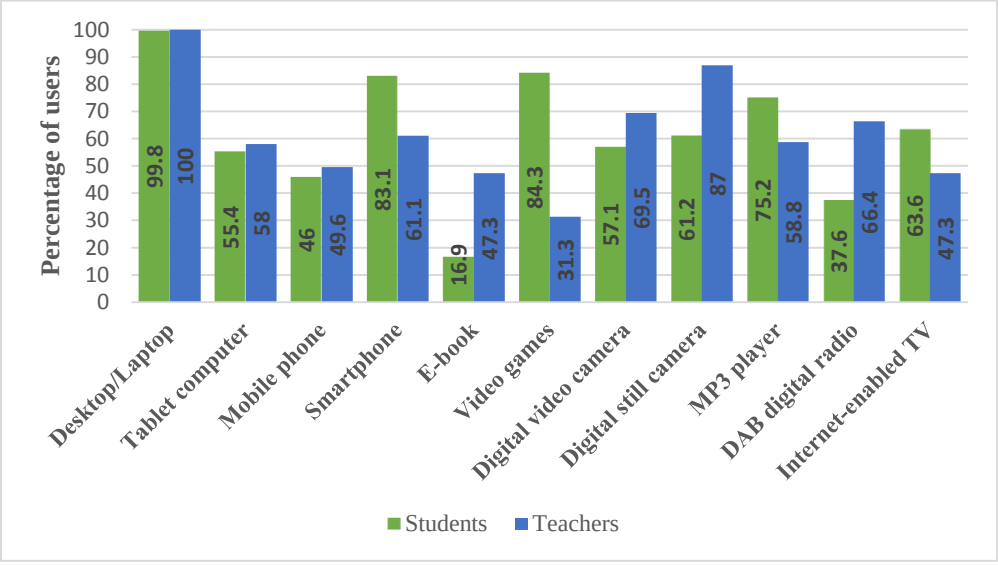


Figure 8: Users of DT&RM items among students and teachers

Average time participants spend using DT&RM related activities

The next set of questions, designed to collect ordinal data about use of the technology, utilised an eight-point Likert-type scale asking participants to answer questions about how often 'on average' they use specific DT&RM. The range of quantifiers for this set of questions ranged from: 8 = several times a day; 7 = daily/almost daily; 6 = several times a week; 5 = about once a week; 4 = several times a month; 3 = about once a month; 2 = rarely; and 1 = never. For these questions, in order to measure the frequency of how often students and teachers use DT&RM, I decided on three specific digital media (Web 2.0, smartphones, and computer video games). All of these allow interactivity, collaboration, and social media dialogue among users as a common characteristic of contemporary digital media. Equality of the distribution of proportions between students and teachers was carried out by using a Chi-square test with appropriate degrees of freedom. For each item, the mean score with standard deviation (SD) was reported, and the same were compared for similarity between students and teachers using an independent t-test. (For more information on statistical procedures used, see Appendix E, p. 200).

Engagement in Web 2.0 related activities

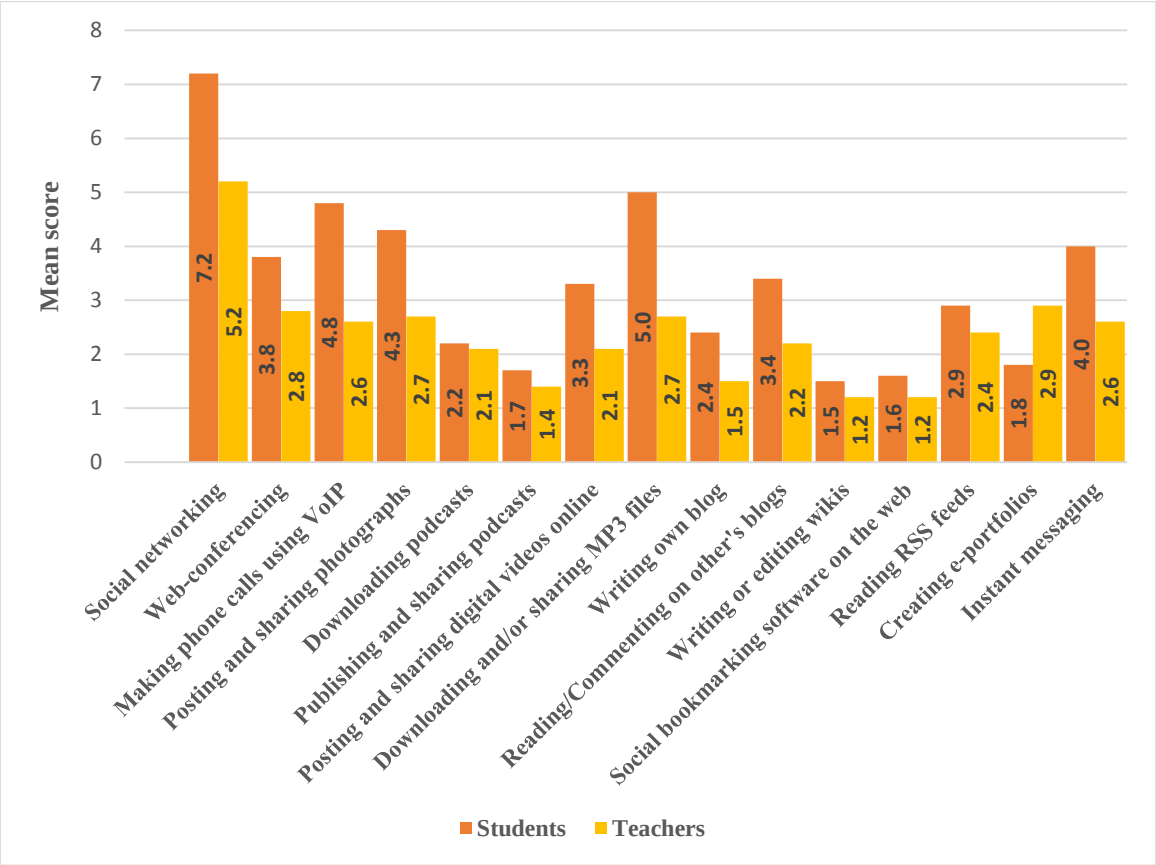
In the first set of questions, participants were asked to rate how often, on average, they engaged in Web 2.0 related activities listed in the questionnaire. The percentage distribution of students and teachers in the eight different response categories denoting the frequency of usage of 15 types of Web 2.0 related activities, ranging from 1 (never) to 8 (several times a day), has been depicted in Table 8.

Table 8: Percentage distribution of frequency of usage of Web 2.0 related activities

Web 2.0 activity		Response (%)								χ^2 (df)	Mean ± SD	t (df)
		1	2	3	4	5	6	7	8			
Social networking	S	3.1	1.9	0	0.7	2.7	7.2	25.8	58.6	99.2*** (5)[a]	7.2 ± 1.6	8.0*** (157.3)
	T	22.9	4.6	3.1	3.8	8.4	6.9	27.5	22.9		5.2 ± 2.7	
Web-conferencing	S	25.5	22.9	2.9	6.7	0.7	25.1	7.5	8.7	65.1*** (7)	3.8 ± 2.5	5.0*** (269.9)
	T	35.9	28.2	6.1	4.6	11.5	8.4	3.1	2.3		2.8 ± 2.0	
Making phone calls using VoIP	S	20.0	14.5	1.4	5.5	6.7	14.5	16.9	20.5	76.7*** (7)	4.8 ± 2.7	9.3*** (262.6)
	T	45.8	23.7	7.6	2.3	4.6	3.8	7.6	4.6		2.6 ± 2.2	
Posting and sharing photographs	S	23.9	14.9	4.1	7.2	8.7	13.3	16.4	11.6	48.8*** (7)	4.3 ± 2.6	7.1*** (274.7)
	T	43.5	15.3	9.9	12.2	6.9	3.1	7.6	1.5		2.7 ± 2.0	
Downloading podcasts	S	55.9	20.7	4.1	3.9	5.3	3.6	3.6	2.9	17.1* (7)	2.2 ± 1.9	0.62 [ns] (266.6)
	T	51.9	19.1	12.2	6.9	5.3	2.3	1.5	0.8		2.1 ± 1.6	
Publishing and sharing podcasts	S	75.2	11.1	3.6	1.9	2.7	1.9	1.2	2.4	2.74 [ns] (2) [b]	1.7 ± 1.6	2.95** (407.5)
	T	78.6	13.0	3.8	3.1	0.8	0.8	--	--		1.4 ± 0.9	
Posting and sharing digital videos online	S	35.4	20.2	6.3	6.0	7.7	7.7	7.5	9.2	34.3*** (7)	3.3 ± 2.5	6.7*** (358.3)
	T	53.4	17.6	11.5	7.6	5.3	3.1	1.5	--		2.1 ± 1.5	
Downloading and/or sharing MP3 files	S	13.3	10.1	7.2	7.7	10.4	18.8	15.2	17.3	93.7*** (7)	5.0 ± 2.4	11.2*** (276.0)
	T	40.5	15.3	11.5	16.8	5.3	6.9	1.5	2.3		2.7 ± 1.9	
Writing own blog	S	56.1	16.9	3.6	5.1	5.1	4.6	4.3	4.3	26.1*** (7)	2.4 ± 2.1	5.83*** (400.1)
	T	76.3	10.7	4.6	1.5	5.3	1.5	--	--		1.5 ± 1.2	
Reading/ Commenting on other's blogs	S	38.1	16.1	3.9	5.5	7.0	10.8	10.6	8.0	30.4*** (7)	3.4 ± 2.6	6.31*** (324.0)
	T	52.7	20.6	8.4	4.6	5.3	5.3	2.3	0.8		2.2 ± 1.7	
Writing or editing wikis	S	79.8	12.8	1.9	0.2	1.2	2.2	1.4	0.5	2.36 [ns] (1)[c]	1.5 ± 1.2	2.45* (378.8)
	T	86.3	9.2	0.8	2.3	1.5	--	--	--		1.2 ± 0.7	
Social bookmarking software on the web	S	80.0	9.9	1.4	1.4	1.4	1.9	1.9	1.9	8.14* (2)[b]	1.6 ± 1.5	3.65*** (414.1)
	T	90.8	4.6	2.3	0.8	0.8	--	--	0.8		1.2 ± 0.8	
Reading RSS feeds	S	48.7	14.0	4.6	4.1	6.3	6.7	9.6	6.0	14.7* (7)	2.9 ± 2.5	2.58* (256.1)
	T	58.0	9.9	9.9	4.6	3.1	6.1	6.9	1.5		2.4 ± 2.1	
Creating e-portfolios	S	67.5	17.6	3.4	2.2	3.4	2.4	1.4	2.2	43.7*** (7)	1.8 ± 1.6	5.1*** (171.7)
	T	45.8	13.7	6.9	6.9	6.1	9.9	6.1	4.6		2.9 ± 2.3	
Instant messaging	S	28.9	16.6	3.4	5.8	8.9	7.7	11.3	17.3	35.6*** (7)	4.0 ± 2.7	5.7*** (248.6)
	T	54.2	14.5	6.1	3.8	3.8	3.8	6.1	7.6		2.6 ± 2.4	

- Response scores: 8 = Several times a day; 7 = Daily/Almost daily; 6 = Several times a week; 5 = About once a week; 4 = Several times a month; 3 = About once a month; 2 = Rarely; 1 = Never
- First row in each category corresponds to the percentage of students (n = 415) in each response group and second row, to teachers (n = 131).
- *** P < 0.001 (significant); * 0.01 < P < 0.05 (significant at 5%); [ns] P > 0.05. [+] (not significant).
- [a] - 2, 3 & 4 combined; [b] - 3 or more combined together; [c] - 2 or more combined together.

The frequency of usage was statistically different between students and teachers in all of the Web 2.0 related items except for publishing and sharing podcasts and writing or editing wikis. Mean scores denoting frequency of usage of the activities were higher for students in all the activities except in the case of creating e-portfolios (Figure 9). The most popular activity among students was social networking (58.6% of students used it several times a day and the mean score was 7.2). The most popular activity among teachers was also social networking (22.9% used it several times a day with a mean score of 5.2); however, as can be seen from Figure 7, it is far behind the proportion of students in the same category. No other Web 2.0 activity was used several times a day by more than 10% of the teachers. The least popular Web 2.0 related activity among the student community was social bookmarking software on the web (80% never used it) followed by writing or editing wikis (79.8%) and publishing and sharing podcasts (75.2%). The least popular activity among teachers was also the same, but the corresponding percentage was slightly higher than the student community at 90.8%, 86.3%, and 78.6% respectively. More than 50% of students never wrote on a blog or downloaded podcasts. Above half of the teachers never engaged in the activities of writing own blog, reading RSS feeds, instant messaging, posting and sharing digital videos online, reading/commenting on other's blogs, and downloading podcasts.



Frequency scores: 8 = Several times a day; 7 = Daily/Almost daily; 6 = Several times a week; 5 = About once a week; 4 = Several times a month; 3 = About once a month; 2 = Rarely; 1 = Never

Figure 9: The mean score of the frequency of usage of Web 2.0 related activities

Usage of smartphone (mobile phones) related functions

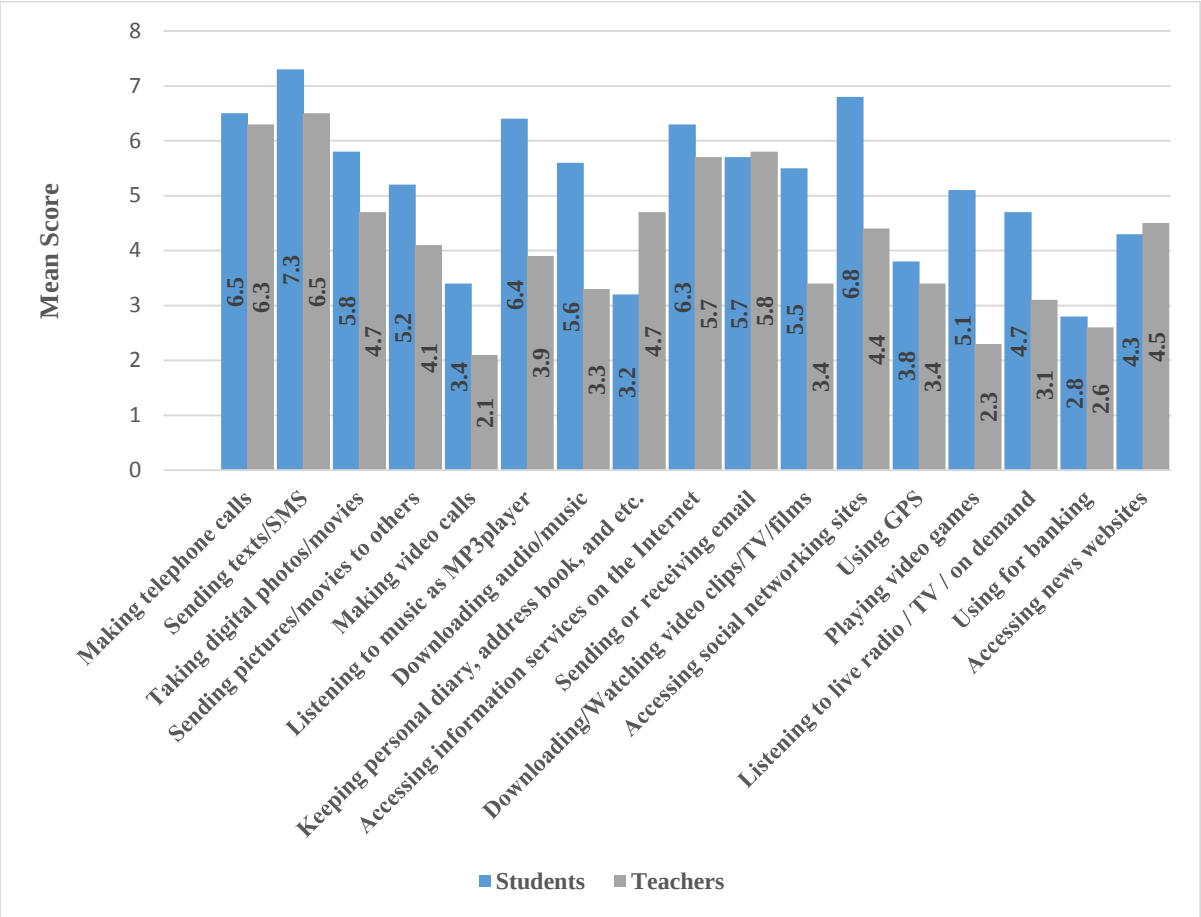
The percentage distribution of students and teachers in the eight different response categories denoting the frequency of usage of 17 types of smartphone functions, ranging from 1 (never) to 8 (several times a day) has been depicted in Table 9.

Table 9: Percentage distribution of frequency of usage of smartphone-related functions

Smartphone-related activity		Response (%)								χ^2 (df)	Mean ± SD	t (df)
		1	2	3	4	5	6	7	8			
Making telephone calls	S	5.5	3.9	0.7	2.9	5.1	16.6	23.6	41.7	29.0*** (5) [a]	6.5 ± 2.0	0.98 [ns] (183.7)
	T	16.8	--	--	0.8	2.3	9.2	26.7	44.3		6.3 ± 2.5	
Sending texts/SMS	S	4.3	1.4	0.2	1.2	1.4	3.9	14.5	73.0	28.5*** (4) [b]	7.3 ± 1.7	3.2*** (166.8)
	T	16.8	--	--	--	0.8	5.3	17.6	59.5		6.5 ± 2.6	
Taking digital photos/movies	S	7.7	7.5	2.2	6.3	8.7	17.8	19.5	30.4	35.3*** (7)	5.8 ± 2.2	4.5*** (193.5)
	T	25.2	5.3	3.1	5.3	10.7	19.1	14.5	16.8		4.7 ± 2.6	
Sending pictures/movies to others	S	12.3	12.0	5.3	3.9	9.2	16.1	15.7	25.5	42.1*** (7)	5.2 ± 2.5	4.6*** (544)
	T	26.0	6.1	11.5	8.4	13.0	14.5	13.0	7.6		4.1 ± 2.4	
Making video calls	S	40.0	14.5	4.1	5.1	7.7	9.4	8.2	11.1	27.2*** (7)	3.4 ± 2.6	6.1*** (298.8)
	T	61.8	13.7	4.6	5.3	4.6	4.6	3.1	2.3		2.1 ± 1.9	
Listening to music as MP3player	S	12.5	3.6	2.2	0.7	2.4	6.0	19.5	53.0	107.8*** (7)	6.4 ± 2.5	9.2*** (200.1)
	T	38.9	6.9	2.3	6.1	6.9	14.5	10.7	13.7		3.9 ± 2.8	
Downloading audio/music	S	14.9	7.0	4.1	4.3	6.5	12.0	15.4	35.7	70.8*** (7)	5.6 ± 2.6	8.8*** (544)
	T	42.7	10.7	6.1	8.4	6.9	9.2	5.3	10.7		3.3 ± 2.5	
Keeping a personal diary, address book, and etc.	S	46.3	13.3	4.1	6.0	4.6	6.5	8.2	11.1	31.2*** (7)	3.2 ± 2.6	5.2*** (201.2)
	T	29.0	7.6	3.1	4.6	6.9	9.2	13.0	26.7		4.7 ± 2.9	
Accessing information services on the Internet	S	11.1	4.3	1.9	2.9	4.3	8.9	19.3	47.2	12.3 [ns] (7)	6.3 ± 2.4	1.9 [ns] (195.0)
	T	21.4	1.5	2.3	3.1	3.1	10.7	14.5	43.5		5.7 ± 2.8	
Sending or receiving email	S	14.2	6.3	2.2	4.6	6.5	13.5	20.2	32.5	33.0*** (7)	5.7 ± 2.5	0.4 [ns] (194.1)
	T	23.7	3.8		0.8	0.8	6.9	14.5	49.6		5.8 ± 3.0	
Downloading/ Watching video clips/TV/films	S	17.8	6.0	3.1	4.3	4.8	10.1	22.4	31.3	62.5*** (7)	5.5 ± 2.7	7.7*** (544)
	T	39.7	11.5	7.6	3.8	8.4	12.2	6.1	10.7		3.4 ± 2.6	
Accessing social networking sites	S	8.9	1.7	1.0	.5	1.9	7.2	16.1	62.7	88.9*** (4) [c]	6.8 ± 2.1	8.5*** (172.1)
	T	38.9	3.1	2.3	3.8	3.1	9.9	12.2	26.7		4.4 ± 3.1	
Using GPS	S	32.0	16.9	4.3	4.6	8.7	8.7	6.3	18.6	12.3 [ns] (7)	3.8 ± 2.8	1.8 [ns] (242.1)
	T	35.1	16.0	6.9	7.6	9.9	7.6	9.2	7.6		3.4 ± 2.4	
Playing video games	S	20.5	9.2	3.4	2.4	7.0	14.0	11.6	32.0	99.4*** (7)	5.1 ± 2.8	12.6*** (293.1)
	T	58.8	16.0	3.1	3.1	6.9	6.1	2.3	3.8		2.3 ± 2.1	
Listening to live radio / TV / on demand	S	24.1	12.0	2.9	5.8	5.5	10.1	15.4	24.1	40.9*** (7)	4.7 ± 2.8	6.4*** (250.6)
	T	42.0	15.3	8.4	4.6	6.9	9.9	5.3	7.6		3.1 ± 2.4	
Using for banking	S	60.2	8.7	2.2	3.4	2.9	3.9	6.7	12.0	16.5* (7)	2.8 ± 2.7	0.6 [ns] (247.2)
	T	58.0	7.6	4.6	4.6	8.4	6.1	6.1	4.6		2.6 ± 2.3	
Accessing news websites	S	26.5	14.7	5.3	3.1	9.4	9.6	14.0	17.3	26.5*** (7)	4.3 ± 2.7	0.9 [ns] (544)
	T	32.1	3.8	1.5	6.1	5.3	18.3	18.3	14.5		4.5 ± 2.8	

- Response scores: 8 = Several times a day; 7 = Daily/Almost daily; 6 = Several times a week; 5 = About once a week; 4 = Several times a month; 3 = About once a month; 2 = Rarely; 1 = Never
- First row in each category corresponds to the percentage of students (n = 415) in each response group and second row, to teachers (n = 131).
- *** P < 0.001 (significant); * 0.01 < P < 0.05 (significant at 5%); [ns] P > 0.05. [+] (not significant).
- [a] - 2, 3 & 4 combined; [b] - 3 or more combined together; [c] - 2 or more combined together;

The usage pattern of smartphone functions by students and teachers was statistically different in all smartphone-related functions with the exception of accessing the Internet and using it for GPS. Mean scores denoting the frequency of usage of the functions were higher for students in all the items except in the case of sending or receiving emails, accessing news websites, and keeping a personal diary, address book, and so on (Figure 10). The most popular smartphone function among students was sending texts/SMS (73% of students used it several times a day, with a mean score of 7.3). More than 10% of the students used all 17 functions several times a day. The most popular activity among teachers was also sending texts/SMS (59.5% of teachers used it several times a day, with a mean score of 6.5). Over 10% of teachers used the functions of accessing information services on the Internet, keeping personal diary, address book, and so on, accessing social networking sites, taking digital photos/movies, accessing news websites, listening to music as MP3 player, downloading audio/music, and downloading/watching video clips/TV/films several times a day. Thus, smartphone-related functions appear to be relatively more popular among teachers when compared to Web 2.0 related activities. Among students, the lowest frequency of use was noted in the use of smartphones for banking (60% never used this function). The least popular smartphone function among the teachers was making video calls (61.8% never used this function). Interestingly, more than 15% of teachers never used any of the 17 smartphone functions listed in the questionnaire.



