The Wallace High School
University of Ulster

THE WALLACE HIGH SCHOOL

University of
ULSTER

NEW TECHNOLOGY AND THE CLASSROOM: AN ETHNOGRAPHIC STUDY

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CONTEXT

The Wallace High School is a successful, well respected and innovative grammar school focused on meeting the needs of our young people through the provision of well developed, self evaluative pastoral care and behaviour management systems.

The school prides itself on its very high and improving academic standards and the depth and breadth of its curricular and extra-curricular provision. The school's core values of commitment, opportunity, respect and excellence permeate school life and are pivotal in decision making, self evaluation and in defining our ethos.

A school with a rich history, the legacy of Sir Richard Wallace, our founder, is an important aspect of our heritage. His philanthropic giving, his concern for others and his value for education remain as relevant today as in 1880 when he founded the school.

A highly selective grammar school, The Board of Governors is committed to the continued use of academic criteria for the purposes of selection. Tradition and innovation sit comfortably together in our school. We respect the past, value what it has taught us but wish to prepare our young people for the future, for life beyond Wallace and for the world of work. We want our young people to be leaders in their chosen careers, significant contributors to society and responsible citizens.

An innovative forward thinking school, our one to one digital project is proof of our commitment to our young people and the creativity of our staff.

The iPad research study at Wallace High School is grounded in a hypothesis that there is a fracture between the behavioural patterns associated with so-called 'new' technologies and the pedagogical structures most prevalent in schools. This fracture constitutes what can be termed a moment of 'discontinuous change' in which space has appeared for the testing of new concepts and new technological infrastructures.

THE DIGITAL NATIVE THESIS

The project in Wallace High School offers, therefore, an opportunity to investigate a number of accepted and developing theoretical positions. Firstly, there is the concept of the 'digital native' as developed by Marc Prensky and championed by Henry Jenkins.

Essentially this theory claims that there is a generation (post-1985) who have been born digital and that this generation hence innately speaks the language and inhabits the specific cultural frameworks of that space. Conversely those of us not born to that generation are 'digital immigrants' who can attempt to assimilate aspects of the innate culture but who will never master fully the new digital terrain. If this theory is correct the implication for education is that there is a group who hold power who have no means of connecting to the digital natives and that, ultimately, failure may be built into the education system because of this disconnect.

Attractive as this thesis seems there are a number of key problematics. Usage of new technologies by the young and adolescent should not be confused with deep knowledge and understanding, and there is growing evidence that, as with 'traditional' media, an ongoing programme of information literacy is vital if these young people are to negotiate their way profitably, and safely, through the digital space. There is also a major question mark over the degree of evidence on which the digital native discourse is constructed. Indeed the work of Bennett, Maton and Kervin

(2008) *(onlinelibrary.wiley.com/store/10.1111/ j.1467-8535.2007.00793.x/asset/j.1467- 8535.2007.00793.x.pdf;jsessionid=525D72A E7645F1698D1898669571E450.d01t01?v=1&t =hl54e7m4&s=f3bf3eda78d3ff264eaab59d9a 99dd3a0814Oc98)* suggests that this thesis may be a form of moral panic. Finally, the digital natives thesis takes no account of geography or class, and there is strong evidence to suggest that being digitally aware is more a matter of geography, status and wealth than of nature. Essentially digital competence is dependent on continuing access to the technologies in question.

The introduction of iPads to both staff and students, and their consistent daily use in a work environment, gives a unique opportunity to compare and contrast the experiences of the users. Similar patterns of usage and competence will indicate that all new technologies have to be assimilated through continual engagement and training.

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EMERGING TECHNOLOGIES AND PEDAGOGY

It is striking that little or no research has been undertaken in the UK context to identify what impact large-scale introduction of new technologies has on teaching and learning.

The Massachusetts Institute of Technology (MIT) has funded substantial research into this in the USA context but only individually-funded projects have been available in the UK. Wallace High School has, however, also been a key research focus for the on-going UK-wide Tablets in Education research project. There is an awareness that teaching methods and learning styles will have to transform in the face of technological growth but this iPad project provides a wide-ranging set of subjects and age groups in which to analyse pedagogic impact.