Frequency scores: 8 = Several times a day; 7 = Daily/Almost daily; 6 = Several times a week; 5 = About once a week; 4 = Several times a month; 3 = About once a month; 2 = Rarely; 1 = Never

Figure 10: The mean score of the frequency of usage of smartphone-related activities

Video game related activities

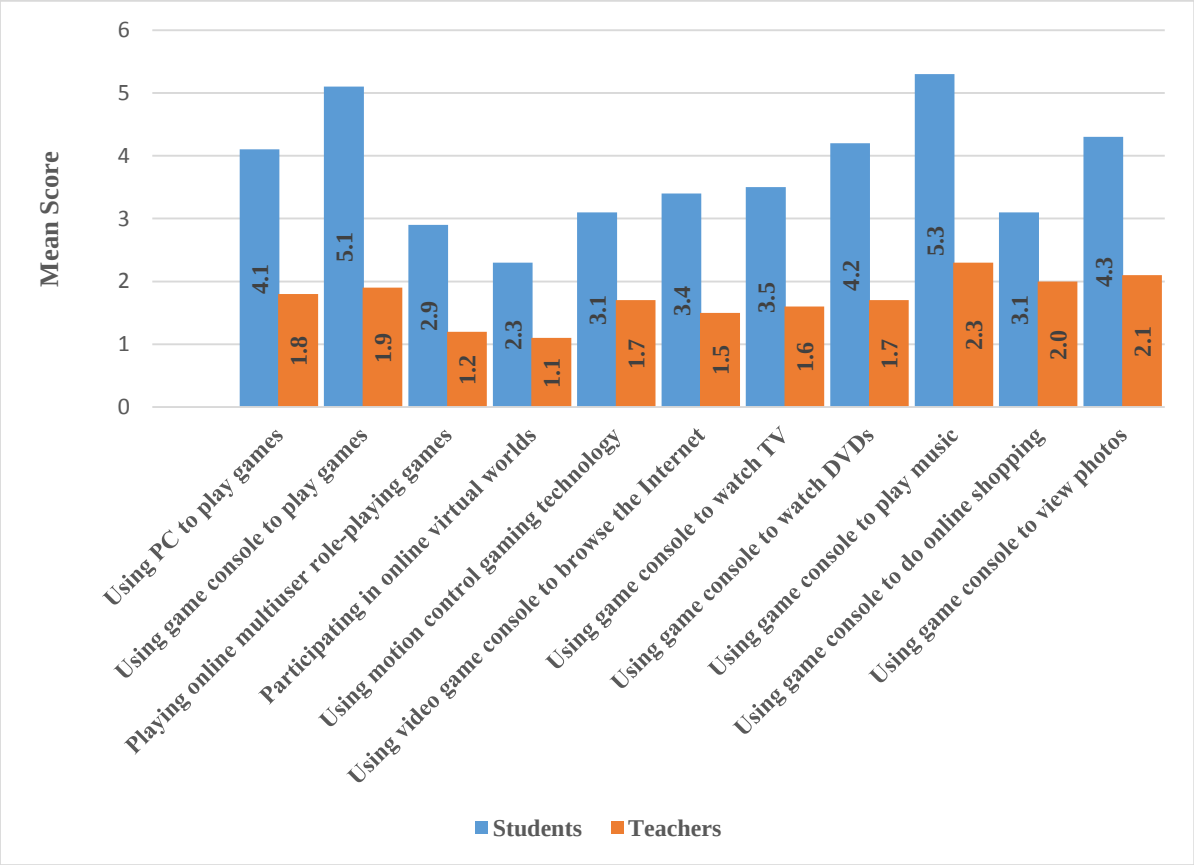
The percentage distribution of students and teachers in the eight response categories denoting the frequency of usage of 11 types of video game related activities, ranging from 1 (never) to 8 (several times a day) has been presented in Table 10.

Table 10: Percentage distribution of frequency of usage of video game related activities

Video game console related activity		Response (%)								χ^2 (df)	Mean ± SD	t (df)
		1	2	3	4	5	6	7	8			
Using PC to play games	S	27.5	20.0	5.3	2.7	5.1	9.4	10.1	20.0	81.1*** (7)	4.1 ± 2.8	12.5*** (450.5)
	T	64.9	17.6	6.1	3.8	3.1	3.8	0.8	--		1.8 ± 1.4	
Using game console to play games	S	17.6	9.4	3.6	5.8	8.7	13.0	16.1	25.8	142.1*** (7)	5.1 ± 2.6	16.9*** (365.6)
	T	66.4	13.7	3.8	6.1	3.8	3.1	3.1	--		1.9 ± 1.6	
Playing online multiuser role-playing games	S	50.8	14.5	3.6	3.6	5.5	5.1	5.3	11.6	60.0*** (7)	2.9 ± 2.6	11.8*** (543.9)
	T	87.0	9.2	1.5	0.8	--	0.8	0.8	--		1.2 ± 0.8	
Participating in online virtual worlds	S	64.6	14.5	2.2	1.9	3.1	1.9	3.4	8.4	35.4*** (3) [a]	2.3 ± 2.3	9.9*** (468.2)
	T	89.3	9.9	0.8	--	--	--	--	--		1.1 ± 0.3	
Using motion control gaming technology	S	33.0	24.8	6.5	8.4	6.5	8.7	4.6	7.5	64.6*** (7)	3.1 ± 2.3	8.4*** (363.4)
	T	71.0	12.2	4.6	3.1	4.6	4.6	--	--		1.7 ± 1.4	
Using video game console to browse the Internet	S	40.7	15.9	4.3	4.1	7.7	7.0	8.4	11.8	73.1*** (7)	3.4 ± 2.6	10.2*** (421.1)
	T	81.7	5.3	3.1	3.8	0.8	3.1	2.3	--		1.5 ± 1.4	
Using game console to watch TV	S	41.4	14.5	3.4	3.4	5.8	8.2	9.2	14.2	62.3*** (7)	3.5 ± 2.8	10.1*** (414.1)
	T	78.6	8.4	2.3	3.8	1.5	3.1	0.8	1.5		1.6 ± 1.5	
Using game console to watch DVDs	S	25.8	14.7	3.6	8.2	7.7	12.5	11.8	15.7	104.8*** (7)	4.2 ± 2.7	13.5*** (395)
	T	71.8	13.7	3.8	2.3	1.5	5.3	0.8	0.8		1.7 ± 1.5	
Using game console to play music	S	18.1	12.8	1.9	3.6	2.9	8.0	16.6	36.1	123.5*** (7)	5.3 ± 2.8	12.5*** (275.6)
	T	65.6	9.2	2.3	3.1	3.1	7.6	5.3	3.8		2.3 ± 2.2	
Using game console to do online shopping	S	44.8	12.5	6.3	5.3	8.9	8.2	7.2	6.7	40.5*** (7)	3.1 ± 2.4	5.3*** (270.8)
	T	74.0	6.1	1.5	1.5	3.8	7.6	5.3	--		2 ± 1.9	
Using game console to view photos	S	30.6	13.3	2.9	3.1	6.7	9.9	11.3	22.2	75.9*** (7)	4.3 ± 2.9	9.3*** (300.7)
	T	71.0	6.9	2.3	1.5	3.8	6.1	7.6	0.8		2.1 ± 2.1	

- Response scores: 8 = Several times a day; 7 = Daily/Almost daily; 6 = Several times a week; 5 = About once a week; 4 = Several times a month; 3 = About once a month; 2 = Rarely; 1 = Never
- First row in each category corresponds to the percentage of students (n = 415) in each response group and second row, to teachers (n = 131).
- *** $P < 0.001$ (significant).
- [a] - 3-7 or more combined together.

The usage pattern of video game activities by students and teachers was statistically different in all video game related activities. Mean scores denoting frequency of usage of the activities were higher for students in all of the 11 items (Figure 11). None of the video game console related activities was popular among teachers. All of the 11 video game related activities were never used by more than 65% of the teachers. Interestingly, some activities were never used by more than 15% of the students. The majority of the students never engaged in activities such as participating in online virtual worlds (64.6%), playing online multiuser role-playing games (50.8%), or online shopping (44.8%).



Frequency scores: 8 = Several times a day; 7 = Daily/Almost daily; 6 = Several times a week; 5 = About once a week; 4 = Several times a month; 3 = About once a month; 2 = Rarely; 1 = Never

Figure 11: The mean score of the frequency of usage of video games related activities

Students' perception of teachers' attitudes towards technology and electronic devices

Since the items under Questions 6 and 7 (about students' and teachers' perceptions of each other's attitudes) were different for each group of participants, a comparison of the percent distribution of responses was not possible and, therefore, was not carried out. The range of quantifiers on the Likert-type rating scale for this set of questions was in the following range: 4 = Very true; 3 = Somewhat true; 2 = Somewhat untrue; 1 = Very untrue; 0 = I do not know.

The majority (75%) of the students stated as somewhat or very true that their teachers always used the latest digital technology for teaching and learning (Table 11).

Table 11: Students perception of *their teachers' attitude towards technology and electronic devices*

Students' perception	**Response (%)**					**Mean ± SD**
	I do not know (0)	Very Untrue (1)	Somewhat untrue (2)	Somewhat true (3)	Very true (4)	
Teachers always use the latest digital technology for teaching and learning	11.8	3.4	9.6	53.7	21.4	2.7 ± 1.2
Almost all teachers use digital video games for teaching and learning	20.0	26.0	17.1	26.7	10.1	1.8 ± 1.3
Teachers are keen on interacting with students and other teachers online	21.2	9.9	15.9	32.5	20.5	2.2 ± 1.4
Usually, teachers know less about new digital technologies than students	16.4	9.9	25.3	32.3	16.1	2.2 ± 1.3
Teachers need support to use technology effectively for teaching	18.1	11.8	22.2	34.0	14.0	2.1 ± 1.3
Teachers find it difficult to learn to use new technologies	22.9	16.9	25.8	24.8	9.6	1.8 ± 1.3
When asked, the majority of teachers can never answer any questions about computers and other related digital media	22.2	23.4	22.4	22.7	9.4	1.7 ± 1.3

A correspondingly high proportion of students' responses regarding teachers' attitude towards technology were that 'teachers are keen on interacting with students and other teachers online' (53%) and 'usually teachers know less about new digital technologies than students' (48.4%). The proportion of students who answered I do not know regarding the above seven aspects ranged from 11.8% to 22.9%.

Teachers' perception of students' attitudes towards technology and electronic devices

As depicted in Table 12, teachers had a clearer perception of their students' attitudes towards digital technology and electronic devices.

Table 12: *Teachers' perception of their students' attitude towards technology and electronic devices*

Teachers' perception	Response (%)					Mean ± SD
	I do not know (0)	Very Untrue (1)	Somewhat untrue (2)	Somewhat true (3)	Very true (4)	
Students feel left out if they do not have the latest technology/device	3.1	--	2.3	54.2	40.5	3.3 ± 0.8
Students often use many electronic devices at once	3.8	--	6.1	55.0	35.1	3.2 ± 0.9
Students are always interested in discovering new things about technology	3.1	1.5	10.7	55.0	29.8	3.1 ± 0.9
Students believe technology is effective for learning	6.1	3.8	9.2	48.9	32.1	3.0 ± 1.1
Students find it easy to learn how to use new technologies	2.3	--	12.2	45.8	39.7	3.2 ± 0.8
Students lose track of time when using technology	4.6	1.5	3.8	37.4	52.7	3.3 ± 1.0
Students need lots of support to use technology effectively for learning purposes	4.6	7.6	20.6	45.0	22.1	2.7 ± 1.0

About 95% of them felt it was either somewhat or very true that their students would feel left out if they did not have the latest technology/device. The proportion of teachers who answered somewhat or very true for the other aspects was also high. The proportion of teachers who answered I do not know regarding the following seven aspects ranged from just 2.3% to 6.1%.

Students' perception of their relationship with digital technology and electronic devices

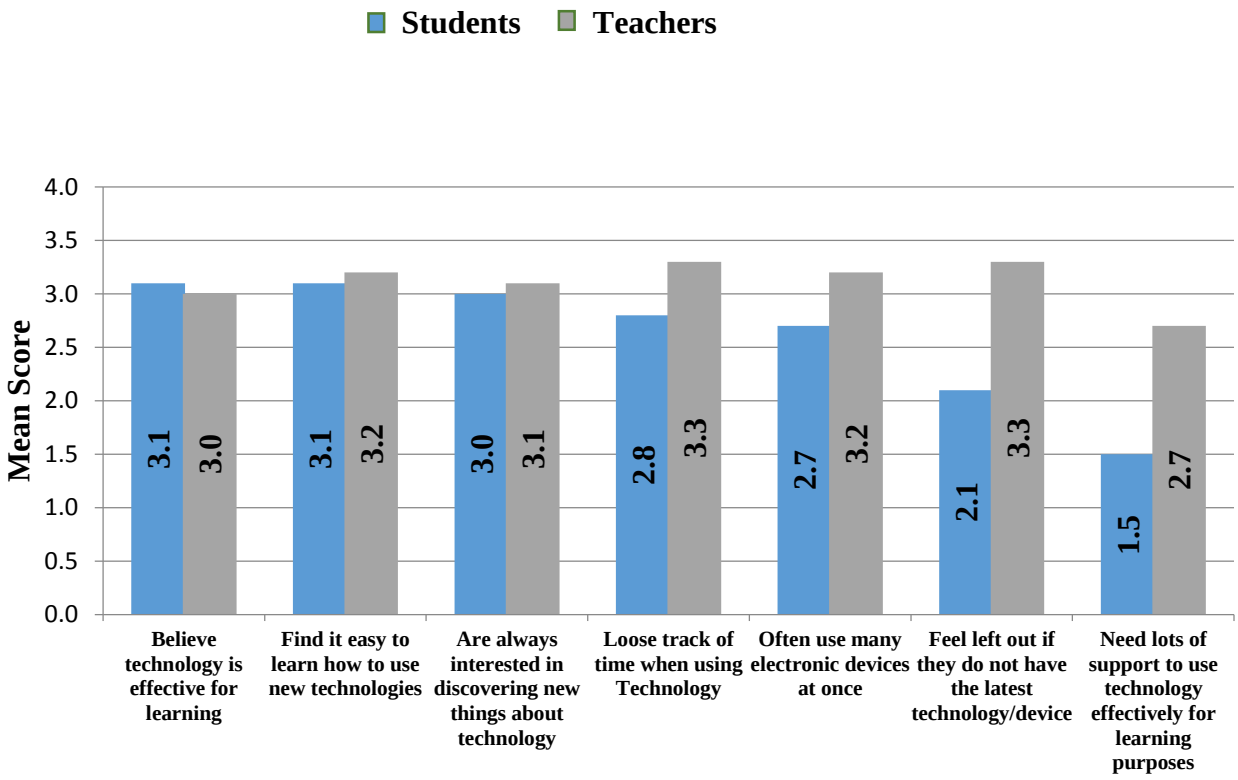
The majority (83.4%) of the students felt it was somewhat or very true that it is very easy for them to use new technologies (Table 13).

Table 13: *Students' relationships with technology and electronic devices*

Students' perception	Response (%)					Mean ± SD
	I do not know (0)	Very Untrue (1)	Somewhat untrue (2)	Somewhat true (3)	Very true (4)	
I feel left out if I do not have the latest technology/device	6.5	34.0	19.8	24.6	15.2	2.1 ± 1.2
I always use many electronic devices at once	6.5	12.8	13.5	36.6	30.6	2.7 ± 1.2
I am always interested in discovering new things about technology	8.2	5.3	9.2	34.7	42.7	3 ± 1.2
I believe technology is effective for learning	7.7	2.9	8.2	38.6	42.7	3.1 ± 1.1
I find it easy to learn how to use new technologies	8.9	1.9	5.8	37.6	45.8	3.1 ± 1.2
I lose track of time when I use technology	7.7	8.2	17.1	32.8	34.2	2.8 ± 1.2
I need lots of support to use technology effectively for learning purposes	33.5	20.5	22.2	14.5	9.4	1.5 ± 1.3

Similarly, 81.3% of them felt that it was somewhat or very true that they believed technology is effective for learning, and that they were interested in discovering new things about technology (77.4%).

The assessment of students regarding their relationship with digital technology as assessed by themselves and by their teachers is depicted in Figure 12. As can be seen from the figure, students' and their teachers' assessments were similar with respect to positive aspects of the relationship and were notably different regarding other aspects with negative connotations.



Opinion scores: 4 = Very true; 3 = Somewhat true; 2 = Somewhat untrue; 1 = Very untrue; 0 = I do not know

Figure 12: *Comparison of mean scores of the students' assessment and their teachers' assessment of their students* regarding the relationship with technology

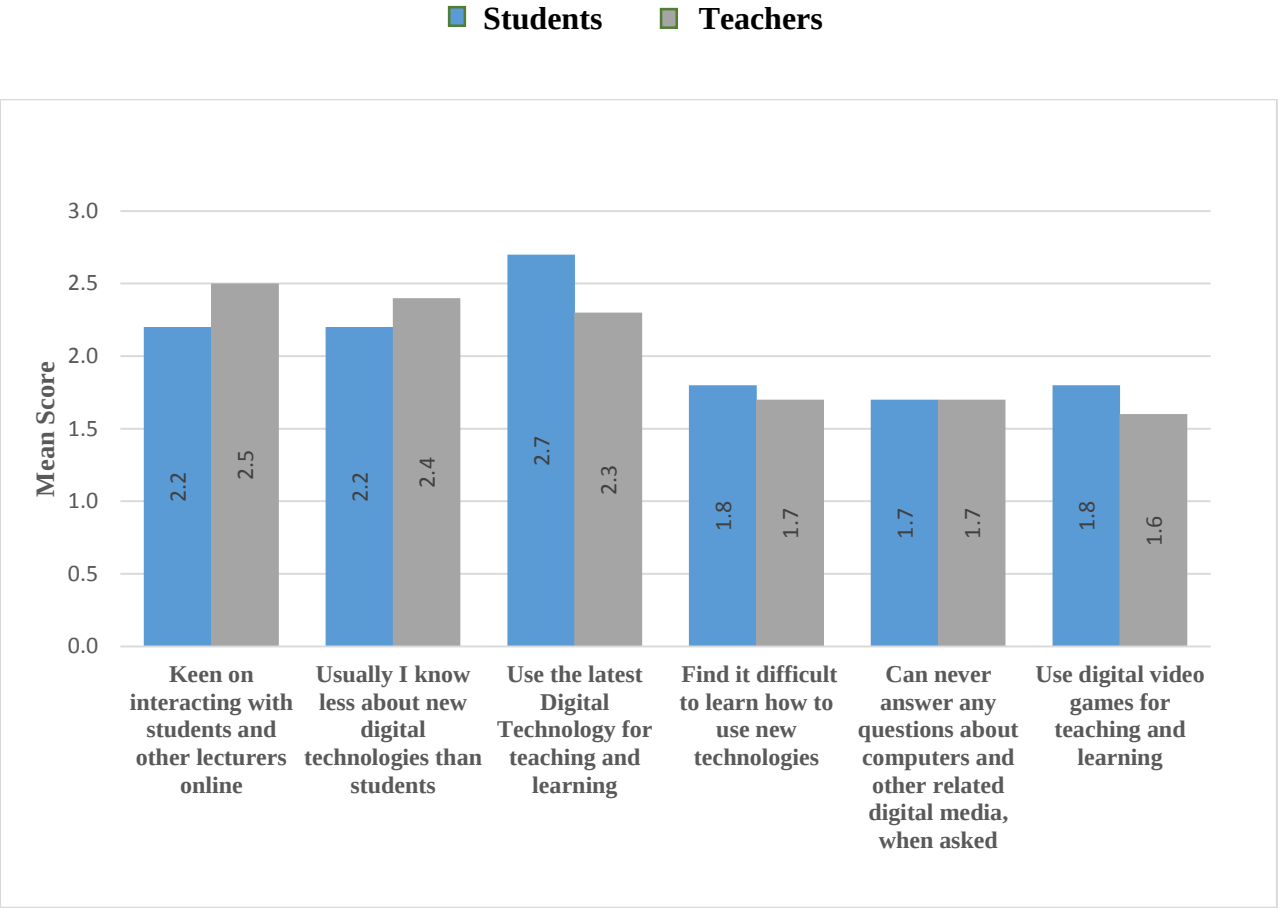
Teachers' perceptions of their relationships with digital technology and electronic devices

The majority (83.2%) of the teachers felt it was somewhat or very true that they were always interested in discovering new things about technology. Similarly, 60.3% of them felt that it was somewhat or very true that they were keen on interacting with students and other teachers online. A small proportion (19.1%) found it difficult to learn how to use new technologies, and when asked, they could never answer any questions about computers and other related digital media (18.3%) (Table 14).

Table 14: *Teachers' relationships with technology and electronic devices*

Teachers' perception	**Response (%)**					**Mean ± SD**
	I do not know (0)	Very Untrue (1)	Somewhat untrue (2)	Somewh at true (3)	Very true (4)	
I always use the latest Digital Technology for teaching and learning	3.8%	12.2%	41.2%	35.1%	7.6%	2.3 ± 0.9
I am always interested in discovering new things about technology	.8%	3.8%	12.2%	38.9%	44.3%	3.2 ± 0.9
I use digital video games for teaching and learning	11.5%	48.1%	16.8%	20.6%	3.1%	1.6 ± 1
Usually I know less about new digital technologies than students	3.8%	16.8%	23.7%	42.7%	13.0%	2.4 ± 1
I am keen on interacting with students and other teachers online	4.6%	17.6%	17.6%	41.2%	19.1%	2.5 ± 1.1
I find it difficult to learn how to use new technologies	1.5%	45.8%	33.6%	14.5%	4.6%	1.7 ± 0.9
When asked, I can never answer any questions about computers and other related digital media	2.3%	49.6%	29.8%	14.5%	3.8%	1.7 ± 0.9

The assessment of teachers regarding their relationships with digital technology as assessed by themselves and by their students is depicted in Figure 13. As can be seen from the figure, students' and their teachers' assessments are similar with respect to aspects with negative connotations of the relationship and differs regarding other relationships with digital media and electronic devices.



Opinion scores: 4 = Very true; 3 = Somewhat true; 2 = Somewhat untrue; 1 = Very untrue; 0 = I do not know

Figure 13: *Comparison of mean scores of the teachers'* own *assessment and students' assessment of their teachers* regarding the relationship with technology

Opinion on the benefits of using digital technology and electronic devices in the classroom

The percentage distribution of students and teachers in six response categories denoting the degree of agreement on the benefits of using digital technology and electronic devices in the classroom, ranging from 0 (I do not know) to 5 (Strongly agree), has been presented in Table 15. The pattern of the degree of agreement on the benefits of using digital technology and electronic devices in the classroom by students and teachers was statistically different in all the aspects queried, as evidenced by the Chi-square tests.

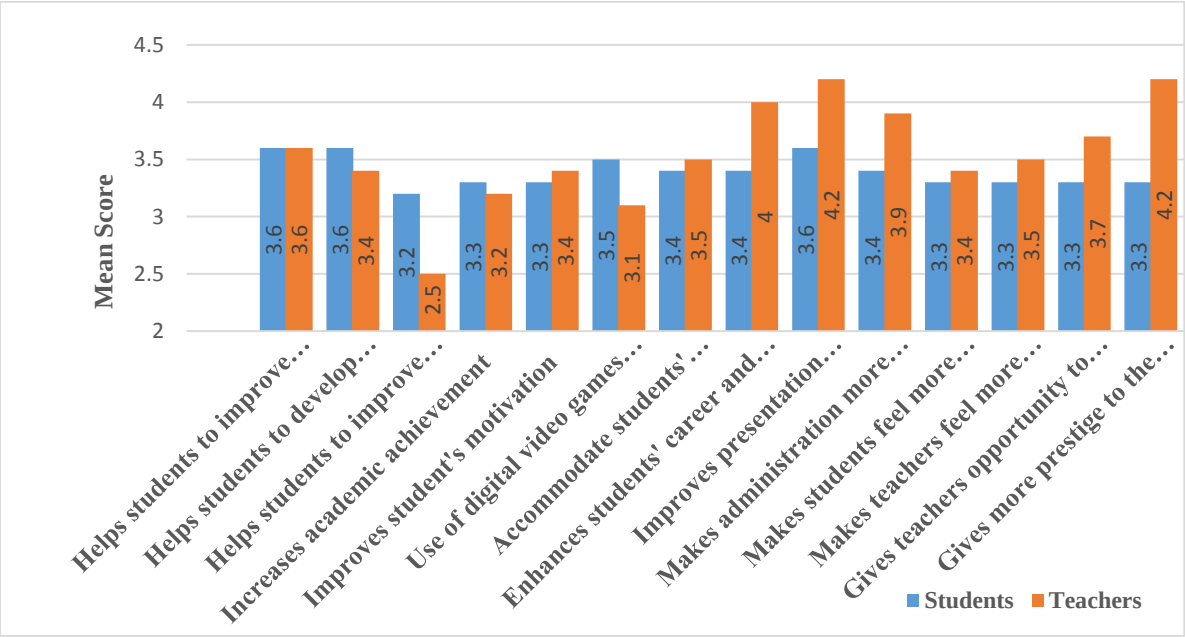
Table 15: Percentage distribution of opinion on benefits of using digital technology in the classroom

Benefits of using technology in classroom		Response (%)						χ^2 (df)	Mean ± SD	t (df)
		0	1	2	3	4	5			
Helps students to improve basic skills	S	9.6	1.2	2.4	17.8	42.4	26.5	37.4*** (5)	3.6 ± 1.4	0.07 ns (544)
	T	.8	6.1	9.9	15.3	48.9	19.1		3.6 ± 1.1	
Helps students to develop creative and thinking skills	S	10.6	1.0	1.9	16.9	41.9	27.7	62.7*** (5)	3.6 ± 1.5	1.41 ns (544)
	T	0.8	6.1	10.7	33.6	30.5	18.3		3.4 ± 1.1	
Helps students to improve their social skills	S	9.9	4.1	11.1	22.4	31.8	20.7	106.3*** (5)	3.2 ± 1.5	5.5*** (276.6)
	T	0.8	14.5	42.7	22.9	9.2	9.9		2.5 ± 1.2	
Increases academic achievement	S	12.5	1.2	5.1	24.1	37.8	19.3	55.4*** (5)	3.3 ± 1.5	0.8 ns (327.3)
	T	0.8	3.1	16.8	43.5	24.4	11.5		3.2 ± 1.0	
Improves students' motivation	S	11.8	2.4	7.0	24.6	31.1	23.1	30.1*** (5)	3.3 ± 1.5	1.15 ns (303.6)
	T	0.8	5.3	13.7	22.9	43.5	13.7		3.4 ± 1.1	
Use of digital video games makes students' learning more enjoyable	S	10.4	1.7	6.3	20.5	34.5	26.6	24.0*** (5)	3.5 ± 1.5	2.5* (543)
	T	9.2	3.1	10.7	37.4	25.2	14.5		3.1 ± 1.4	
Accommodate students' personal learning styles	S	12.5	0.5	4.6	24.1	37.1	21.2	16.8** (4) [a]	3.4 ± 1.5	1.29 ns (302.8)
	T	3.1	1.5	8.4	29.0	43.5	14.5		3.5 ± 1.1	
Enhances students' career and job prospects	S	12.5	1.0	4.1	21.9	37.6	22.9	29.5*** (4) [a]	3.4 ± 1.5	5.68*** (431.5)
	T	--	0.8	4.6	13.7	58.0	22.9		4.0 ± 0.8	
Improves presentation material and teaching resources	S	11.1	0.2	3.4	15.7	40.5	29.2	27.7*** (4) [a]	3.6 ± 1.5	6.43*** (483.7)
	T	--	--	2.3	6.9	57.3	33.6		4.2 ± 0.7	
Makes administration more efficient	S	13.5	0.7	2.2	21.9	36.9	24.8	28.8*** (4) [a]	3.4 ± 1.6	4.23*** (355.3)
	T	0.8	2.3	5.3	14.5	51.1	26.0		3.9 ± 1.0	
Makes students feel more competent as learners	S	14.0	1.2	4.1	22.7	36.4	21.7	36.5*** (4) [a]	3.3 ± 1.6	0.75 ns (323.4)
	T	2.3	0.8	11.5	42.0	26.7	16.8		3.4 ± 1.1	
Makes teachers feel more competent as educators	S	15.9	0.7	3.6	22.9	35.4	21.4	50.1*** (4) [a]	3.3 ± 1.6	1.85 ns (364.6)
	T	--	1.5	13.0	40.5	26.7	18.3		3.5 ± 1.0	
Gives teachers opportunity to be learning facilitators instead of information providers	S	14.7	1.4	4.1	21.4	37.1	21.2	36.2*** (5)	3.3 ± 1.6	2.97*** (313)
	T	0.8	3.8	13.0	15.3	45.8	21.4		3.7 ± 1.1	
Gives more prestige to the college	S	14.9	0.7	3.1	25.5	31.6	24.1	37.2*** (4) [a]	3.3 ± 1.6	7.19*** (354.2)
	T	0.8	1.5	3.1	17.6	30.5	46.6		4.2 ± 1.0	

- Response scores: 5 = Strongly agree; 4 = Agree; 3 = Neither agree nor disagree; 2 = Disagree; 1 = Strongly disagree; 0 = I do not know
- First row in each category corresponds to the percentage of students (n = 415) in each response group and second row, to teachers (n = 131).
- *** P < 0.001 (significant); * 0.001 < P < 0.01 (significant at 5%); ns P > 0.05. + (not significant).
- [a] - 1-2 combined.

As depicted in Figure 14, the mean score denoting the degree of agreement of students with the statements for all of the 15 items had a narrow range between 3 and 3.6. The mean scores denoting the degree of agreement of teachers with the statements for the 15 items had a relatively wider range between 3.1 and 4.2. Whilst the level of agreement between students and teachers was similar, on average, for helps students to improve basic skills, helps students to develop creative and thinking skills, increases academic achievement, improves students' motivation, makes students feel more competent as

learners, and makes teachers feel more competent as educators, averages for other aspects were statistically different. Teachers, in general, expressed stronger agreement (higher mean scores) in all other aspects except in the case of use of digital video games makes students' learning more enjoyable and helps students to improve their social skills.



Response scores: 5 = Strongly agree; 4 = Agree; 3 = Neither agree nor disagree; 2 = Disagree; 1 = Strongly disagree; 0 = I do not know

Figure 14: Mean scores of the opinion of the benefits of using digital technology in the classroom

The percentage of students who agreed with the statements (agree or strongly agree) ranged from 48.1% to 69.7%, and for teachers, it ranged from 19.1% to 90.9%, again showing relatively wider variation in the degree of agreement of teachers with the 15 statements (see Table 13). While 9.6% to 18.8% of the students chose I do not know when asked about benefits, the corresponding percentage of teachers ranged from just 0% to 9.2%, showing that teachers had a better perception of the benefits than students.

Opinion on the barriers to the use of digital technology and electronic devices in the classroom

The percentage distribution of students and teachers in the six response categories denoting the degree of agreement regarding the listed barriers to the use of digital technology

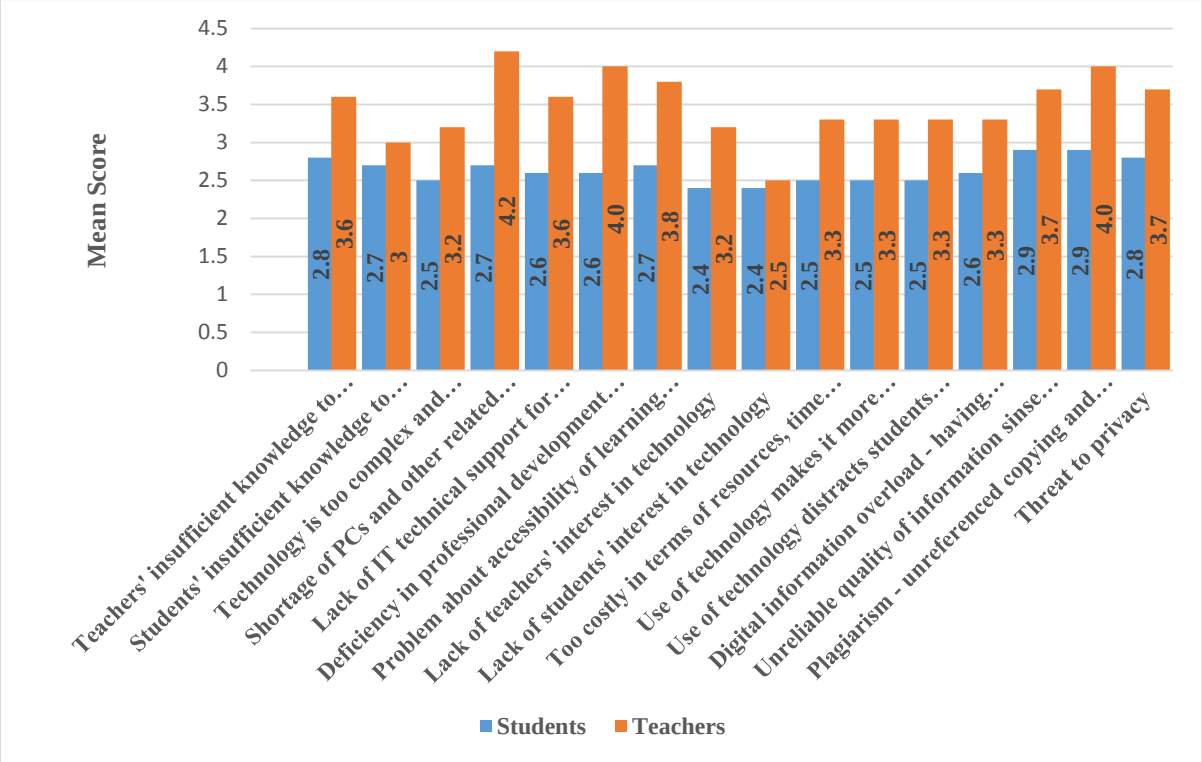
and electronic devices in the classroom, ranging from 0 (I do not know) to 5 (Strongly agree), has been presented in Table 16. As inferred from the Chi-square tests, the pattern of the degree of agreement on the listed barriers by students and teachers was statistically different in all the listed aspects.

Table 16: Percentage distribution of opinion on barriers to the use of digital technology in the classroom

Barriers to the use of digital technology in classroom		Response (%)						χ^2 (df)	Mean ± SD	t (df)
		0	1	2	3	4	5			
Teachers' insufficient knowledge to develop teaching activities based on technology	S	20.0	2.4	8.0	31.3	25.5	12.8	43.4*** (5)	2.8 ± 1.6	6.62*** (329.4)
	T	2.3	2.3	9.9	19.8	48.9	16.8		3.6 ± 1.1	
Students' insufficient knowledge to engage in learning activities based on technology	S	19.8	2.7	10.6	31.1	26.3	9.6	32.6*** (5)	2.7 ± 1.6	2.76** (346.7)
	T	2.3	3.8	18.3	45.8	23.7	6.1		3 ± 1	
Technology is too complex and complicated for quick and effective use in the classroom	S	15.2	9.9	22.2	25.8	17.1	9.9	48.7*** (5)	2.5 ± 1.5	5.56*** (312.7)
	T	--	6.9	22.9	23.7	41.2	5.3		3.2 ± 1.1	
Shortage of PCs and other related digital devices (printers, scanners, whiteboards)	S	21.0	3.6	9.9	28.9	23.1	13.5	121.6*** (5)	2.7 ± 1.7	13.2*** (370.3)
	T	0.8	.8	6.1	9.2	27.5	55.7		4.3 ± 1	
Lack of IT technical support for existing technology at the college	S	21.9	4.1	13.7	28.4	19.3	12.5	59.5*** (5)	2.6 ± 1.7	8.41*** (320.8)
	T	--	3.8	16.0	16.8	38.2	25.2		3.6 ± 1.1	
Deficiency in professional development opportunities for gaining knowledge and skill	S	19.8	3.6	9.2	37.8	18.8	10.8	105.2*** (5)	2.6 ± 1.6	12.43*** (392.6)
	T	1.5	--	2.3	16.8	49.6	29.8		4 ± 0.9	
Problem with accessibility of learning technologies from home	S	21.0	3.9	12.0	27.0	24.1	12.0	67.7*** (5)	2.7 ± 1.7	9.58*** (383.8)
	T	0.8	2.3	7.6	15.3	55.7	18.3		3.8 ± 1	
Lack of teachers' interest in technology	S	21.0	7.0	17.1	28.4	18.3	8.2	50.7*** (5)	2.4 ± 1.6	6.46*** (323.8)
	T	1.5	4.6	20.6	25.2	42.7	5.3		3.2 ± 1.1	
Lack of students' interest in technology	S	18.8	8.2	19.8	29.2	14.5	9.4	60.5*** (5)	2.4 ± 1.5	0.6 ns (361.3)
	T	1.5	8.4	48.9	25.2	14.5	1.5		2.5 ± 0.9	
Too costly in terms of resources, time, and effort	S	21.2	5.5	13.5	30.8	21.2	7.7	48.9*** (5)	2.5 ± 1.6	6.79*** (323.1)
	T	0.8	4.6	19.1	22.9	43.5	9.2		3.3 ± 1.1	
Use of technology makes it more difficult to enforce discipline	S	20.5	6.0	15.7	28.7	21.0	8.2	39.7*** (5)	2.5 ± 1.6	6.18*** (299.4)
	T	2.3	5.3	16.8	23.7	42.7	9.2		3.3 ± 1.1	
Use of technology distracts students from learning	S	21.0	4.8	14.2	28.2	23.1	8.7	35.9*** (5)	2.5 ± 1.6	5.9*** (305)
	T	1.5	5.3	18.3	23.7	39.7	11.5		3.3 ± 1.1	
Digital information overload – having too much information to make decisions	S	19.8	4.1	14.5	30.6	23.6	7.5	40.3*** (5)	2.6 ± 1.6	6.58*** (338.7)
	T	1.5	2.3	16.8	26.7	45.8	6.9		3.3 ± 1	
Unreliable quality of information since everybody can be a publisher	S	14.0	4.8	9.2	35.2	26.0	10.8	40.1*** (5)	2.9 ± 1.5	7.07*** (341.8)
	T	1.5	1.5	6.1	26.0	50.4	14.5		3.7 ± 1	
Plagiarism – unreferenced copying and pasting of material from the Internet into assessments	S	12.5	4.8	9.2	36.1	26.3	11.1	81.6*** (5)	2.9 ± 1.5	10.6*** (367.2)
	T	0.8	0.8	3.8	13.0	52.7	29.0		4 ± 0.9	
Threat to privacy	S	13.7	5.1	8.9	37.6	24.6	10.1	57.6*** (5)	2.8 ± 1.5	8.39*** (360.9)
	T	.8	.8	7.6	21.4	53.4	16.0		3.7 ± 0.9	

- Response scores: 5 = Strongly agree; 4 = Agree; 3 = Neither agree nor disagree; 2 = Disagree; 1 = Strongly disagree; 0 = I do not know
- First row in each category corresponds to the percentage of students (n = 415) in each response group and second row, to teachers (n = 131).
- *** $P < 0.001$; ** $0.001 < P < 0.01$; ns – $P > 0.05$.

As depicted in Figure 15, mean scores denoting the degree of agreement between students with the stated barriers for all of the 20 items had a narrow range between 2.4 and 2.9. Mean scores denoting the degree of agreement among teachers with the statements for the 20 items had a relatively wider range between 2.4 and 4.3. While the levels of agreement between students and teachers were similar on an average for lack of students' interest in technology, it was statistically different on average for all the other 18 aspects. Teachers expressed stronger agreement (higher mean scores) in all aspects.



Response scores: 5 = Strongly agree; 4 = Agree; 3 = Neither agree nor disagree; 2 = Disagree; 1 = Strongly disagree; 0 = I do not know

Figure 15: Mean scores of opinions on barriers to the use of digital technology in classrooms

Students, in general, do not think that their lack of interest in technology is a barrier to the implementation of digital technology in the classroom (16%). The percentage of students who expressed their agreement with other statements regarding barriers were in a narrow range from 25.8% to 40.5% and teachers from 15.3% to 83.2%. This again shows a

relatively wider variation in the degree of agreement of teachers with the 20 statements regarding perceived barriers to the use of digital technology in the classroom (Table 14). Except for the lack of students' interest in technology as a barrier (only 1.5% stated they do not know), 12.5% of 21.9% students chose I do not know for the rest of the listed barriers. As many as 18.8% of the teachers also did not know whether the lack of students interest in technology was a barrier.

Participants' perception of their expertise in DT&RM

This question was designed to collect ordinal data about students' and teachers' perceptions of their expertise in DT&RM. The participants were asked to position their self-perceived digital skills on a six-point Likert-type scale ranging from: 1 = Sceptic (not interested in technology at all); 2 = Beginner (able to use basic functions in limited number of applications); 3 = Average (use technology for well-established reasons); 4 = Advanced (use broad spectrum of digital technology); and 5 = Expert (innovates with digital technology). A total of 15.4% of students considered themselves to be experts in digital technology and related media; 35.7% thought themselves to be advanced; and 44.6% considered themselves to be average. Corresponding percentages of teachers were 8.4%, 24.4%, and 61.1% respectively. Only 4.4% of students and 6.1% of teachers assessed themselves as either a beginner or sceptic (see Figure 16). The proportion of students and teachers in any of the expertise groups was not similar, as suggested by Chi-square test: $\chi 2(3) = 13.6$; $P < 0.01$. The independent t-test also suggested that the mean scores of teachers and students were statistically different: $t255.1 = 3.31$; $P < 0.01$ (see Table 17).

Table 17: Percentage distribution of perception about expertise in digital technology and related media

Study group	Expertise in digital technology and related media					χ^2 (df)	Mean ± SD	t (df)
	1 Sceptic	2 Beginner	3 Average	4 Advanced	5 Expert			
Students (n = 415)	1.0%	3.4%	44.6%	35.7%	15.4%	13.6** (3) [a]	4.6 ± 0.9	3.31** (255.1)
Teachers (n = 131)	--	6.1%	61.1%	24.4%	8.4%		4.4 ± 0.7	

- ** 0.001 < P < 0.01
- [a] - Sceptic and Beginners combined for the Chi-square test.