There is generally little that teachers, educationalists, and the public agree on when it comes to designing the best curriculum for children and young people. In the contemporary educational ecology, however, there is one presumption that virtually all agree on. It is that technology is having a significant, perhaps even seminal, impact on the way children learn, and that this impact is for the most part negative. Headlines such as these from the New York Times predominate the public debate; Technology Changing How Students Learn, Teachers Say, followed by the morally panic-stricken strap line - There is a widespread belief among teachers that students' constant use of digital technology is hampering their attention spans and ability to persevere in the face of challenging tasks, according to two surveys of teachers being released on Thursday. (NYT 01:11:12). In fact the actual reports referred to are much less sure of the impact of these technologies (see http://pewinternet.org/Reports/2012/Student-Research/Summary-of-Findings.aspx) but the reporting is consistent with the real fear that teachers and parents have that they are losing control of the intellectual growth of those young minds in their care. Conversely research reported by Wired journal asserts that,

"The benefits of having web tools available were found to outweigh the risks.   Interestingly, in their interviews with 200 of the teenagers the researchers found that there was no perception that web use was impairing their ability to concentrate on work. That was in direct contrast to the experience of parents, who

frequently "despaired" at the sight of their kids multitasking on multiple devices and using social networks they didn't understand.

The study's other author, education researcher Chris Davies, said: "The evidence shows that parents have tended to focus on the negative side -- especially the distracting effects of social networking sites -- without always seeing the positive use that their children often make of being online."

The negatives from being online that the teenagers reported included things like arguments between friends over photographs published on Facebook. These kinds of problems were seen as mild compared to the benefits of having access to online educational resources. (www.wired.co.uk/news/archive/2013-01/02/teenager- web-use-educational)

Evidently there is no doubt that there is a growing schism between what policy makers think ought to be in a school curriculum, how it ought to be taught and what the purpose of this learning is, and what Raymond Williams would have termed the 'everyday lived experience' of young people developing in a 21st century world. There are two reasons for this dysfunction; the changing nature of attention, and the mismatch between the foundations of the school system and the needs of the contemporary economy.

These issues form the basis of a key analysis produced by Cathy Davidson - Now You See It: How the Brain Science of Attention Will Change the World (Davidson 2011). Davidson acknowledges the extent of the problem early in the book:

"But to step back and look at the digital age from the long view of human history is to see that this is one of those rare times when change concatenates: A change in one place makes a series of other changes in others. with the Internet, we have seen dramatic rearrangements, in a little over a decade, in the most basic aspects of how we communicate, interact, gather knowledge of the world, develop and recognise our social networks and our communities...(Davidson 2011: 251 KE)

Crucially, though, Davidson argues that this change is not going to be reversed, is not subject to the whims of governments and policy makers, and is anticipating a new form of thinking, one based on process not product, immersed in techniques synthesising vast forms of information through associational, interactive thinking. To make matters more complicated the methods of learning and the assessment methodologies we are imposing on the young people who inhabit this new space were designed for an earlier age where the economy was grounded in a less complex matrix of manufacturing and producing technologies. Hence we are asking young people to learn and be tested using architectures they simply do not understand or relate to. This leads Davidson to conclude:

I believe that kids today are doing a better job preparing themselves for their futures than we have done providing them with the institutions to help them. (Davidson 2011: 234 KE)

Essentially Davidson suggests it is time to rethink everything, from our approach to the school (and work), to how we measure progress, to how we ask young people to engage with learning. This is not easy and as internet analyst Clay Shirky has so pointedly noted, institutions will invariably try to preserve the problem to which they are the solution.

On a more positive note we are undoubtedly in a transitional moment and given the infancy of the Internet, we are embroiled in what might be considered to be 'growing pains'. Crucially, nevertheless, it is vital that schools which hope to be at the forefront of this learning revolution find new and effective ways to engage their young people.

It is this theoretical thinking which has led to the growth of the 'Flip classroom' movement. Bodies such as Co.Exist (www.fastcoexist.com) have been defining the key aspects of this initiative:

It is time to rethink everything, from our approach to the school (and work), to how we measure progress, to how we ask young people to engage with learning.

No wonder many are proposing using digital technology to "flip" the classroom. In flipping, students do the homework before class, typically reading course materials or watching videos of lectures online. Class time is spent on individual or small group tutoring, with the lesson plan set by the student, concentrating on areas he didn't understand.