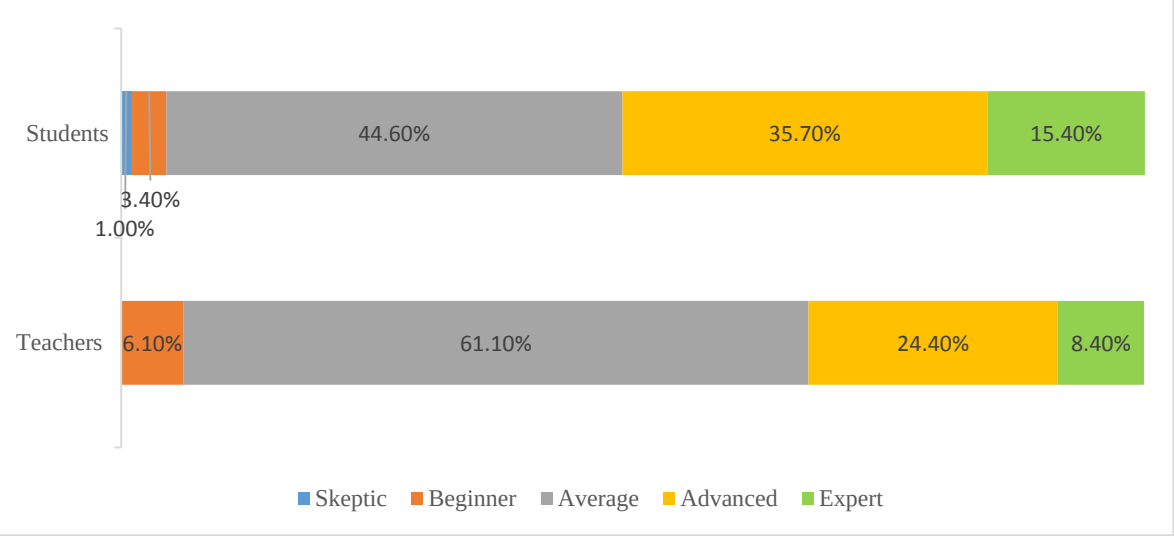


Figure 16: Expertise in DT&RM among students and teachers

Demographics

As age was the main reference for the generational divide argument, where all those born after the 1980s were 'digital natives' and those born before were 'digital immigrants', I also investigated the relationship between age-related groups. The age range for digital natives was assumed to be between 16 and 31 years and digital immigrants between 32 and 55+ years. The comparison of mean standardised scores, using independent t-test, of different aspects of DT&RM between native and immigrant types of students and teachers

did not indicate significant differences. As depicted in Table 18, a comparison of the mean scores of different aspects of DT&RM indicates that they differed statistically for spending time on video game related activities (immigrants spent less time, $P = 0.011$) and agreement on the use of DT&RM in teaching practice (immigrants agreed more, $P = 0.032$). Native and immigrant types of student participants had similar scores on all other aspects.

The only aspect where native and immigrant teachers differed was on spending time on smartphone-related activities (immigrant teachers spent less time relative to natives, $P = 0.008$). The native type of students and teachers differed significantly in the mean scores of spending time on Web 2.0 related activities (students spent more time, $P = 0.002$), spending time on video game related activities (students spent more time, $P < 0.001$), and agreement on barriers to using DT&RM in classroom (teachers agreed more strongly, $P < 0.001$). Native students and teachers had similar mean scores for all other aspects.

The immigrant type of students and teachers differed significantly in the mean scores for spending time on Web 2.0 related activities (students spent more time, $P = 0.015$) and agreement on the use of DT&RM in teaching practice (students agreed more strongly, $P < 0.001$). Immigrant students and teachers had similar mean scores for all other aspects.

Table 18: Comparison of the mean scores of different aspects of DT&RM between native and immigrant types of students and teachers

		Students			Teachers			Native vs. Immigrant students	Native vs. Immigrant teachers	Students vs. Teachers
	Type	n	Mean	SD	n	Mean	SD	P-value	P-value	P-value
Access to DT&RM items	Native	400	8.07	0.89	32	8.05	0.93	0.122	0.895	0.915
	Immigrant	15	8.64	1.32	99	8.08	1.02			0.062
Spending time on Web 2.0 related activities	Native	400	4.15	1.43	32	3.32	1.48	0.984	0.073	0.002
	Immigrant	15	4.16	1.80	99	2.85	1.21			0.015
Spending time on smartphone related activities	Native	400	6.52	1.99	32	6.20	2.26	0.340	0.008	0.391
	Immigrant	15	6.01	2.44	99	4.89	2.42			0.096
Spending time on video game related activities	Native	400	4.74	2.14	32	2.48	1.46	0.011	0.097	< 0.001
	Immigrant	15	3.29	2.30	99	2.06	1.13			0.061
Perception of students/teachers about the other	Native	400	6.15	1.89	32	8.40	1.38	0.127	0.359	--
	Immigrant	15	6.91	2.03	99	8.16	1.29			--
Agreement on the use of DT&RM in teaching practice	Native	400	7.24	2.18	32	7.76	1.36	0.032	0.402	0.179
	Immigrant	15	8.46	1.38	99	7.55	1.19			0.008
Agreement on barriers to using DT&RM in classroom	Native	400	6.02	2.14	32	7.44	0.73	0.098	0.632	< 0.001
	Immigrant	15	6.95	1.77	99	7.52	0.89			0.240

Demographic variables related to gender indicated that there is no big difference in the distribution of scores between male and female students except in the cases of access to DT&RM items (females have higher access) and spending time on video games (males spend more time). The distribution of standardised scores on different aspects of DT&RM among male and female students has been depicted graphically using box-and-whiskers plots in Figure 17.

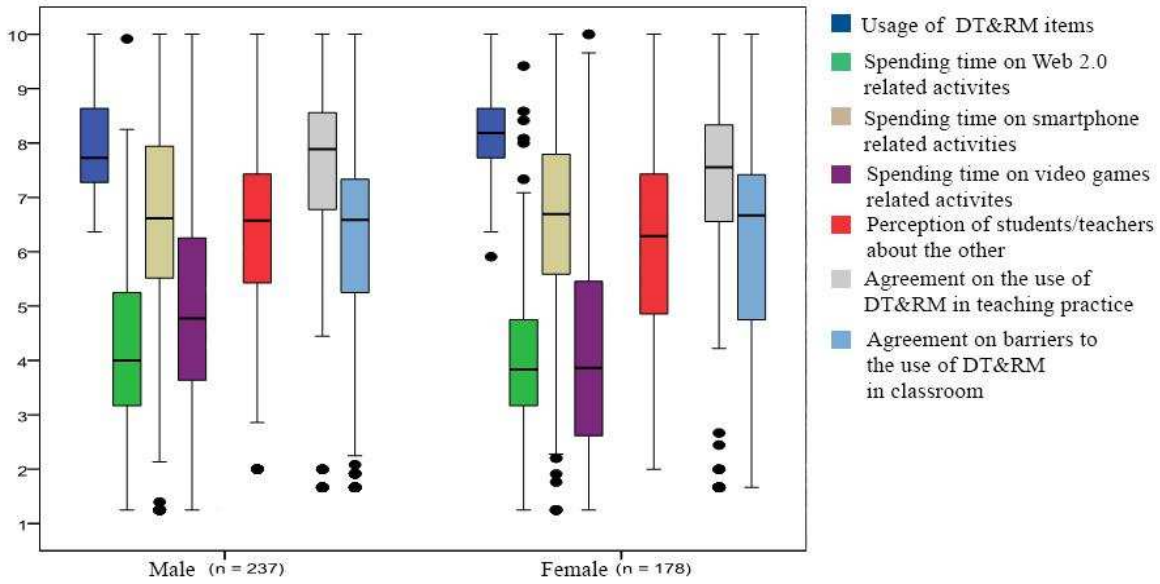


Figure 17: Comparison of overall standardized scores on different aspects of DT&RM between male and female students (for an explanation of how to read box-and-whiskers plots above please see Appendix F, p. 202)

The formal comparison of overall standardised scores on different aspects of DT&RM between male and female students has been presented in Table 19, and the interpretation is similar to the box-and-whisker plots above. An exception is the marginal significance of the difference in standardised score of 'Agreement on the use of DT & RM in everyday teaching practice' between male and female students.

Table19: Comparison of mean standardised scores of different aspects of DT&RM between male (n = 237) and female (n = 178) students

Aspect of digital technology and related media	Student gender	Mean	SD	t (df)	P-value
Access to DT&RM items	Male	7.95	0.90	3.66 (413)	< 0.001
	Female	8.28	0.89		
Spending time on Web 2.0 related activities	Male	4.20	1.48	0.86 (413)	0.389
	Female	4.08	1.39		
Spending time on smartphone related activities	Male	6.46	2.02	0.48 (413)	0.632
	Female	6.55	1.99		
Spending time on video game related activities	Male	5.04	2.11	3.98 (413)	< 0.001
	Female	4.21	2.15		
Perception of students/teachers about the other	Male	6.27	1.89	1.06 (413)	0.290
	Female	6.07	1.92		
Agreement on the use of DT&RM in teaching practice	Male	7.46	2.03	1.97 (413)	0.049
	Female	7.04	2.32		
Agreement on barriers to using DT&RM in classroom	Male	6.12	2.12	0.69 (413)	0.494
	Female	5.97	2.16		

The distribution of standardised scores on different aspects of DT&RM among male and female teachers has been graphically depicted in box-and-whiskers-plots in Figure 18, which also confirmed that there is no big difference in the distribution of scores between male and female teachers in any of the aspects.

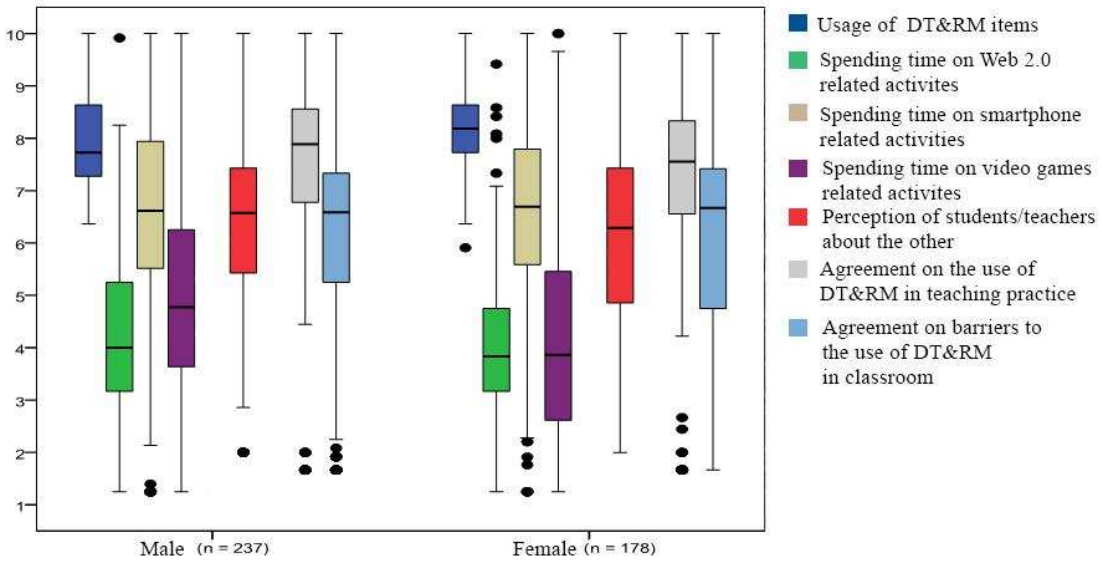


Figure 18: Comparison of overall standardized scores on different aspects of DT&RM between male and female teachers

A formal comparison of the overall standardised scores on different aspects of DT&RM between male and female teachers has been presented in Table 20 and the interpretation is similar to the box-and-whiskers plots above, except for the marginal difference in standardised score on agreement on barriers to using DT&RM in the classroom.

Table 20: Comparison of mean standardised scores of different aspects of DT&RM between male (n = 62) and female (n = 69) teachers

Aspect of digital technology and related media	Teacher gender	Mean	SD	t (df)	P-value
Access to DT&RM items	Male	8.21	1.08	1.50 (129)	0.137
	Female	7.95	0.90		
Spending time on Web 2.0 related activities	Male	3.11	1.45	1.18 (114.9)	0.241
	Female	2.84	1.13		
Spending time on smartphone related activities	Male	5.37	2.43	0.72 (129)	0.472
	Female	5.06	2.46		
Spending time on video game related activities	Male	2.32	1.34	1.44 (129)	0.153
	Female	2.02	1.10		
Perception of student/teacher about the other	Male	8.17	1.26	0.37 (129)	0.709
	Female	8.26	1.36		
Agreement on the use of DT&RM in teaching practice	Male	7.44	1.26	1.48 (129)	0.140
	Female	7.76	1.19		
Agreement on barriers to using DT&RM in the classroom	Male	7.33	0.91	2.26 (129)	0.025
	Female	7.66	0.77		

Qualitative Data

Participatory video production

This phase is guided by the following research questions:

- What are the factors that motivate students and teachers to use DT&RM in their everyday teaching and learning practices?
- How do students and teachers negotiate their digital relationships with technology, and what kinds of technical requirements, solutions, and moral conflicts emerge as a result of the negotiation?

This phase of the research used participatory video production and in-depth, semi-structured interviews with participant-collaborators, eliciting their responses about the experience of filming and specific issues highlighted in the video material. The qualitative data organised and presented in this chapter follows two approaches: the first by issues and themes (see Figure 5, The code hierarchy), and the second by groups of respondents.

Description of population

The sample size for this phase of the research was n = 50. The student population consisted of n = 26 (male n = 14, 53.8%; female n =12, 46.2%). The teacher population was made up of n = 24 (male n = 13, 54.1%; female n = 11, 45.9%). All students who took part in this phase of the research were 16–19 years old. The majority of teachers n = 21 (80.8% belonged to the 32–55+ age group while n = 5 (19.2%) of the teachers belonged to the age group of 16–31 years.

In Table 21, I have provided a list of basic information about participants to supplement what has been presented in the text. The participants listed here do not represent all 50 participants who took part in this stage of the research. The names of the participants are fictional and have been used to protect their identity. The interviews that were conducted by participant-collaborators have been marked as such.

Table21: Demographic information about participants

Students					
Name	**Sex**	**Age**	**Contribution**	**Attending Course**	**Interviewed by**
Carl	Male	17	Participant	Sports and Leisure	Rachel
Caroline	Female	18	Participant	Hair and Beauty	Rhiannon
Charlie	Male	18	Participant collaborator	Art and Design	Me
Claudia	Female	16	Participant	Sports and Leisure	Rachel
Dave	Male	19	Participant	Art and Design	Charlie
George	Male	18	Participant	Art and Design	Charlie
Jacqueline	Female	16	Participant	Hair and Beauty	Rhiannon
John	Male	17	Participant	Performing Arts	Jonathan
Jonathan	Male	17	Participant collaborator	Performing Arts	Me
Kian	Male	16	Participant	Sports and Leisure	Rachel
Mario	Male	17	Participant	Art and Design	Charlie
Mark	Male	18	Participant	Art and Design	Charlie
Nikita	Female	17	Participant	Sports and Leisure	Rachel
Oliver	Male	18	Participant	Performing Arts	Jonathan
Rachel	Female	17	Participant collaborator	Sports and Leisure	Me
Rhiannon	Female	17	Participant collaborator	Hair and Beauty	Me
Sabina	Female	17	Participant	Performing Arts	Jonathan
Teachers					
Name	**Sex**	**Age**	**Contribution**	**Teaching**	**Interviewed by**
Adam	Male	Mid-thirties	Participant	English Literature	Davina
Chris	Male	Mid-thirties	Participant collaborator	Music Technology	Me
Davina	Female	Late forties	Participant collaborator	English Literature	Me
Donna	Female	Late forties	Participant	Public Services	Helena
Gabriella	Female	Mid-sixties	Participant	English Literature	Davina
Helena	Female	Late forties	Participant collaborator	Public Services	Me
Irma	Female	Mid-twenties	Participant	Librarian	Stephen
Jennifer	Female	Early forties	Participant	Public Services	Helena
Laura	Female	Mid-thirties	Participant	Librarian	Stephen
Mathew	Male	Late forties	Participant	Health and Soc. Care	Helena
Mike	Male	Late twenties	Participant	Public Services	Helena
Miriam	Female	Late thirties	Participant	Dance	Stephen
Nick	Male	Early fifties	Participant	Sociology	Davina
Peter	Male	Late forties	Participant	Public Services	Helena
Philip	Male	Late thirties	Participant	History	Davina
Richard	Male	Late sixties	Participant	Property Law	Davina
Rosemary	Female	Mid-sixties	Participant	Functional Skills	Chris
Ruth	Female	Mid-twenties	Participant	English Literature	Davina
Scott	Male	Late twenties	Participant	Stage Management	Stephen
Simon	Male	Late fifties	Participant	Music	Chris
Stephen	Male	Late fifties	Participant collaborator	Performing Arts	Me
Susanna	Female	Late twenties	Participant	Sociology	Davina

Use of DT&RM

The most frequently reported use of digital technology in the classroom by students and teachers was use of the Internet for research and use of different DT&RM for multimedia presentations (PowerPoint, YouTube, use of phones for MP3 music, Video projector, and so

on). Both students and teachers discussed smart boards and stated their preference for wider availability of these in the classroom; however, no teachers or students identified or described the creative use of smart boards. Rosemary, a functional skills teachers in her mid-sixties, was the only participant to comment that she used a smart board because of the links to external resources such as BBC Skillswise and Bitesize. The rest of the teachers said that they used smart boards mainly as a convenient way of projecting PowerPoint presentations and playing video clips. This was also confirmed by teachers admitting that they did not know how to use smart boards and expressing the need for further training. Even teachers who reported frequent use of DT&RM in their practice admitted to not using smart boards to their full potential as they did not know how. For example, a young teacher in his late twenties named Scott who had just completed his teacher training and spoke very enthusiastically about use of DT&RM and how effectively he used mobile phones and VLE resources for his session confessed:

> There are things now that scare me about technology, like smart boards. That is quite a recent technology; I like to think that I keep up with technological advances; I would not know where to start. I probably would not even know where to turn it on, it is not a generational thing.

He then went on to explain that teachers have to play catch up constantly with fast-developing technology and that there is a need for a college to take a supportive role in this.

There was a split in the opinions about the use of mobile phones in the classroom among all participants, especially teachers. There are teachers who use mobile phones as a learning resource and think that the use of mobile phones should be allowed in classrooms and others who do not allow students to use mobiles during their classes. The teachers who did not like the idea of using mobile phones in the classroom argued that they are disruptive. For example, Susanna, a young teacher in her late twenties says that students always ask to charge their "wretched phones" during her sessions. As she found this very disruptive and

difficult to control, she got visibly frustrated and called for a ban on mobile phones in the classroom, strengthening her view with the statement, "I would go back to chalk and blackboard if I had a choice." Philip, a teacher in his late thirties with a very strong attitude against the use of technology in the classroom, tried to explain why teachers like him have negative attitudes towards DT&RM: "Most of our time we are trying to get our students not to use their mobile phones for texting, Facebook, and Twitter." This is reflected in the course handbook, as Stephen, a participant collaborator teacher in his late fifties, reminds us. In his interview with Scott, who was talking about the use of mobile phones in his lesson, Stephen quotes the college policy: "There are no phones allowed in the classroom." As such, he believes we are sending confusing messages to students about the use of mobile phones.

It is interesting to compare this with students' attitudes towards mobile phones in the classroom. While teachers debate about the appropriateness of their use in the classroom, students report very limited enthusiasm for the use of mobile phones as a learning resource. Rhiannon, a student collaborator, was very clear about how she uses her mobile phone: "We young people like mobile phones for socialising; we do not love it for education. The only educational use I get out of my phone is, like, to check spelling, or if I don't understand the word. That's all." She gave an example of how young people her age use their mobile phones for music, Facebook, and Twitter and to stay in touch with their friends. Rachel, another student collaborator, laughed loudly while concluding her statement saying that her generation did not use mobile phones to go to BBC Bitesize and learn. Rachel was even more careful in providing her account about the use of mobile phones. With her response, she demonstrated that young people are critical users and not passive consumers of technology. As reported by Rachel, she did use the mobile phone, but not all the time. She found it ridiculous to use social networking sites when in company of her friends, commenting:

> It is good for being in touch with your friends, but when you are sitting with your friends and having a conversation and everyone is like this (she mimes a person with head down and eyes glued to the mobile phone, with both hands on the keyboard of the phone) it is just annoying.

This clearly contradicts the views of teachers who justified the use of mobile phones in the classroom. Davina, a participant collaborator, and an English literature teacher in her forties justified her use of mobile phones in the classroom, saying, "It is important that students see we keep up; we should not expect that students slow down for us." Similarly, Scott added, "Lots of students cannot be without their phones for a second; we need to be prepared for that." The teachers who were keen on using mobile phones in the classroom gave us examples of how they use them. Davina, a heavy user of digital technology in her teaching practices commented: "I get them [students] to use their phones to look things up on Google. I get them to use their phones as dictionaries, spelling aids; if they have a phone and they want to know it [something], I would say Google it." Richard, a teacher in his late sixties who has a placard above his desk saying "I am Luddite!" is a great user of technology in his teaching of property law. He explained how he allows students to use their mobile phones in the classroom: "We have protocol [where students say] 'please may I use it, yes you may' and then they stand up and tell us what they found out." Miriam, a dance teacher in her late thirties, who loves her mobile phone for keeping all her music on it, explained how she found mobile phones useful. However, for her, technology did not mean much in her teaching practice, as the benefits of technology were obvious. Students can instantly access any music when they are doing their own choreography, or if they forget the music and have a performance coming up, she can download music for them very easily.

Use of VLE was prevalent among participants, and all students and teachers were well aware of its use. There were some very good examples of the use of VLE. Simon, an experienced music teacher in his late fifties, summarised the use of VLE at the college well. He reported that teachers used the VLE as a convenient resource where they placed various

teaching resources, examples of units, assignment briefs, timetables, tutorial lists, session guides, and links to online video and audio resources. As stated by Simon, the VLE is an effective instrument in making students aware of what units they are doing and helping them to plan their learning.

Students also reported the use of VLE but not necessarily in the way teachers would like it to be used. For Rhiannon, the VLE was not a learning resource but rather a convenient "backup". Articulating what she expected from her teachers, Rhiannon concluded, "Teachers teach, that is why they are called teachers." For her, the aim should be to use VLE less as she finds a teacher more inspiring than technology: "I would rather have a teacher explain to me what I need to do than read about what I need to do; it is more motivating." Rachel expressed her scepticism about students using the VLE from home: "It is a good thing that you can access VLE at home, but people will not do it because they are on Facebook and Twitter (she laughs), that's all they do." Caroline, a hairdressing student, noted that not all teachers uploaded learning resources on the VLE, admitting that she "only used VLE twice" because her teachers "haven't put anything on VLE."

Chris, a participant collaborator, and a music technology teacher in his mid-thirties, made some comments that resonated with some students' statements about VLE. He supported the claim that the VLE was utilised as a useful tool for providing students with convenient and broad access to learning resources. However, he also expressed scepticism about its use:

> We want them (students) to sit down at home, get their heads down and do all the work; unfortunately, that's not the case. They are teenagers; they do what teenagers do: going on Facebook, playing video games, whether we like it or not.

He also expressed his reservation about making all learning resources available on the VLE. Contrary to popular belief that VLE has the potential to enhance independent learning, Chris

claimed that it can make students passive instead of making them active learners, commenting that "we are spoon-feeding them a little bit too much". He was also very critical about the college's motivation to pursue the use of DT&RM in the classroom. Chris perceived Ofsted as the main force behind it:

> We were told if Ofsted is in, get them [the students] to use their mobile phones (he raises his arm with clenched fist up in the air), and access content via the VLE so they can see we are doing stuff, get them to set a new target for next session, upload the work onto the VLE for marking.

Chris was very pragmatic about the use of DT&RM at the college. He believed that students do not necessarily care too much how teachers use technology as long as it helps them to do their job better. "If you asked students, I imagine they would say, I want Chris to do what is best for him not what's best for the college because he is my tutor and that's what I want." Students are interested in getting the best possible marks, and all they are concerned about is how to achieve that, not how teachers use technology. If a teacher writes on a piece of paper, "Well Jack, this is what you need to do to get a merit," it is all that matters, believes Chris. Technology often makes teachers do more work, suggested Chris. They often upload a brief to the VLE, to be downloaded by students to do an assignment, who then upload it again back to the VLE for a teacher to download it, print it off and mark it. "Just do me a printed copy, it is easier for me, and it is easier for the student. Job done!" Chris advocated freedom for teaching staff to determine how they should use technology:

> I think from the staff point of view if it works for you, fine use it, if it doesn't work for you and you've got alternative methods that are easier, use the alternative methods. Do not worry about guys at the top; just worry about your job and do your job. Do your job and get done what needs to be done.

After Chris had completed his strong and critical statement about the use of VLE at the college, he made the remark, "I will probably get sacked now!" explaining that the management at the college was forcing staff to use the VLE and was not ready for a debate

about its efficiency. “It does not help teachers by saying you have to use it, I think it needs to be the case of what’s best for the staff and the student,” concluded Chris.

Regarding the use of social media in the college, both students and teachers confirmed its frequent use. However, Mathew, a health and social care teacher, in his late forties, felt that social media is not yet fully adequate for educational use. He pointed out that there are issues of confidentiality and trust to be addressed if we are to use more social media in the future. If somebody posts something on social media, everybody can see it. This raises the issue of cyber-bullying, which he believed is not going to be easy to regulate. In his account, Mathew expressed great concern when it came to communicating with students over social media, admitting that he preferred using e-mail rather than Facebook. However, he believed that if used correctly, social media can be very useful as students are always on Facebook.

For students, social media is very much a synonym for their mobile phones and part of their social life. Although some of them use it to communicate with their teachers, they prefer face-to-face communication. Rachel, a student collaborator, suggested:

> If you are only to use Facebook to communicate with your friends and teachers, you would never meet anyone. It is not the same thing; I do not think that this is a good idea. It makes it easier for everyone, but you will never have college experience.

The evidence suggests the use of YouTube to be very popular among teachers. Davina recorded several video clips exploring the use of YouTube for teaching and learning. In her video clip of Gabriella, an experienced English Literature teacher in her mid-sixties who is very proud of not using DT&RM for her session, we can see in her classroom written on the white board, “No need for computers, TDSW (tutor directed study week).” However, during the interview with Davina, Gabriella admitted that she found YouTube very useful:

> I have found much against my better judgement that YouTube has been very useful to use occasionally. When we do poetry and you read them poems, you find a couple

> of nutters who have made their own videos of these poems. There is a guy who stands sideways on the side of a very busy road, somewhere very cold, and he is reading his Valentine a love poem and it is so scary that it actually makes the poem come alive (she laughs). It is a different view, I find that sort of thing very useful, but not every lesson.

Richard, a property law teacher, also found YouTube to be "a great learning tool". He found it useful for accessing news, video clips on court cases, documentaries, legal and crime drama television series, and so on.

Students were more critical about YouTube. While teachers did not find a problem accessing what they wanted on YouTube, students did not have the same privileges with their college accounts. John, a student from performing arts commented, "You are allowed to access YouTube, but you are not allowed to watch any videos." Rhiannon pointed out another case of concern when using YouTube for teaching and learning: "YouTube is helpful, but you do not know how old the YouTube video is; the information might not be valid." In an effort to address online safety concerns and control what students are watching on YouTube at the college, the IT department restricts students' access to various video content. This, however justified, limits students' access to DT&RM and ignores their competence, voiced in Rhiannon's comment, to manage their online environment.

When asked how often they used technology in the classroom, some teachers reported high levels of use while others reported moderate or very little. After we had watched his video, Stephen commented about the extent technology is used for teaching and learning at the college. He felt that technology has been imposed on teachers. When in his video he asked participants the question, "If technology did away overnight would you carry on with your class?" the average figure of 50% answered "Yes". Stephen believes that 50% is not enough to justify high investments in technology at the college, which, in his opinion could be spent more effectively:

> There is such a huge expense involved in that technology. If you look at the amount of money spent on the technology that's not being used and if you extract that in terms of pounds and pennies, my God there is a fortune you could use in other human resources, such as investing in people to come and give one-to-one help to students who need it.

Students also preferred the balanced use of technology and the majority of them expressed the need for teachers. Kian, a sports student who preferred being taught by teachers, commented, "It's best learning from someone who is in front of you." All participants, students and teachers, agreed that in the future, there will be more technology in the classroom; however, they all believed that technology will not necessarily change education for better. Oliver, a performing arts student warns us:

> It is a daunting realisation; with the introduction of more technology in the classroom, teacher-student relationships in the classroom will weaken. It is a sad thing because that relationship is the most important thing we have at school.

Scott, a young teachers predicts, "The way that students use it – I am giving thumbs down for technology in the future, but if we look at it closely then it could be thumbs up."

When asked what technology they would like to see in the future at the college, all participants were hesitant to respond for a few seconds. Wish lists for students and teachers were different. Teachers asked for more smart boards, working laptops, and better Wi-Fi connections, while the majority of students asked for iPads and no web restrictions at the college.

Motivation and benefits of using DT&RM

When asked about motivational factors to use DT&RM for teaching and learning, both groups of participants cited the benefits they received from using technology. One of the most commonly reported benefits was the use of technology for research. Donna, a public services teacher in her late forties, summed this up by saying, "30 years ago when I was at college we had a book; now students can go as far as anywhere in the world to research what

they need to do." In addition, Donna commented that technology opens up a whole new level of possibilities in using DT&RM for teaching and learning. This, she believed, makes teachers "hungry to learn" how to use it and how to improve the way they teach students. Mathew suggested, quoting his own experience, that technology "engages students" and makes them want to learn. Mike, a technology savvy teacher from public services in his late twenties, although very keen on technology, expressed a balanced view about the impact that technology had on teachers' professional practice:

> I like an interactive lesson. I find the technology easy to use; that is something I build into my everyday life. I feel that students are quite capable of using it, it improves their learning, improves their engagement; but I think you should not go out of your way to use it if you are not comfortable because it changes your teaching practice for no reason.

The other reasons of a practical nature were summarised in Simon's account: "I am not good with paperwork. It tends to be very easy for me to lose bits of paper, folders etc., and it's really great to have everything all in one place."

There were also some teachers who were critical of the use of technology in education, stating that they have been under pressure to use it. Chris and Stephen both held the view that they had to use the technology just because they felt obliged to do so. The constant pressure from the college made them put more of their free time into learning technology that, they believed, might benefit only a tiny minority of their students.

Practical reasons for the use of DT&RM were also motivational for students. For Jacqueline and Mark, technology is an inseparable part of everyday life and is "always available", making access to information easy and instant. Sabina agreed with their statement, finding the information she accessed on the Internet very useful for her college work. Oliver as well as Claudia and Nikita confirmed the benefit of technology for spelling, while Dave made the point that technology made communication between students and tutors easier. For example, he found "online feedback from tutors beneficial because it's

quick and easy to acquire". George commented, "You can use different techniques you cannot use without technology, so you can edit photos, chuck in the effects and stuff."

Limitations and barriers to use of DT&RM

Even though all participants did find that DT&RM have brought some benefits to their teaching and learning practices, they were critical of them. Several teachers expressed their worries about the quality of information students find on the Internet. Helena, a participant collaborator in her late forties, described the problem. Students use web resources without any knowledge of "whether it is right wing or left wing, fanatical or radical". She continued, "Information that most of the students are accessing has an opinion, but they do not know it, and they do not research all the facts to make their opinion." In her account, Helena gives us an example where a student might struggle even with a very simple assignment such as The Causes of Crime in a Social Area:

> All that they do when they do the research on the topic is type 'causes of crime' into a search engine. When they get millions of hits from all over the world, before they use the information, they never ask which country the information comes from. They do not ever ask themselves what kind of political bias the information they are using might have. They find information online, they copy it, or they rewrite it in their own words, most of the time without even sourcing it. This is what concerns me more than anything.

Although this is worrying, it is comforting to hear that students are fully aware of the issues Helena was talking about. In his interview, John gave an account of his personal experiences: "Sometimes, certain websites can be incorrect. I used a certain maths website where they actually gave me a wrong answer." Carl, Rhiannon, and Charlie commented that you cannot always believe what you see on the Internet. Rhiannon, in her statement, demonstrated full awareness that the information accessible on the Internet is often secondary and inaccurate. As a result, she argued, teachers have an important role in ensuring

that students learn how to access relevant information on the Internet. Charlie commented on the need for teachers' help:

> If you are going to Google something when you ask the question, it gives you thousands of different answers. You don't know which one is right, but with the actual teacher in the room, a real human, with whom you have a relationship, you can instantly ask the question, and he can sit down with you and help you, something technology cannot do yet.

To illustrate the danger of unrestricted access to information over the Internet, Stephen talked about the short film he watched created by some students as part of their research assignment. The film was made up of documentary footage found on the Internet that included graphic images of beheadings, torture, and killings. In his comment, Stephen raised the issue of the moral responsibility we have for our young students when we are asking them to research using the Internet for their assignments:

> I was quite horrified by the film and astonished by the fact that the footage was so easily available on the Internet, with the push of a button. If they can find it, everybody can find it. I find it deeply upsetting that such obscene material, genuinely shocking, can be so easily found by young people on any digital application. Do we not have a moral responsibility to young people? I think we do! Certainly we have a moral responsibility in the classroom when we teach them (Stephen).

Talking about moral responsibilities, Stephen acknowledged that the college was trying to put in place some restrictions on the websites that students are accessing at the college. However, in doing so, the college is creating another problem. John, a performing arts student, explained, "Many useful websites at the college are often blocked. I understand some web pages being out there with explicit material, but they should block those, not entire sites such as YouTube." Miriam, a dance teacher, pointed out that the college blocked many web pages she needed for her lessons without any rational basis:

> Pineapple Dance Studios, pages on the Mariinsky Theatre, just random, there is no way of actually guessing what's going to be blocked. Also on some of the laptops, it seems to be blocked but not on others. Very crazy! I feel so frustrated.

Both groups of participants were in agreement when talking about technical problems that limit the use of DT&RM at the college. Describing a college computer system, two teachers used the same description: "it is a bit of a clunky system". Rosemary found that when it does not work, technology was "the biggest barrier" for teaching and learning. Trying to estimate how often the technology fails during the sessions, Scott stated, "Out of 10 [he took a long pause to think] I would say probably five to six sessions will be OK." When this happens, it can seriously ruin the session, commented both Rosemary and Scott.

Charlie, a student collaborator, raised an issue of students being "locked-in" in the technology, where technology becomes a barrier rather than a liberating creative force:

> One of the worst things is when the technology does become available and promotes great things that we can do with it, and then when you come up with some ideas and when you go to try to do that stuff, then it does not do it because of this thing or the other. If you use traditional methods which do not involve digital technology that's it, that's all you will produce. However, with technology, limitations can turn into nightmares. For example printing, it's all there, and it's supposed to work but it doesn't. I try to avoid printing anything at the college altogether because it's going to take ages.

Printing was pointed out as a barrier by both students and teachers. "Printing is very annoying; it's the bane of my life," commented Oliver. "In case we want to print, we actually have to find the printer because the printer nearby us is for teachers only," said Mark. Scott's comments supported students' statements about printers. He stated that the college just recently invested in a new printing system, which was not good: "Printers just slow the whole process down; they are very slow and very unreliable."

The other barriers mentioned by teachers and students which limited the effective use of DT&RM at the college were technology not being up to date, poor wireless connectivity, not enough laptops, and Macintosh computer platforms not being supported by the college IT department.

Generational divide as a supposed barrier to using DT&RM

One of the potential barriers identified by literature is the generational divide between students and teachers. Some of the teachers' observations about their digital skills supported the view that they were less digital than their students. Rosemary used the metaphor 'digital natives' to make the point that the college needs to keep up with the new generation, commenting:

> We are dealing with digital natives. It is second nature for them. If we do not use it, I think we are being left behind a little bit. I am old school. I still use pen and paper. That is how I was taught, but I still think we have to move with the times.

Simon commented:

> As far as the students are concerned, that is what they are familiar with. So if we are asking them to use their mobile phones for instance, or various apps i.e. using iPads or whatever, those are the kind of methods of working that young people are using all the time.

Donna confessed, "Quite often, embarrassingly so, it is the students showing the staff how to use the equipment. This happened to me quite a few times." Nick, a sociology teacher, remarked, "I am too old and set in my ways to understand technology. It's taking me a horrendous amount of time to get anywhere near competence on the computer, and I am 44 now." However, Mathew commented, "Young people are far more in touch with technologies than old generations," but he added, "I don't believe that it is necessarily true because we have many young people here that are quite poor with technology and, of course, we have many tutors that are exceptional with technology."

Mathew's statement was supported by teachers who, because of their age, belong to the generation born with digital technology. Susanna, a teacher in her late twenties said, "I have a smartphone and I can barely use that." Ruth, another young teacher in her mid-twenties, talked about being trained to use a smart board: "I am comfortable with importing PowerPoint slides and getting students to write on the board, but I am not so confident using

some more advanced features." Helena, a teacher and participant collaborator, after watching her video clips, remarked, "Two of the teachers I interviewed are under 30 years old. I expected them to be a little more upbeat, and they are not necessarily pro-technology as you would have thought."

The theory that students are better with technology than their teachers was only supported by one student. Rhiannon commented, "We are better than our teachers with technology because technology is nowadays more for a younger generation; we use it lot more than the older generation. In my generation, everything around us is technology." However, she also added, "Because we grow up with technology, you guys think we prefer to learn from technology. That's not right, I learn more from my teachers than technology."

When talking about their digital skills, students perceived themselves to be much less confident about digital technology than did their teachers. They were very aware that they needed help with technology and identified teachers as those who would help them learn about it. Sabina commented, "Technology is pretty confusing sometimes. We used digital cameras at some stage, and I did not really understand much about it. I needed someone to show me what to do." John recognised the same need for support: "Teachers need to keep students updated with the Internet and get them familiar with technical devices. The world is getting newer every day when it comes to technology." Charlie, student and participant collaborator, pointed out in his interview that the problem with the adoption of technology may be with students:

> We do have some really good people teaching us, who know technology inside out, and sometimes it doesn't seem to matter how many times you teach someone how to use it, or you sit with them one-to-one — they still can't use it. I think it's mostly based on their own interest, if they are not interested, they don't seem to want to learn.

Evidence that students are not so digital was demonstrated by statements obtained in Stephen's video. In the video, two librarians commented about students' attitudes towards online resources available in the college library. Laura, one of the librarians, said:

> A great deal of our students prefer books; they actually are a little bit frightened of our online resources. During the progression week, we are actually doing research sessions showing students our online resources because they don't understand how to use them. When we tell students and give them leaflets about our online resources, they never check it out.

Irma, another college librarian and a female in her mid-twenties, added to Laura's comment: "All the students I have seen during this progression week have been gaming, not doing college work." However, some argued that gaming gives young people transferable skills that help students to navigate technology for learning. Jonathan, a student participant collaborator, recognised that computer video games "…are a similar piece of kit. If you are using a laptop or you are using a game console, it doesn't automatically mean you will be able to use these things for education."

Accepting that there are differences in people's abilities to work with digital media, Mike, a teacher from public services, pointed out, "Technology is a problem for those who do not engage with it." Davina a teacher participant collaborator noted:

> There are some students who do not have a smartphone, and they are embarrassed by this. You can marginalise people by their use or lack of technology. By encouraging excessive technology use, I think we are creating barriers to learning as well. If students feel that they should have a smartphone and they haven't, then that is the barrier.

Jonathan stated, "If we do everything with technology, we will have people left behind because some people will just not understand it, someone will not want to learn it, and they will all stay behind." Commenting about a possible digital divide between those who are computer literate and those who are not, Oliver believes that we should be "trying to get everyone on the same par; otherwise, there will be people lagging behind, and it's only

going to get more complicated." Charlie, a student collaborator, pointed out the divide between those students who have technology at home and those who do not:

> One of the main things which creates the barrier — no one wants to say this — is the fact that students do not have specialist software at home. We do lots of home study, and when you come to do digital work, if you don't finish it, it just stays at the college; you cannot take it home if you do not have same facilities at home.

Forms of negotiation

To overcome problems with technology and settle differences caused by the use of DT&RM, students and teachers have to compromise and look for solutions to avoid disruption of teaching and learning. Peter, a public services teacher, admitted that very often, "If there are any queries — students ask questions I don't necessarily know the answer to — I ask students to find out on the Internet." This practice was confirmed by Mario, an art student: "When I do not know how to do something with technology I look it up on the Internet."

The teachers and students talked about working with the limited amount of equipment. Jennifer, a public sector teacher, commented, "We have limited amount of equipment at the college so we have a system with our department where we can book equipment, making sure that all students have fair usage of what's available."

Stephen commented that as the result of using technology in the classroom, we are failing to engage students as "it's all too easy, it's all spoon fed". Adam, an English teacher in his mid-thirties, also noted, "Students don't want to take notes anymore if there is a PowerPoint available on VLE." Davina was very aware of the issue and explained how she ensured that students were not passive and were engaged in the session: "To encourage students to take ownership of the learning, I do put my stuff on VLE but only after I deliver it. I never give PowerPoint handouts because they do not need to write it down. I also embed in my PowerPoints tasks they have to do, and I do the tasks at the same time as them".

All teachers felt that the biggest limitation to the use of technology in the classroom was a lack of reliability. “I don’t always have time to go before my session and check if the technology is working,” confessed Rosemary. The other teachers also talked about not having enough time to dedicate to technology. Chris, a teacher collaborator, also talked about a shortage of time to ensure the technology was ready and working: “Technology is fine if you’ve got time to check if it’s working beforehand. You cannot rely on it working if you jumped into the classroom and you have two minutes to start your session.” Chris also pointed out that teachers needed to prepare for the session additionally if they were to use technology: “All the content there someone has to write anyway. It is not just a matter of turning up, putting a smart board on and it’s there. She or he has to go and write the content anyway, and if it’s not working, you shoot yourself in the foot.”

In overcoming this problem, teachers did not feel supported by the college and claimed that they had to put more of their own free time and energy to be up to date with technology. Simon commented, “I am fairly confident in using it but because I have spent my time trying to learn it. There isn’t much support provided by the college; you have to do it in your own time.”

Perceived issues related to DT&RM

Overall, teachers expressed a positive attitude towards DT&RM and its future in education. They demonstrated a good awareness of technology and its potential benefits for teaching and learning. Teachers expressed their worries about the reliability of the technology and the quality of information available over the Internet. There were some teachers who found the use of technology in the classroom disruptive and expressed preferences for more traditional educational methods; moreover, some of those participants belonged to the young generation of teachers.

Helena, one of the participant-collaborators, in her response, suggested that answers she got in her video could be biased as she believed respondents in her videos were intimidated by the camera, which could have influenced their comments. She explains this:

> The fact that I was asking them [teachers] about digital technology — I feel that they seem to have assumed that I wanted positive feedback regarding this topic. As such, they seem to put more of the positive spin on these issues than they would if you spoke to them in a pub, in a more relaxed setting. I feel they were giving institutionalised answers that are within the college setting.

Students expressed more critical and sceptical views on technology and the future of education than their teachers. Oliver was talking about the future where there will be "no libraries, no teachers, no books, everything will be technology; it is a daunting realisation that will break down relationships between teacher and student." John sees the negative influence of technology already happening: "Lots of people nowadays tend to be more shallow, more quiet, more to themselves, were 20 years ago people were more out and open to talk to everyone on the street. Today, everyone is on their phone constantly." Mark, however positive about digital technology, still believed in old analogue technology such as books: "I believe that technology does help to a certain extent, but I do believe that it is always good to actually read the book and to have teachers tell you about certain things, about what they have learned and they pass their knowledge and experience." To emphasise the danger of social engineering by technology, Jonathan, student collaborator, quoted Albert Einstein: "I fear the day when technology will surpass our human interaction. The world will have a generation of idiots."

Summary

This chapter reported and analysed data utilised by mixed methods research design that included data collected by self-reported online survey questionnaires, and collaborative participatory video making. The online survey questionnaires provided quantitative data regarding access and use of technology, beliefs and attitudes, perceptions, as well as

demographics. The finding from this phase of the research confirmed the existence of digital differences between students and teachers; however, those differences are not the result of the generational divide but are rather related to trends in how students and teachers use a specific technology. The next qualitative stage of data collection involved participatory video making and semi-structured interviews. This part of the study looked at what motivates students and teachers to use DT&RM and how they negotiate their relationships with technology? The findings from this stage of the study suggest that both groups of participants use technology, not for its potential, but rather perceived benefits technology can provide in meeting their goals.

In the following chapter, key findings have been synthesised and discussed in light of the specific research questions that guide this enquiry. This is followed by a conclusion, recommendation for practice, and future research, with reflections on my research journey and original contribution to the field.

CHAPTER FIVE

DISCUSSION AND CONCLUSION

Discussion

With the goal of contributing to the debate about the effective diffusion of DT&RM in education, the aim of this study was to investigate the differences and similarities between students' and teachers' relationships with technology by answering the principal research question: In what ways do students and teachers vary in how they relate to digital technology in the context of teaching and learning practices? The research reported in this study offers an account of some experiences, perceptions, and attitudes of students and teachers in an FE college in the South East England. The research originated out of my professional interest in the integration of technology into everyday teaching and learning practices as well as my role as curriculum manager and media teacher in an FE college in South East England, where I conducted the study. The study population (n = 602) comprised students (n = 444) and teachers (n = 158) who took part in the mixed methods research inquiry.

In 2001, with the publication of Digital Natives, Digital Immigrants Prensky (2001a; 2001b) gave rise to an attractive and speculative theory of digital natives as an exceptional generation of young people with distinguishable characteristics and predictable preferences and behaviours, which quickly turned into a widely accepted and popular idea. The theory predicted that this digital generation of students is so unique and different that they will stretch the education system to the point that it will have to change forever. The new digital vision of education is seen as a genuinely democratic and self-deterministic system, where teachers will not be in the role of authority but rather facilitators of the system governed by students' needs and desires (Derry, 2009; Jukes et al., 2010; Negroponte, 1996; Tapscott, 1998; Tapscott & Williams, 2010). With the advent of a collaborative network environment of Web 2.0 technology, which facilitates information sharing, collaborative applications, and

social media dialogue, the idea of personalised interactive education has been given a fresh vision. In this vision, the old form of educational control will be unnecessary because, with interactive and collaborative digital technologies, students will become a part of self-regulating networks of learning individuals who will attain and share knowledge without the central control of teachers (Prensky, 2007, 2011).

This idea of a self-regulating education system — parallel to the liberal ideas of self-governing educational institutions which should embrace principles of market economy and be regulated by supply and demand — attracted governments across the world, which started creating policies and investing money in strategies that would update the old analogue education system into a new digital system of 'schools for the future' (BIS, 2009). As the investments did not elicit desired outcomes and the adoption of technology in educational institutions did not provide quick enough results, teachers were often found to be responsible for it. Belonging to the generation of digital immigrants who did not grow up with digital technology, teachers have been perceived as 'Luddites' (Jukes et al., 2010; Prensky, 2001a, 2001b). Often portrayed as not confident and knowledgeable users of digital technology, they have been held responsible for slowing down technological progress and the learning of a generation of students who are not accustomed to old teacher-centred ways of learning (Crowne, 2009; Godwin-Jones, 2015; Luckin et al., 2012; Mundy et al., 2012).

Based on very limited empirical research and with the view of technology as a driving force for social change, before long, impressive claims about the nature of this exceptional generation started to be academically and empirically questioned (Corrin et al., 2010; Harwood & Asal, 2007). It has been argued that the topics of a generational divide and a digital generation are controversial, and instead of being based on sound evidence are rather founded on speculative and conceptual stereotypes (Bennett et al., 2008; Buckingham, 2009; VanSlyke, 2003). The idea of digital natives began to be challenged by studies whose

research and evidence began to confirm that a digital generation of students is not a homogenous group as earlier believed, and if asked about how digital they are, members of this ostensible generation identify themselves as intermediate users of technology (Bennett et. al., 2008; Bennett & Maton, 2010; Buckingham, 2009; Bullen & Morgan, 2011; Corrin et al., 2010; Green & Hannon, 2007; Kennedy et al., 2007; Krause, 2007; Kvavik, 2005). Their usage and access to digital technologies do not neatly fit into the suggested paradigm, and all members of an alleged digital generation are not affectionate and confident users of the new technologies (Hargittai, 2008; Kennedy et al., 2008; Kennedy & Judd, 2011; Livingstone, 2009; Palfrey & Gasser, 2008; Taylor, 2012; VanSlyke, 2003). Even more notable are claims that digital natives are not very different in their digital skills from their digital immigrant teachers (Kennedy, 2007). Digital natives are hardly using the full creative potential of the interactive and collaborative potential of Web 2.0 technology; however, they are aware of safety issues and are apprehensive about the quality of information they access (Corrin et al., 2010; Kennedy et al., 2007; Margaryan & Littlejohn, 2008). In addition, they might already be affected by digital technology in the way that it is changing them into a depressive, unmotivated, and cynical generation with a pessimistic view of the future (Car, 2010; Twenge, 2006). Despite new evidence about the digital generation emerging, 'policy-makers continue to adopt generational argument' (Jones et al., 2010, p. 367), and with the fast development of new and more interactive DT&RM, the argument about differences between the new generation of students and their outmoded teachers did not die out. Moreover, there has been a great deal of improvement in the adoption and use of DT&RM in FE colleges (Sero, 2009; City & Guilds, 2014), OFSTED (2009) refers to the development as 'a cottage industry' (p. 4) rather than full-scale national technology revolution. At the same time, others criticise FE sector of ignoring the opportunities to embrace technologies

blaming teachers for it (Sherlock & Perry, 2013; Sharpe & Brown, 2015) while praising students as 'the greatest resource available to FE' (FELTAG, 2014, p. 5).

By conceptualising the research issue of a digital divide between students and teachers as a socially situated and constructed concept, the study rejects the generational divide model based on the belief that the adoption of technology by students and teachers is directly related to the time an individual was born. As a result, it has been suggested that we cannot separate students' and teachers' relationships with technology from the meanings they attach to their activities and experiences with technology.

Though, DT&RM are an inseparable part of young people's everyday lives (boyd, 2015), the results of this study indicate that some of those everyday digital skills are not easily transferable to educational situations. This is in line with claims that students are not confident users of DT&RM (Corrin et al., 2010; Green & Hannon, 2007; Kennedy et al., 2007; Kvavik, 2005), and that they struggle with the use of technology in an academic context (Eduserv, 2015; Sharpe & Benfield, 2012). Furthermore, this study is also consistent with claims that students' ability to transfer digital skills to learning context are largely dependent on skills and confidence of their teachers to use technology (Sharpe & Brown, 2015). In the study, students reported that teachers, libraries, books, and human interaction are very important parts of education that cannot be replaced by technology.

The assertion that teachers are 'technology fossils' (Sherlock & Perry, 2013, p. 14), who are struggling to teach in new digital age (Prensky, 2001a, 2001b), and not prepared to use technology (Sharpe & Brown, 2015) is not supported by the findings of this study. Although there were some teachers who see technology as unhelpful and a disruption in the learning process and some who admit they are not always confident with digital technology, all teachers demonstrated a positive attitude and willingness to use technology, with some of them demonstrating the very proactive use of technology in their teaching practices. For

example, the data indicated widespread VLE adoption among teachers at the college with some good examples of its use. Though, VLE is recognised by teachers as a valuable resource, the research findings are in agreement with the Van der Veen (2013) and Ofted (2013) reports that VLE is mainly used as a digital repository, which is often not regularly updated. The teachers' explanation for the limited use of VLE's capabilities ranged from not having enough time, insufficient training, to OFSTED inspection being the main driving force behind it. The findings suggest that VLE, however useful, can be a barrier to learning as students do not pay attention or take notes during the lesson if they know they can find the information about it on VLE. Making everything available on VLE 'spoon feeds' students instead of encouraging them to be independent learners. There was a suggestion that students do not care too much if they use VLE or not, as for them the most important goal is to get the best possible marks and pass the course. Students see VLE as a 'backup' rather than a learning resource and prefer teachers over the technology as teachers are more inspiring. These findings are in agreement to OECD, (2006) report that students use computers at home more to play games than for educational purposes. According to students and teachers who participated in this study, students at home use technology to access social network sites, play games, and have fun rather than use it for learning.

A similar picture emerged when students and teachers commented about smart boards (IWBs). Widely adopted and welcomed by students and teachers (Somekh, et al., 2007; Moss et al., 2007), there are indications that IWBs are not utilised to their full potential, often being used as blackboard replacements and reinforcement of a didactic style of teaching (Greiffenhagen, 2002; Digregorio & Sobel-Lojeski, 2010; Higgins et al., 2007; Tanner et al., 2005; Smith et al., 2005, 2006; Somekh et al., 2007; Maxwell & Finlayson, 2007). The findings of this study confirmed that both students and teachers recognise the potential of IWBs, but no one identified or described the creative use of IWBs. Instead, data

revealed IWBs being used as convenient classroom projectors for PowerPoint presentations and playing video clips. Only one teacher reported using IWBs as a gateway to external learning resources such as BBC Skillswise and Bitesize. The reason teachers gave for the limited use of IWBs were: reliability and complexity of the technology, lack of time for preparation, and insufficient training.

The results from this study indicated statistically significant differences between students and teachers related to the use of digital video games and mobile phones. These findings are in agreement with those from Ofcome (2015) regarding high percentage of use of mobile phones by young people aged 16 to 24 and McGonigal's (2011) claims of the existence of new digital generation of young people who 'crave gameplay' (p. 129). Nevertheless, as data from this study confirms significant differences between student and teachers looking at the use of mobile phones and video games, these differences are not consistent across other DT&RM activities. Findings suggest that differences are related to a certain type of technology rather than a generational divide. The findings of this study are in agreement with Mtega et al. (2012) that mobile phones, however popular among young generation of users, are not used to its full potential. Students, as well as teachers, use mobile phones mainly for voice calls and SMS messaging failing to utilise their full multi-media potential. This study also found that use of mobile phones in the classroom did not follow generational divide pattern. While some teachers who by their age belonged to the digital natives' generation, found mobile phones disruptive in teaching and learning, some senior teaching staff, who by their age would fall into the digital immigrant category, utilised mobile phones into their classroom practice. Students also questioned the use of mobile phones for teaching and learning. Even though quantitative data findings depicted a higher level of students' engagement with mobile phones, on the other hand, the qualitative data indicated that everyday use of mobile phones does not necessarily translate to use of mobile

phones for teaching and learning. One student confirms that young people use their phones for socialising a lot; however, she is very clear that it does not mean that they like to use their phones for education. Another student is very sceptical about the use of phones, labelling their use by young people as ridiculous and annoying. The similar findings were confirmed in relation to students' use of computer video games. The differences between students' and teachers' use of video games were evident in the demographic analysis of the data where the native type of students and teachers differ significantly from their older immigrant students and teachers. However, an integral part of their youth culture, students in this study addressed the issue of transferability of video games skills. This is in agreement with Bourgonjon et al., (2010) findings that playing video games at home does not necessary have to be directly relevant to learning. The findings of this research also confirmed those of Standford et al., (2006), that is, the existence of gender difference with male students spending more time playing computer video games; however, data confirmed that there is no big difference between male and female participants in any of the other aspects of the use of DT&RM.

The observation that different technologies attract different users, and that there are some devices where teachers reported higher use than students, agree with Buckingham (2005, 2008) that some digital devices are specifically marketed to a particular age group and therefore some digital media such as computer video games and mobile phones are a part of the students' culture and identity. However, this can lead us to the conclusion that students are more digital than their teachers, though it is not enough to support a generational model of the digital divide.

According to the survey in this study, almost half of the students (49%) considered themselves average and below average users of technology (44.6% - average; 3.4% - beginner; 1% - sceptic). This finding is not in line with Prensky's (2001a; 2001b) theory as

it emerged 15 years ago and related to a new generation of young people having a natural affinity for technology. Although the percentage of students (49%) is lower in comparison to that of teachers (67.2%) who considered themselves to be average and below average (61.1% - average; 6.1% - beginner; no sceptics), this gap is not as wide as the advocates of a generational gap suggested. This was also confirmed by qualitative data where 49% of students who took part in the interviews stated that their use of digital technology is not anything as we might expect (1% - sceptics; 3.4% - beginners; 44.6% - average). Of all the students who took part in the interviews, only one commented that young people are better with technology than their teachers because they are born surrounded by technology. In terms of a generational divide, both groups agreed that there are students and teachers that are equally good and bad with technology and that this is an individual rather than a generational issue. The comparison of the views between students and teachers regarding each other's assessment and the self-assessment of their relationships with DT&RM reveal that both groups of participants hold some misconceptions about each other that are in line with qualitative data and common digital native / digital immigrant stereotypes. Teachers perceive students to be more digitally savvy than students perceive themselves, while they see themselves less digitally savvy than perceived by students.

Looking further, the results above indicate that differences between students' and teachers' relationships with technology also originate from the roles they play in the educational social setting. To be a successful teacher and successful student in any educational setting, one must adopt a social role and relationships often prescribed by policies, rules, and the educational process itself. Those roles and relationships, as Markie (2003) argues, are an important part of life in an academic institution. Teachers have a professional commitment to their students to regulate their academic lives by setting up policies on attendance, exams, and disciplines; plan and deliver the curriculum; evaluate

students' knowledge, and apply standards for the certification of achievement. On the other hand, students' roles stem from accepting and agreeing to terms set up by teachers and academic institutions. For this reason, claims Markie (2003), teacher-student interactions are not relationships similar to those between the service providers and their customer. Any ordinary service provider is governed by its financial self-interest, but teachers' interest is in their students' education. Therefore, education is not a process of equal partners and comparable responsibilities. Teachers are committed to using their expertise and knowledge to advance the education of their students, develop their rational autonomy, and help them be independent and critical thinkers. On the other hand, students are committed to accepting the rules and responsibilities of that process.

Based on the preceding argument, we can deduce that the roles students and teachers play within an educational setting will considerably influence their relationships with technology. For example, looking from this point of view, it is no surprise to see an English Literature teacher who insists on books rather than computers, or a property law teacher who sees the benefits of digital technology as a means of having up to date, relevant information. We can also understand better a teacher who sees the VLE as being long-winded, too complicated, and not necessarily beneficial to the learning process. He would rather have a printout of students' work as he sees it as a more convenient and practical way to mark it than have their work uploaded onto the VLE. Teachers also question the reliability, quality, and amount of information students can access through technology. They are also concerned with issues of cyber-bullying, protection of privacy, and technology being disruptive for the teaching and the learning process. This can also explain why students who, although more comfortable with DT&RM than teachers, are critical towards technology and expect teachers to help them learn how to navigate it and to equip them with the crucial skills and knowledge that will help them use DT&RM to its full potential.

Even though it has been nearly 50 years since Papert (1992, 1996) experimented with technology in education, and access to technology in educational institutions has significantly improved over the years, the reliability of the technology is still an issue. Both groups of participants were very vocal about the problems and barriers technology represents to them. This is a very important finding, because if technology — digital or not — does not present a useful, easy, and workable experience, then it is more likely that that piece of equipment will be meaningless for its users. This still does not mean that that a particular piece of equipment will not be used. However, it is likely that users will not widely adopt it. The use of technology in education has promised us better, effortless, more efficient, and less expensive teaching and learning. It is also supposed to lead to better communication, equality, and diversity, and widen participation. However, if it turns out to be different, it is less likely to be adopted.

Key findings

Key findings from both phases of the study can be stated as follows:

1. What are the distinctions, if any, between how students and teachers use, perceive, and experience DT&RM in everyday life and daily educational practices?
    - Although there are differences in how students and teachers use, perceive, and experience DT&RM, those differences are not supportive of the generational divide model.
    - Demographic data suggests that there is no age- or gender- related clear-cut trend in either of the participant groups.

- There are students and young teachers who have limited knowledge of and struggle with technology, and teachers born in the analogue age who are confident users with good knowledge about DT&RM.
- The differences between students and teachers are related to the specific technology and trends in how and what they use, rather than a general use of technology.
- Different technologies attract different users; therefore, there are some DT&RM where teachers reported high use.
- Different technologies have a different meaning for students and teachers, and for students, some technological devices used in the classroom are a part of their culture and identity.

2. What are the factors that motivate students and teachers to use DT&RM in their everyday teaching and learning practices?
    - The motivation to use technology for teaching and learning for both groups of participants was not technology and its potential, but the perceived benefits technology bring to users in achieving their goals.
    - Students did not like to learn exclusively through technology, and they perceived it as capable of enhancing traditional learning but not substituting it.
    - Both students and teachers agreed that a digital experience cannot match every aspect of the educational experience.
    - Students' and teachers' offline behaviour and habits did not necessarily match their online behaviour, in the same way as their social, out-of-education, digital behaviour did not immediately translate into digital behaviours within education.

- Some teachers believed that the use of technology has been forced upon them by political and management agendas and not necessarily out of care for learners.
- To use technology successfully, teachers expressed the need for more training and timetabled time for planning and preparation.

3. How do students and teachers experience and perceive their digital relationships with technology; what kinds of technical requirements, solutions, and moral conflicts emerge as a result of the negotiations?
    - When asked to evaluate how digital they are, almost half of the students considered themselves average or below average.
    - Some students struggled with technology at the college and need to be educated on using it.
    - Technology can marginalise people and can create a socio-economic divide.
    - Popular misconceptions about students being more digital than their teachers were rejected by both students and teachers in their assessments of each other's' relationships with DT&RM. Teachers perceived students to be more digital than students perceived themselves while teachers saw themselves as less digital than perceived by their students.
    - Many teachers were worried about the negative impact of technology on students and felt that technology did not effectively support teaching and learning practices.
    - Some students were very aware of the problems and moral conflicts technology poses for their education, and they saw teachers playing an

important part in solving this by instructing them on how to use technology more effectively and safely.

- Students still perceived their role in digital learning in a traditional way, as someone who is taught and has to listen to their teachers, who are perceived as an authority or ‘knowledge keeper’ — someone whose job is to teach them.
- To protect students from the potentially harmful influence of digital technology, the college restricts web access, but this potentially limits creative, innovative ways of using technology in the classroom.
- Poor reliability of technology was perceived as a big obstacle for both students and teachers.
- Both groups of participants recognised and appreciated the advantages technology brings to the education.
- Students were very realistic about technology, and although they believed that technology is here to stay, they were very aware of potential consequences and negative effects the careless use of technology can bring to the education system.
- Though critical, both groups of participants were very enthusiastic and optimistic about the future of technology in education.

Conclusion

When evaluated in the light of prior research on the digital differences between students and teachers, the findings of this study are consistent with respect to the fact that generational differences between students and teachers, as well as different generations, are overestimated. What emerged from the data is that students and teachers are different, not because of their natural abilities as determined and enhanced by technology, but in the way that they relate to technology, and what technology means to them in relation to the active pursuit of their goals. In general, the results suggest that students and teachers are different in terms of what DT&RM they use and how they use it; however, these differences are related to a perceived sense of purpose and meaning they give to technology.

If we are going to talk about the future of education, it is not only important to know where we are going, but also to understand where we are coming from. Even if we have knowledge of where technology will be in 10, 15, or 30 years, we must not forget that education is not just a process of accessing and gathering information but also a process of creating knowledge, critical understanding, and creative manipulation of information and knowledge, and supporting students' autonomy. There is no doubt that technology has its place as part of that process and should be utilised as a great educational resource. However, we must not forget that learning does not happen because we have access to new tools and resources, but because we adopt new behaviours through experience, guidance, and questioning. What students suggest, when they call for teachers to help them with technology, is not a need for technical help or access to information, but a need to have experience of engaging with someone who has knowledge and expertise of the field they are studying. Someone who can help and guide them to understand the meaning of the information they are accessing, provide instant feedback, who can inspire and motivate them,

be their role model, know their strengths and weaknesses, and give them immediate answers which will be up to date and relevant to their personal needs and learning.

Therefore, there is a great danger in the bipolar metaphor of digital natives and digital immigrants. The advocates of this model often justify their beliefs by looking at the use of and access to technology, creating a myth of a special digital generation of students and backward educational institutions run by old-fashioned analogue teachers rather than empowering users to talk about their experiences with technology. Just because young people are using mobile phones and video games for socialising and entertainment does not mean that they do not want to have the experience of going to school, college, or university, or meet and interact with their peers and teachers as a very important part of the learning process. This model also makes us believe that teachers are the problem for the slow adoption of technology in education just because they do not use Facebook or computer video games for their teaching. This creates a situation in which teachers feel the pressure to prove and justify their role by use of technology.

However, there is a great potential for the use of technology in education. To be able to employ it to its full potential, we must resist utopian dreams based on unfounded predictions. This does not mean rejecting technology but making sure that the adoption of technology in education is meaningful for its users. When teachers and students use technology in education, it is not technology but their experience with teaching and learning that stands out. If students do not learn, or teachers do not see technology as a meaningful way of supporting the learning experience, then the technology does not have sense or meaning to be used.

Recommendations for practice

Following the findings of this study, which are broadly in line with those research studies which counter popular expressed views that the new generation of students is digital natives and their teachers are digital immigrants (Sappey & Relf, 2010; Hargittai, 2010, 2008; Hargittai & Hinnant, 2008; Taylor, 2012; Kennedy et al., 2008; Margaryan & Littlejohn, 2008; Buckingham, 2009; Helsper & Eynon, 2009; Bennet at al., 2008; Livingstone, 2009), it is important for all educators and policymakers to take into account heterogeneity within students' and teachers' digital attitudes and skills when planning the development and use of technology in education. We must not assume that students are digital natives who do not need to learn about technology. We have to help young people to develop their digital media literacy so they can take full advantage of DT&RM in their education, future life, and career.

Furthermore, to successfully integrate technology into education, we need to understand the strength and weakness of DT&RM in relation to teaching and learning practices. Therefore, we need to foster and encourage an open assessment of technology in which students and teachers, as the main actors in the educational process, will have the key voice. Fundamentally, the technology should not be promoted to students and teachers as compulsory or a replacement but as a useful addition to teaching and learning activities. The traditional teaching and learning methods should not be abandoned for some technological alternatives. Just because something is digital, it does not necessarily mean that it is more interactive than traditional educational methods and the relationship between students and teachers. Therefore, we must not neglect face-to-face interaction as a very important part of the educational experience for interaction mediated by technology, nor forget that a digital experience cannot match every aspect of the educational experience. Technology is here to stay, and the only way forward is for both students and teachers to learn how to use it in an

effective and constructive way that will support teaching and learning practices and not replace them.

To effectively support teaching and learning activities, all educational institutions must ensure secure and reliable digital infrastructures, which are up to date and available to all users. Students' safety is a very important part of the successful integration of DT&RM into education; however, to protect students, it is not enough to let Internet filtering software block random sites. To effectively safeguard students from inappropriate contacts, content, and online activities it is important to educate them about the safe use of DT&RM, and for that to happen, we need to take digital media education very seriously as one of the key skills for the 21st century.

Although access and ownership of technology have significantly improved over the last few years, we must not forget that still not all students have access to DT&RM and up-to-date technology. Therefore, we must be very careful not to contribute further to the marginalisation of students and assist in furthering a socio-economic gap. At the same time, while most of the teachers do not have a problem with using DT&RM we must not forget that if we want teachers to use the technology, we need to support them. They not only need adequate professional development but also dedicated time for planning and preparation, as well as the academic freedom to determine how and when they should use technology.

Successful integration of technology into the educational system cannot be done from the top down by checking it against preconceived criteria driven by a political, ideological, and economic agenda, but by assessing its real impact on learning. It should be done through responsible educational policies about digital technology that will not be driven by the utopian dreams of some entrepreneurs and business opportunists. It should be based on and informed by credible independent research that will empower students and teachers to talk about their experiences of how technology affects their educational experiences.

Recommendations for future research

Based on the findings and conclusions of this research, there are several suggestions that can be offered for further studies. This study highlighted the disparity between students' and teachers' relationship with DT&RM in relation to their perceived roles in the educational system. This might serve as a starting point for further research, which could examine how the technology is changing those roles and how those changes impact the quality of teaching and learning.

Students and teachers in this study were given the opportunity to put forward their views and express their opinions about the use of technology in education. Following the experience of this study, further research could be conducted to determine what students' and teachers' observations and thoughts are on where technology is needed, as an alternative choice to traditional teaching and learning practices.

Although this study has investigated how students and teachers negotiate their relationships with technology in everyday educational practices, a further research project could benefit from following participants' engagement with technology over a longer period, observing how they engage with technology, what strategies and solutions they use, and how it impacts their educational practices. An improved study might also consider a larger number of colleges and a wider geographic region with more economic diversity. My role as an insider researcher was convenient for this study; however, an additional study might revisit my role and make sure the study is conducted in an environment with less potential bias.

Teachers in this study expressed a lack of time to use DT&RM effectively in their teaching practices. Further investigation could be done in the area of digital pedagogy. Hence, in order to establish an effective preparation time for a digital classroom, there is a

need for research that investigates and compares the effectiveness of traditional and digital teaching methods in relation to complexity and time for preparation.

Both groups of participants recognised that training and education of students and teachers in digital skills and literacy is crucial to the successful adoption of DT&RM in education. To determine the best approach to offering and organising this training and education, further research is needed to investigate and analyse what the differences are between everyday and academic digital skills and literacy.

However much the digital divide between individuals in England is closing, according to regular annual surveys of the UK's communications markets by Ofcom (2014), students and teachers in this study expressed concern about the increased possibility that technology can marginalise people and widen the socioeconomic gap. Therefore, one avenue for further study would be to research into students' and teachers' relationships with technology according to their socio-economic background, as well as various ethnic groups.

What I would do differently in my research journey

One of the important parts of my research has been the notion of participants' voice. To capture it, I utilised participatory video production as a collaborative research method. This involved use of digital video as a method of visual and audio data recording, but also as a way of engaging participants in the process of knowledge production. As stimulating and exciting as this research design was, there were some issues that I would consider doing differently.

Constrained by time and balancing my role as a doctoral student and an insider researcher, to ensure the qualitative phase was finished on time, I guided participant-collaborators on the objectives of the project, and in the video recording guide, I suggested to them opportunities for video capture. However, I communicated to them that they were

free to record anything they liked. It can be questioned to what extent I influenced their decision on what to film.

To minimise my influence and encourage participants to have their own views and perspectives on what is being researched, I would extend collaborative research approach by adopting more of a facilitator's role. This would mean involving a more democratic model in which participants will be involved right at the beginning of the project to develop collaboratively questions and themes they are going to film. This will enable participant-collaborators to take more control over the process of filming, placing further emphasis on the physical environment, objects, and people in action, allowing more informed visual representation of the phenomenon of the study.

Another variable unaccounted for in this study was the great number of employees who do not belong to students or academic staff at the college and are directly responsible for effective functioning of DT&RM, its strategic implementation, running of the college information system, the web, and the intranet content. This includes the IT department and the management, marketing, and admin staff. Thus, the data collected in this study cannot be used to establish the influence of issues regarding the operational efficiency of IT, decision-making, leadership, and other college activities related to the successful adoption of DT&RM. Therefore, to construct a more comprehensive picture of the adoption of technology in an educational institution, I would collect data across the entire population of the college. This would provide deeper insight into the adoption of technology and could potentially identify a broader scope of issues that affect the adoption of the existing technology.

In an attempt to allow participants to remain anonymous in the online survey questionnaire, I did not collect data on attendance mode, the course students were taking, or the departments teachers were employed in. This allowed the possibility that there could be

some discrepancy in answers based on the curriculum students study and teachers teach, along with the technology available to them within different departments which were not captured. In a future study, I would add questions related to curriculum areas and subjects of study, which would provide a more detailed picture of the sample. As the data for this study came from an FE college in one part of the country, I would also consider extending the research to more FE institutions across different parts of the country, which would improve the generalisability of the findings.

This study provides a snapshot of students' and teachers' experience of technology in an educational institution over a short period of time. It would be valuable to carry out a more in-depth longitudinal study (following a group of students and teachers through the length of their courses) to examine how their experiences and perceptions of technology change in relation to, for example, the subject of study and the different demands of the curriculum during the academic year.

My original contribution to the field

This study added to the existing understanding of the digital differences between students and teachers. While the issue of digital differences has been researched, it is not evident that research in this field has been conducted exclusively in the context of an FE college. In seeking to understand, while the myth of digital natives and digital immigrants is still alive, this inquiry confirmed digital differences among students and their teachers. These differences contributed to this discussion by asserting the digital divide among students and teachers as a result of the different roles they play in an educational setting, motivated by their individual aims and needs rather than age-related digital characteristics. This means that the use of technology among people differs depending on how meaningful they find

technology in the sense of their role in the educational situation, which is different for teachers and for students.

The empirical evidence also suggests digital differences within the same group of participants. This means that not all students are equally digital, nor all teachers 'Luddites', and that students are very critical users rather than passive consumers of digital technology. Challenging the understanding that young people are digitally savvy and prefer digital learning to traditional methods of education, the study assists in understanding the complexity of students' and teachers' relationship with technology in the classroom. This perspective can be very informative for educational practitioners and policymakers emphasising the importance of the practical and contextual issues regarding the adoption of DT&RM at the classroom level.

With the research concerning digital differences between students and teachers by predominantly deploying survey methods (Jones et al., 2010), this study provided a different perspective by using an innovative approach to examine the subjects of inquiry from their own point of view. In seeking to understand the relationships students and teachers have with DT&RM, this study used a collaborative mixed methods research design involving participants' video making, mixed with self-reported survey questionnaires, thus enabling the investigation of students' and teachers' perceptions, beliefs, attitudes, and experiences with technology beyond simple quantitative 'yes' or 'no' answers.

Furthermore, by highlighting potential for a collaborative research method, this study will aid those wishing to involve further students and teachers in the process of research regarding the development of DT&RM in education. Similarly, my experience as an insider researcher will also contribute to the knowledge of work-based research to those willing to research in the context of their own practice.

APPENDICES

APPENDIX A. The Pilot Study

The pilot study was conducted during the educational college trip to the Computer Video Games Show by Play.com at Wembley Arena, London – an important event in the world of digital video games. Its aim was to address the following question: What are the differences, *if any, between students' and teachers' attitudes towards computer video games* as one of the new cultural forms of digital technology?

Instrumentation

The pilot comprised three steps (see Figure 19):

1. Participatory image making: Collaboration with participants in the production of visual data using digital still cameras;
2. Photographic survey: Unstructured and structured viewing of the visual data;
3. Photo-elicitation: Asking questions in an unstructured group interview (Collier & Collier, 1986).

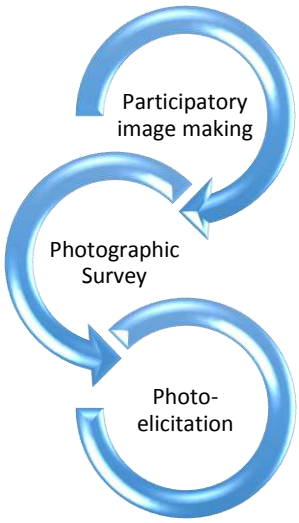


Figure19: Three steps of the pilot study

For the first step, the six participants (n = 3 students and n = 3 teachers) were each given a 7.1 megapixel digital still camera with a 2 GB memory stick (capable of storing around 700 photos) and observation instructions covering the procedure for taking photos and categories for recording the data (those categories would later be used for the research analysis). The participants were instructed to take photographs during the entire trip to London. They could take as many photographs as they liked – the space on the memory stick would allow them to. They were asked not to delete any photographs or use in-camera facilities to manipulate images (crop them, change colours, add visual effects, and so on). The categories suggested to participants were objects (hardware, software, books, props, costumes etc.); space and locations (showground, bus, parking space, streets, and so on); people in action and interaction (photographs of students, visitors, and other participants of the show and school trip; interaction of students and others with the video games and other objects in the show; interaction between people; and so on). Participants were allowed to use any type of shots (from wide-angle to close-ups). After the trip was over, and participants safely returned to the college, I collected the cameras with the recorded data from participants and prepared the data for the next stage of the investigation.

The next step involved a photograph survey, a viewing, and visual interpretation and analysis of the visual data, which involved putting all records together in chronological order so that temporal and spatial relationships were established, as well as classifying video data into categories that reflected the research goal. After this step, I presented photographs to the participants who had recorded the images. This last step entailed photo-elicitation – a group interview involving going through the visual evidence with participants and asking them specific questions to elicit further information about the content of the photographs and their experience of the event.

Data analysis

The photograph survey was also the first step of visual data analysis. Before starting with analysing photographs as visual data, it is very important to take care while organising the images (Collier & Collier, 1986; Rose, 2001). This involved analysing visual data by putting images into a sequential order so that temporal and spatial relationships could be established. The aim was to reconstruct the events recorded by the participants rather than to respond to individual images (Collier & Collier, 1986). It involved storing the images onto the external memory stick and dividing them into six different folders, naming them 1S, 2S, and 3S (for students) and 1L, 2L, and 3L (for teachers). After I had named the folders, I numbered each photograph in each folder with the name of the folder followed by a number. (For example 1S 001, 1S 002 ...) I kept the temporal order of the images, so the numbers progress in the order they were originally recorded. To help the process, I copied the leaflet I collected at the show, with the floor plan of the event with the exact locations, and handed it to each participant (see below, Figure 20).

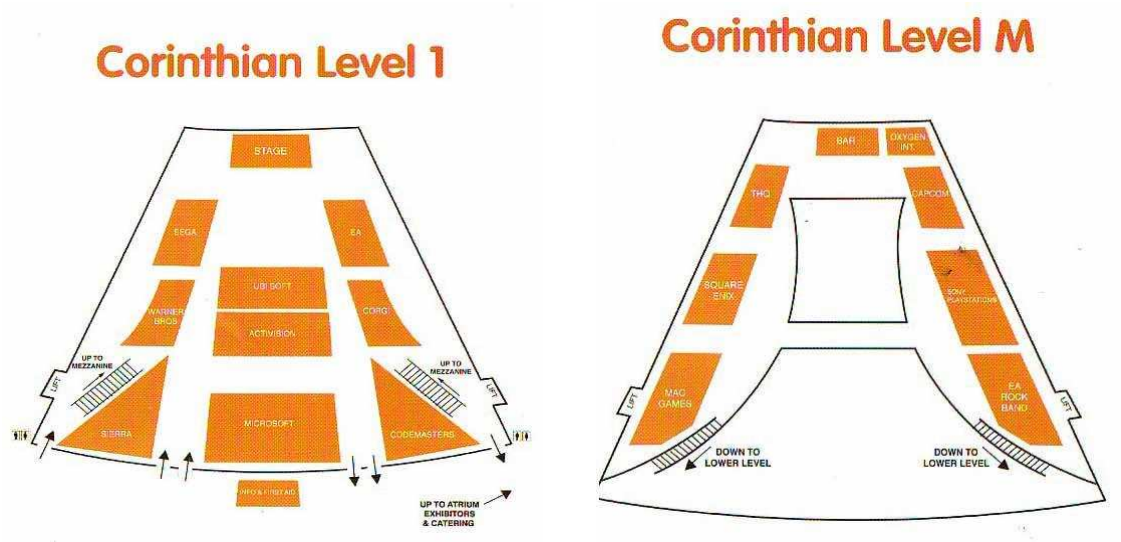


Figure 20: The floor plan of the Computer Video Games Show, Wembley Arena (Play.com, 2008)

I used Adobe Bridge CS3 software to link the images already codified by numbers in temporal order (for example 1S 001, 1S 002 or 1L 001, 1L 002) to the physical space of the show ground. The software allowed me to create a list of codes (meta-tags) and to assign a code (tag) to any image. For example, I created a code for each level (there were three-floor levels of the show, see Figure 5) and a code for each individual space presented on the ground floor, labelling each image to the accurate physical space. By relating images in temporal order to the specific space, I was able to recreate the individual experience of each participant and generate evidence of their interest expressed in time and location (how much time they spent at what place in the show). After I organised images in sequential order and assigned the first round of codes, I analysed photographs looking at the content of the images. This method of analysis was based on counting the frequency of certain visual elements in a clearly defined sample of images and analysing those frequencies (Rose, 2001). During this session, new coding strategies emerged, which I used later for further analysis of the data.

After I completed the content analyses of the images, I presented them to the participants – who had already collaborated for image making – for further analysis and unstructured interviews focussed on discussion of the photographs (Collier & Collier, 1986; Pink, 2007; Schwartz, 1989). The interviews and video data were later analysed by summarising, discovering patterns, and generating themes for further research, looking for similarities and differences within the data, and testing and analysing the research procedures piloted in the study.

Findings

Photographic survey

A total of 323 images were recorded during the trip, with 210 recorded by students and 113 by teachers. After I cleaned the visual data by discarding all images that were not related to the research topic and those whose quality deemed them unusable, there were 202 students' images and 100 teachers' images ready for analysis. At first glance, it can be seen that students produced twice as many images as teachers. The further photographic survey analysis indicated that all participants spent significantly more time on the first level of the Wembley Arena (158 images) than at level M (45 images) and the second level (23 images). This emerging pattern was confirmed during photographic interviews, where participants explained that there was more music entertainment at the first level of the exhibition. This was confirmed by further observation. The highest number of images recorded at a particular location was at Ubisoft (32 images) followed by the stage with live music (31 images). Both places had live entertainment: Ubisoft (a video games company) had dancers while at the music stage there was a band.

Comparing the number of photographs taken by each group at each of these locations (Ubisoft and the live stage) in relation to the total number of photographs taken at the show revealed a noteworthy pattern. There were twice as many images of the music entertainment

recorded by teachers (41 images) than students (22 images). This was a reverse trend to the general pattern established at the beginning of the analysis of having twice as many images of the games show recorded by students (202 images) than teachers (100 images). In interviews with the participants, all three teachers were unanimous in explaining that although they were interested in video games and were themselves video game players, they found the whole games show boring and uninspiring: "There was not enough there to sustain our interest," stated one of the teachers. Teachers also stated that all the information that they could get at the show about games they could access on the Internet.

Contrary to teachers, students readily engaged with the games show, which is evident from the images they produced. Looking at the number of images that showed participants involved in activities at the show, there were 37 images of students (taken by students) engaging and interacting in different activities compared with no images of a similar content and nature recorded by teachers.

Content analysis

Once I analysed the frequency of visual elements in a clearly defined sample of images (Rose, 2001), I asked participants to analyse the content of the images. There were two general categories for coding: objects and people in action and interaction. Participants were encouraged to devise further sub-categories.

The new categories that emerged were:

For objects:

- Hardware
- Software (video games)
- Exhibits
- The Wembley Stadium

For people in action and interaction:

- Playing games
- Students having fun
- Portraits of students
- Students interacting with each other
- Students interacting with the staff of the show
- Students with the games' mascots
- Shots of the crowd
- Other people

With the analysis of the objects and actions of people in the images, a more detailed picture continued to emerge. Despite having an interest in video games, the teachers did not find the whole experience of the show very interesting. "Very soon we gave up and ended up in the restaurant," admitted a teacher. This was also evident in the number of images of the Wembley stadium, teachers took. There was a total of 50 photographs featuring the stadium, 37 of these recorded by teachers. The content analysis also revealed a total absence of images taken by teachers that had software (video games) as the object. There were 27 photographs with screenshots of software (all taken by students) and 15 of them were on the new Sony PlayStation 3 video game, Little Big Planet. This video game, which was due for release, is based on principles of creativity, innovation, active learning, practice, discovery, identity, and other qualities recognised by many promoters of games as the ultimate learning tool (Gee, 2003; Papert, 1993; Prensky, 2007; Shaffer, 2006). The players of this game will be able to design, shape, and manipulate both objects and their environments. The game producers promise the players will be able to learn all of this by simply interacting with the game without a complicated level editor (PlayStation, 2008). Interestingly, when talking about the new PlayStation game 'Little Big Planet', both groups were equally familiar with the subject. Whilst in their excitement students talked about how they all played the game at the show, the teachers demonstrated good knowledge of the innovative new concept of the game and its creative potential, although admitting that they did not play it at the show.

Photo interviews (Photo-elicitation)

With the aim of further establishing variations between shared and diverse perspectives among students and teachers about the show and video games, I conducted a group interview. During this session, a very open and lively discussion was held among participants, encouraged by images and the whole process of categorising and analysing the visual data. The process itself encouraged participants to talk spontaneously and openly about their views and attitudes, contributing to the further analysis of the visual data.

During the group interview, evidence of different views and attitudes between students and teachers emerged. Most of the students were very confident game players and were happily talking about what games they play, but when asked questions about the computer games industry, teachers were able to make connections between the company that produced the game and the game much quicker and more accurately than students. Students also commented that they learn a lot about games and computer skills from their teachers. "We learn many things from our teachers," commented one of the students. "We learn how games work, how to design them. Teachers' passion for video games played an important role in developing further my interest in games development and made me seriously consider a career related to it."

What was also evident from the group interview with participants was the existence of a games culture (or as one of the teachers described it, 'sub-culture'). "We grew up with playing computer games," confirmed one of the teachers, "but with a different type of game experience, there was no identity attached to it." Young people are nowadays targeted by the computer games industries as the main users of their products; this necessarily becomes part of their culture, shaping their identities and deliberately creating a gap between young and adult generations (Buckingham, 2005). As the game companies at the show were targeting young people by basing their marketing strategies at the games' cultural appeal, it is not

surprising that teachers, however interested in the games, found the whole experience of the event boring and claimed that all the information about video games they could find on the Internet. This resulted in them spending their time in the restaurant of the stadium, whilst their students were embracing the identities of their virtual heroes.

APPENDIX B. Copy of survey questionnaires

STUDENTS' QUESTIONNAIRE

Dear Participant,

Before you decide to participate, please read the details below.

We are taking a survey of [redacted] students and teaching staff to get a better understanding of their use and views on digital technology and related media (DT&RM). We would be very grateful if you could spare a few minutes and give us some input about your use of digital technology.

The survey is entirely voluntary and anonymous, and there will be no consequences if you do not participate in the survey or withdraw at any time without giving any reason.

It will take you approximately 7 minutes to complete the survey and it is very straightforward:

- Please follow the instructions for each question
- Use the ***'Prev'*** button to go back and amend if necessary
- You can break at any point and **'Save to complete later'**
- When you have completed all the questions, please click **'Submit'**
- **Start** by clicking the ***'Next'*** button below

GLOSSARY:

- Digital Technology and Related Media (DT&RM): An acronym which refers to the use of digital applications not just as technology per se, but also the use of digital technology for social interactions across multiple media platforms.
- Web 2.0: Refers to a 'second generation' of Internet-based services that emphasise online collaboration and sharing among users, often allowing users to build connections between themselves and others.
- VLE (Moodle) – Virtual Learning Environment: The Internet-based system designed to support teaching and learning in an educational setting
- VoIP – Voice over IP: technologies that allow delivery of voice communication over the Internet – 'Internet telephone'.

If you understand the above and agree to participate, please press the next button.

Part 1: Access and use of Digital Technology and Related Media (DT&RM)

1.1 Which of the following digital technology items do you use?

Mark answers relevant to the YES or NO statement only (you can mark as many boxes as apply):

USE OF DIGITAL TECHNOLOGY & RELATED MEDIA		
	Yes	No
Desktop/laptop computer		
Tablet computer		
Mobile phone		
Smartphone		
E-books		
Video games		
Digital video camera		
Digital still camera		
MP3 Player		
DAB digital radio		
Internet-enabled TV		

1.2 Using the scale provided, please rate how often, on average, you spend on the following activities related to specific DT&RM listed below:

USE OF WEB 2.0								
	Several times a day	**Daily/Almost daily**	**Several times a week**	**About once a week**	**Several times a month**	**About once a month**	**Rarely**	**Never**
Social networking (e.g. Facebook, Myspace, Twitter, Bebo, Google+)								
Web-conferencing (e.g. using a webcam with Skype)								
Making phone calls using VoIP								
Posting and sharing digital photographs (e.g. EG, Flickr, Picasa)								
Downloading podcasts								
Publishing and sharing podcasts (e.g. using Podcaster, PodProducer)								
Posting and sharing digital video online using YouTube, Vimeo, Google Video, and so on.								
Downloading and/or sharing MP3 files (e.g. music, videos)								
Writing own blog								
Writing or editing wikis								
Social bookmarking software on the web (e.g. Del.icio.us)								
Reading RSS feeds (e.g. news feeds)								
Creating e-portfolio (e.g. VLE)								
Instant messaging (e.g. MSN)								

SMARTPHONE FUNCTIONS								
	Several times a day	**Daily/Almost daily**	**Several times a week**	**About once a week**	**Several times a month**	**About once a month**	**Rarely**	**Never**
Making telephone calls								
Sending texts/SMS								
Taking digital photos /movies								
Sending pictures /movies to other people								
Making video calls								
Listening to music on MP3 player								
Downloading audio/music								
Keeping your personal diary, address book, etc.								
Accessing information services on the Internet								
Sending or receiving email								
Downloading/Watching video clips/TV/Films								
Accessing social networking sites (e.g. Facebook, Myspace, Twitter, Bebo, Google+)								
Using GPS								
Playing video games								
Listening to live radio/TV/on demand								
Using for banking								
Accessing news websites								

COMPUTER VIDEO GAMES								
	Several times a day	**Daily/Almost daily**	**Several times a week**	**About once a week**	**Several times a month**	**About once a month**	**Rarely**	**Never**
Using a PC to play games								
Using a game console to play games								
Playing online multi-user role-playing games (e.g. World of Warcraft, RuneScape, etc.)								
Participating in online virtual worlds (Second Life, SmallWorlds, Active Worlds, Twinity, etc.)								
Using motion-control gaming technology (e.g. Kinect, Wii)								
Using video console to browse the Internet								
Using game console to watch TV								
Using game console to watch DVD								
Using game console to watch/play music								
Using console to do online shopping								
Using console to view photos								

Part 2: Beliefs and Attitudes

2.1 In your view, please indicate below your beliefs on the attitude most of the teachers have towards the use of technology and electronic devices.

	Very True	Somewhat True	Somewhat Untrue	Very Untrue	I do not know
Teachers always use the latest digital technology for teaching and learning					
Almost all teachers use digital video games for teaching and learning					
Teachers are keen on interacting with students and other teachers online					
Usually, teachers know less about new digital technologies than students					
Teachers need support to use technology effectively for teaching					
Teachers find it difficult to learn to use new technologies					
When asked, the majority of teachers can never answer any questions about computers and other related digital media					

2.2 Using the scale provided, please indicate below your attitude regarding the use of DT&RM.

	Very True	Somewhat True	Somewhat Untrue	Very Untrue	I do not know
I feel left out if I do not have the latest technology/device					
I always use many electronic devices at once					
I am always interested in discovering new things about technology					
I believe technology is effective for learning					
I find it easy to learn how to use new technologies					
I lose track of time when I use technology					
I need lots of support to use technology effectively for learning purposes					

Part 3: Perceptions

3.1 Using the scale provided, please indicate in general, what is your perception of the benefits of DT&RM in the classroom.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	I do not know
Helps students to improve basic skills (literacy and numeracy)						
Helps students to develop creative and thinking skills						
Helps students to improve social skills						
Increases academic achievement						
Improves students' motivation						
Use of digital video games makes students' learning more enjoyable						
Accommodates students' personal learning styles						
Enhances students' career and job prospects						
Improves presentation material and teaching resources						
Makes administration more efficient						
Makes students feel more competent as learners						
Makes teachers feel more competent as educators						
Gives teachers opportunity to be learning facilitators instead of information providers						
Gives more prestige to the college						

3.2 Using the scale provided, please rate the extent to which you agree or disagree with the following statements about the barriers to the use of DT&RM in the classroom.

	Strongly Agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree	I do not know
Teachers' insufficient knowledge to develop teaching activities based on technology						
Students' insufficient knowledge to engage in learning activities based on technology						
Technology is too complex and complicated for quick and effective use in classroom						
Shortage of PCs and other related digital devices (printers, scanners, whiteboards)						
Lack of IT technical support for existing technology at the college						
Deficiency in professional development opportunities for gaining knowledge and skill						
Problem with accessibility of learning technologies from home						
Lack of teachers' interest in technology						
Lack of students' interest in technology						
Too costly in terms of resources, time, and effort						
Use of technology makes it more difficult to enforce discipline						
Use of technology distracts students from learning						
Digital information overload –having too much information to make decisions						
Unreliable quality of information–since everybody can be a publisher						
Plagiarism – unreferenced copying and pasting of material from the internet into assessments						
Threat to Privacy						

3.3 Which statement below determines the level that best describes you in relation to digital technology and related media?

Expert	Advanced	Average	Beginner	Sceptic
Innovative with digital technology	Use broad spectrum of digital technologies	Use technology for well-established reasons	Able to use basic functions in limited number of applications	Not interested in technology at all

Part 4: Demographic

Demographic information

1. Are you: Female? ☐ Male? ☐

2. Please check the age group to which you belong

16-19
20-25
26-31
32-45

Thank you for your help!

TEACHERS' QUESTIONNAIRE

Dear Participant,

Before you decide to participate, please read the details below.

We are making a survey of [redacted] students and teaching staff to get a better understanding of their use and views on digital technology and related media (DT&RM). We would be very grateful if you could spare a few minutes and give us some input about your use of digital technology.

The survey is entirely voluntary and anonymous, and there will be no consequences if you do not participate in the survey or withdraw at any time without giving any reason.

It will take you approximately 7 minutes to complete the survey and is very straightforward:

- Please follow the instructions for each question
- Use the ***'Prev'*** button to go back and amend if necessary
- You can break at any point and ***'save to complete*** **later.**'
- When you have completed all the questions, please click **'Submit.**'
- **Start** by clicking the ***'Next'*** button below

GLOSSARY:

- Digital Technology and Related Media (DT&RM) - An acronym which refers to the use of digital applications not just as technology per se, but also the use of digital technology for social interactions across multiple media platforms.
- Web 2.0 - refers to a 'second generation' of Internet-based services that emphasise online collaboration and sharing among users, often allowing users to build connections with themselves and others.
- VLE (Moodle) – Virtual Learning Environment: The Internet-based system designed to support teaching and learning in an educational setting
- VoIP – Voice over IP, technologies that allow delivery of voice communication over the Internet, 'Internet telephone'.

If you understand the above and agree to participate, please press the next button.

Part 1: Access and use of Digital Technology and Related Media (DT&RM)

1.1 Which of the following digital technology items do you use?

Mark answers relevant to the YES, or NO statement only, (you can mark as many boxes as apply):

USE OF DIGITAL TECHNOLOGY & RELATED MEDIA		
	Yes	No
Desktop/laptop computer		
Tablet computer		
Mobile phone		
Smartphone		
E-books		
Video games		
Digital video camera		
Digital still camera		
MP3 Player		
DAB digital radio		
Internet-enabled TV		

1.2 Using the scale provided, please rate how often, on average, you spend on the following activities related to specific DT&RM listed below.

USE WEB 2.0 FOR	Several times a day	Daily/almost daily	Several times a week	About once a week	Several times a month	About once a month	Rarely	Never
Social networking (e.g. Facebook, Myspace, Twitter, Bebo, Google+)								
Web-conferencing (e.g. using a webcam with Skype)								
Making phone calls using VoIP								
Posting and sharing digital photographs (e.g. EG, Flickr, Picasa)								
Downloading podcasts								
Publishing and sharing podcasts (e.g. using Podcaster, PodProducer)								
Posting and sharing digital video online using YouTube, Vimeo, Google Video, and so on.								
Downloading and/or sharing MP3 files (e.g. music, videos)								
Writing own blog								
Writing or editing wikis								
Social bookmarking software on the web (e.g. Del.icio.us)								
Reading RSS feeds (e.g. news feeds)								
Creating e-portfolio (e.g. VLE)								
Instant messaging (e.g. MSN)								

SMARTPHONE FUNCTIONS								
	Several times a day	**Daily/almost daily**	**Several times a week**	**About once a week**	**Several times a month**	**About once a month**	**Rarely**	**Never**
Making telephone calls								
Sending texts/SMS								
Taking digital photos /movies								
Sending pictures /movies to other people								
Making video calls								
Listening to music on MP3 player								
Downloading audio/music								
Keeping your personal diary, address book, etc.								
Accessing information services on the Internet								
Sending or receiving email								
Downloading/Watching video clips/TV/Films								
Accessing social networking sites (e.g. Facebook, Myspace, Twitter, Bebo, Google+)								
Using GPS								
Playing video games								
Listening to live radio/TV/on demand								
Using for banking								
Accessing news websites								

COMPUTER VIDEO GAMES								
	Several times a day	**Daily/almost daily**	**Several times a week**	**About once a week**	**Several times a month**	**About once a month**	**Rarely**	**Never**
Using a PC computer to play games								
Using a game console to play games								
Playing online multi-user role-playing games (e.g. World of Warcraft, RuneScape etc.)								
Participating in online virtual worlds (Second Life, SmallWorlds, Active Worlds, Twinity, etc.)								
Using motion-control gaming technology (e.g. Kinect, Wii)								
Using video console to browse the Internet								
Using game console to watch TV								
Using game console to watch DVD								
Using game console to watch play music								
Using console to do online shopping								
Using console to do view photos								

Part 2: Beliefs and Attitudes

2.1 In your view, please indicate below your beliefs on the attitude most students have towards the use of the technology and electronic devices.

	Very True	Somewhat True	Somewhat Untrue	Very Untrue	I do not know
Students feel left out if they do not have the latest technology/device					
Students often use many electronic devices at once					
Students are always interested in discovering new things about technology					
Students believe technology is effective for learning					
Students find it easy to learn how to use new technologies					
Students lose track of time when using technology					
Students need lots of support to use technology effectively for learning purposes					

2.2 Using the scale provided, please indicate below your attitude regarding the use of DT&RM.

	Very True	Somewhat True	Somewhat Untrue	Very Untrue	I do not know
I always use the latest Digital Technology for teaching and learning					
I am always interested in discovering new things about technology					
I use digital video games for teaching and learning					
Usually, I know less about new digital technologies than students					
I am keen on interacting with students and other teachers online					
I find it difficult to learn how to use new technologies					
When asked, I can never answer any questions about computers and other related digital media					

Part 3: Perceptions

3.1 Using the scale provided, please indicate, in general, what is your perception about benefits of DT&RM in the classroom?

	Strongly Agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree	I do not know
Helps students to improve basic skills (literacy and numeracy)						
Helps students to develop creative and thinking skills						
Helps students to improve social skills						
Increases academic achievement						
Improves students' motivation						
Use of digital video games makes students' learning more enjoyable						
Accommodate students' personal learning styles						
Enhances students' career and job prospects						
Improves presentation material and teaching resources						
Makes administration more efficient						
Makes students feel more competent as learners						
Makes teachers feel more competent as educators						
Gives teachers opportunity to be learning facilitators instead of information providers						
Gives more prestige to the college						

3.2 Using the scale provided, please rate the extent to which you agree or disagree with the following statements about the barriers to the use of DT&RM in the classroom?

	Strongly Agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree	I do not know
Teachers' insufficient knowledge to develop teaching activities based on technology						
Students' insufficient knowledge to engage in learning activities based on technology						
Technology is too complex and complicated for quick and effective use in classroom						
Shortage of PCs and other related digital devices (printers, scanners, whiteboards)						
Lack of IT technical support for existing technology at the college						
Deficiency in professional development opportunities for gaining knowledge and skill						
Problem with accessibility of learning technologies from home						
Lack of teachers' interest in technology						
Lack of students' interest in technology						
Too costly in terms of resources, time, and effort						
Use of technology makes it more difficult to enforce discipline						
Use of technology distracts students from learning						
Digital information overload –having too much information to make decisions						
Unreliable quality of information–since everybody can be a publisher						
Plagiarism – unreferenced copying and pasting of material from the internet into assessments						
Threat to Privacy						

3.3 Which statement below determines the level that best describe you in relation to digital technology and related media?

Expert	Advanced	Average	Beginner	Sceptic
Innovative with digital technology	Use broad spectrum of digital technologies	Use technology for well-established reasons	Able to use basic functions in limited number of applications	Not interested in technology at all

Part 4: Demographic

Demographic information

1. Are you: Female? ☐ Male? ☐

2. Please check the age group to which you belong:

16-25
26-35
36-45
46-55
55+

Thank you for your help!

APPENDIX C. Guidance for collaborative video-making

Video recording guide and consent form for participants

Dear Participant,

Thank you for agreeing to collaborate in the process of collecting data for this research project, which investigates differences between students and teachers in their relationship with digital technology and related media (DT&RM) in the context of everyday teaching and learning practices.

As part of your contribution to the project, you will be asked to produce the video footage that explores or reflects your and other teachers' views, experiences, attitudes, and perceptions about the use of DT&RM in everyday teaching and learning practices and events.

Within the general themes suggested below as opportunities for video capture, it is up to you to record what you like, and for as long as you like. You can record in any types of shots, with any number of takes, and anything you find interesting and think will contribute to the research objective. You are also free to decide what type of style/genre your footage is going to be in.

Opportunities for video capture include:

- Actions
    - What activities do you and others do with DT&RM (search for information, communication, VLE/PLP/E-portfolio)?
    - What are the barriers to action (if any)?
    - How do you negotiate the use of DT&RM in everyday educational practice?
    - What are the benefits and drawbacks?
- Motivation
    - What motivates you and others to use DT&RM for teaching and learning?
    - What proportion of your teaching includes technology?
    - How confident are you in using DT&RM in everyday teaching and learning practices?
    - In addition to what you already have, what digital resources do you want/need?

- Visions
    - What do you think we are trying to achieve with the use of DT&RM in education?
    - How will we judge whether we are succeeding or failing?
    - What role would you like technology to play in your future practice? (Participants' relationship with DT&RM – behaviour and trust – looking at some of the typical activities participants perform with DT&RM in their education practices)
    - Do you see a shift towards the use of technology for teaching and learning as beneficial or problematic in the future?
    - What is your prediction about it?

You are provided with two memory cards with 8 GB each. One is already in the camera and the other in the camera bag. Each will record about 30 minutes of footage. Feel free to use both cards, and if you need more, please do not hesitate to contact me and I will provide more memory cards for you. I will collect the cameras and the cards from you after a week, and we will be meeting later to watch and talk about the footage you recorded.

All recorded footage or any other recorded information will be treated as confidential, and no one will be identified/named in any report. Before you film any participants, you will have to ask them to fill in a consent form that will be provided to you as part of this guide. All video data, notes, transcriptions, and other recorded data will be kept in a locked file and the password-protected computer in the personal possession of the researcher. When no longer necessary for the research, all material will be destroyed.

You will also be involved in reviewing and analysing recorded footage. Any information recorded during this process will be used only for the purposes of this study and the final research report. In the case of any publication of the research results, no participants will be identified, and your and their anonymity will be maintained.

Participant data will be kept confidential except in cases where the researcher is legally obligated to report specific incidents. These incidents include, but may not be limited to, incidents of abuse and suicide risk.

If you have any queries concerning the nature of the research or are unclear about the extent of your involvement in it, please contact me at [redacted], or on my mobile phone: [redacted].

Consent:

By signing this consent form, I confirm that I have read and understood the information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Participant's Signature _____ Date_____

Researcher's Signature _____ Date_____

Copies: 1 for participant

1 for researcher

APPENDIX D. How data was calculated

The percentage of students and teachers who possess items listed under Question 1 regarding possession of DT&RM items was calculated. The comparison of the same for equality between students and teachers was carried out by using the Chi-square test with Yates's continuity correction. The Chi-square test with Yates's continuity correction was used as there were two categorical variables of students and teachers with two categories: 'yes' and 'no'. The idea behind the Yates's continuity correction is that data with 2x2 (two categorical variables with two categories) is dichotomous while statistical χ^2 Chi-square distribution is continuous, which creates overestimation of the event it attempts to describe. To correct the overestimation (Pearson's Chi-square formula creates) Yates suggested subtracting 0.5 from the absolute value as of the calculated deviation and then squaring it (Field, 2009).

$$\chi^2_{\text{Yates}} = \sum_{i=1}^{N} \frac{(|O_i - E_i| - 0.5)^2}{E_i}$$

Lowering the value of the Chi-square statistic makes it less significant and, therefore, more sensitive.

APPENDIX E. Statistical procedures

Similarly, the percentage of students and teachers under each different response category was calculated. Equality of the distribution of proportions between students and teachers was carried out by using the Chi-square test with appropriate degrees of freedom. Whenever the condition for the validity of the test was not met (all expected counts should be more than 1 and not more than 20% of the cells should have expected counts less than 5), nearby columns in the tables were merged and degrees of freedom were adjusted accordingly. Whenever such merging was carried out, this was mentioned in the table as a footnote. Since the items under Questions 6 and 7 differed for students and teachers, comparison of the percent distribution of responses was not carried out between them.

For each item, the mean score with standard deviation (SD) was also reported, and the same was compared for similarity between students and teachers using an independent t-test. The t-test assumes equality of variance in the two groups, and whenever the assumption of equality of variance was not met, a modified t-test was employed for comparison that scales down the degrees of freedom associated with the test. When the assumption of equality of variance was met, degrees of freedom associated with the t-test would be the total sample size - 2, and when it was not met, it was adjusted to compensate for the violation of the assumption and would vary depending on the variance in the two groups.

A statistically non-significant test result (meaning that both students and teachers have similar proportions or means) was reported with ^{ns} with the test statistic; test results at 5% level of significance ($0.01 < P < 0.05$) were indicated with '*' with the test statistic; test results 1% level of significance ($0.001 < P < 0.01$) were indicated with '**'; and test results significant at 0.1% level of significance were indicated with '***' ($P < 0.001$). P-value stands for the probability value or significance of a test, asserting whether an effect is meaningful within the research context.

Side-by-side bar diagrams were used for the visual assessment of the percentage of students and teachers who possessed DT&RM items, and for comparison of the mean score of each item under Questions 2 to 9.

The scale of responses varied from 0–1 (Question 1), 1–8 (Questions 2–5), 0–4 (Questions 6 and 7); and 0–5 (Questions 8 and 9). To derive an overall score that can be compared across the nine aspects (access to DT&RM items; spending time on Web 2.0 related activities; spending time on smartphone-related activities; spending time on video

game related activities; spending time on other DT&RM activities; perception of students/teachers about the other; relationship with DT&RM; agreement on the use of DT&RM in teaching practice; agreement on barriers to use DT&RM in classroom), the scales were recoded to start from 1 and averaged for each of the nine aspects. Thus, the average for the first aspect was derived by averaging the responses for the 11 constituent items, second by averaging 15 items, third by averaging 17 items, fourth by averaging 11 items, fifth by averaging 5 items, sixth and seventh by averaging 7 items each, eighth by averaging 15 items, and finally, ninth by averaging 20 constituent items. The derived averages were standardised by dividing by the maximum of the scale and multiplying uniformly by 10. Therefore, all the overall mean scores for the comparison of the nine aspects would be between 1 and 10. The derived scores could be compared against each other as a measure of possession/frequency of use/agreement, with higher scores indicating higher possession, higher frequency of use, and stronger agreement, as the case may be.

The derived standardised mean score was also compared between students and teachers (seven aspects other than the sixth and the seventh) by using t-tests. All the standardised mean scores were also compared between males and females – separately for student and teacher groups – by using t-tests. Analysis of variance (ANOVA) was employed for comparison of the mean standardised score across different age groups, again separately for student and teacher groups. In the case of students, the age groups of 26–31 (n = 10) and 32–45 (n = 15) were merged before comparison. Similarly, teachers in the age groups of 16–25 (n = 6) and 26–31 (n = 26) were also combined together.

APPENDIX F. Box-and-whiskers-plot

The distribution of standardised scores on different aspects of digital technology and related media (DT&RM) among students and teachers has been depicted graphically using box-and-plot. It is a rare but useful way of displaying data as it allowed me to depict the distributional characteristic of group scores and level of scores. At the centre of the box-plots, (often referred to as box-and-whisker) is the median (the middle bar of the plot which depicts the middle of the dataset where 50% of data is greater than this value). The median is surrounded by the top and bottom box, which represent limits within which the middle 50% of observations fall (the interquartile range, 25% of upper quartile that is above the median and 25% lower quartile that is below the median). Sticking out from the boxes at the top and the bottom are two whiskers that extend to the greatest and lowest scores separately. Outside of the whiskers are small circles or outliers that represent those scores that are a lot more than typical or a lot less than typical (Field, 2009). To make an overall comparison of the scores against the demographic data, I grouped all data in the categories related to the questions in the questionnaires. Therefore, each box-plot represents one set of standardised data for the each of the following categories: access to DT&RM; spending time on Web 2.0 and related DT&RM; spending time on smartphone-related DT&RM; spending time on video game related DT&RM; spending time on other DT&RM activities; agreement on the use of DT&RM in teaching practice; and agreement on barriers to use of DT&RM classroom.

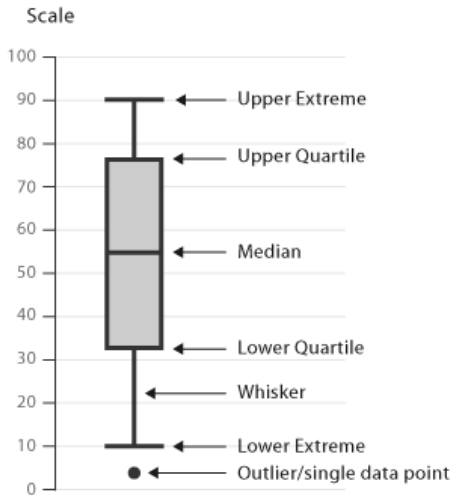


Figure 21: Box-and-whiskers-plot

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