If this sounds educationally far-fetched then it is useful to note the research undertaken by the American and Australian governments which found that those becoming adult in the contemporary space will change careers four to six times in their working lives and, more startlingly, that 65% of young people presently at school will work in jobs that have not yet been invented. The essence of the flipped classroom is an understanding that young people will work on collaborative real-world issues through interdisciplinary connectivity.
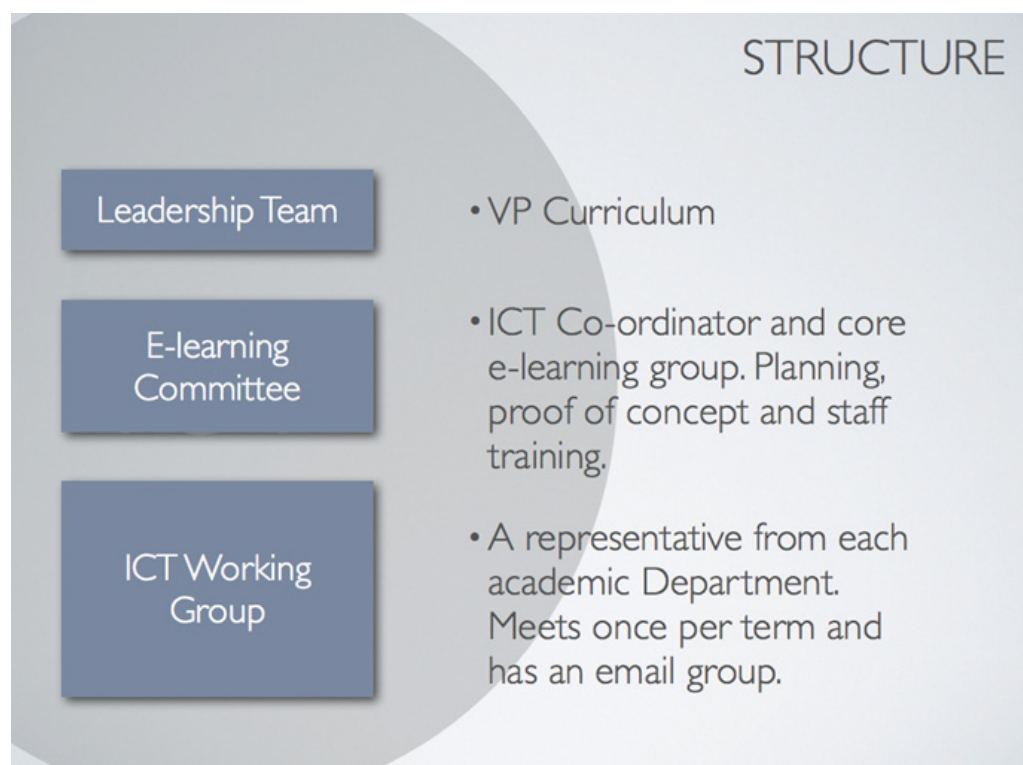
The cartwheeled classroom not only connects text books and classrooms to the real world, but it also inspires, uplifts, and offers the joy of accomplishment. Transformative, connected knowledge isn't a thing--it's an action, an accomplishment, a connection that spins your world upside down, then sets you squarely on your feet, eager to whirl again. It's a paradigm shift.

TABLETS IN THE CLASSROOM AT WALLACE HIGH SCHOOL

It is striking that little or no research has been undertaken in the UK context to identify what impact large-scale introduction of new technologies has on teaching and learning.

It is the contention of this report that the iPad project operating in Wallace High School is the beginning of a strategy to address some of these issues. The project was initiated in September 2011 with all staff being supplied with an iPad and the first three years of students being offered the opportunity to access an iPad. It is not the aim of this report to comment on the decision to opt for the Apple tablet as the technology of choice but there were a range of reasons which led the senior team in the School to this decision, not least the facilitation of the company, and the range of apps which were then available. For the purpose of this report, however, the concentration will be on the impact of the tablet as

STRUCTURE

Leadership Team
- VP Curriculum

E-learning Committee
- ICT Co-ordinator and core e-learning group. Planning, proof of concept and staff training.

ICT Working Group
- A representative from each academic Department. Meets once per term and has an email group.
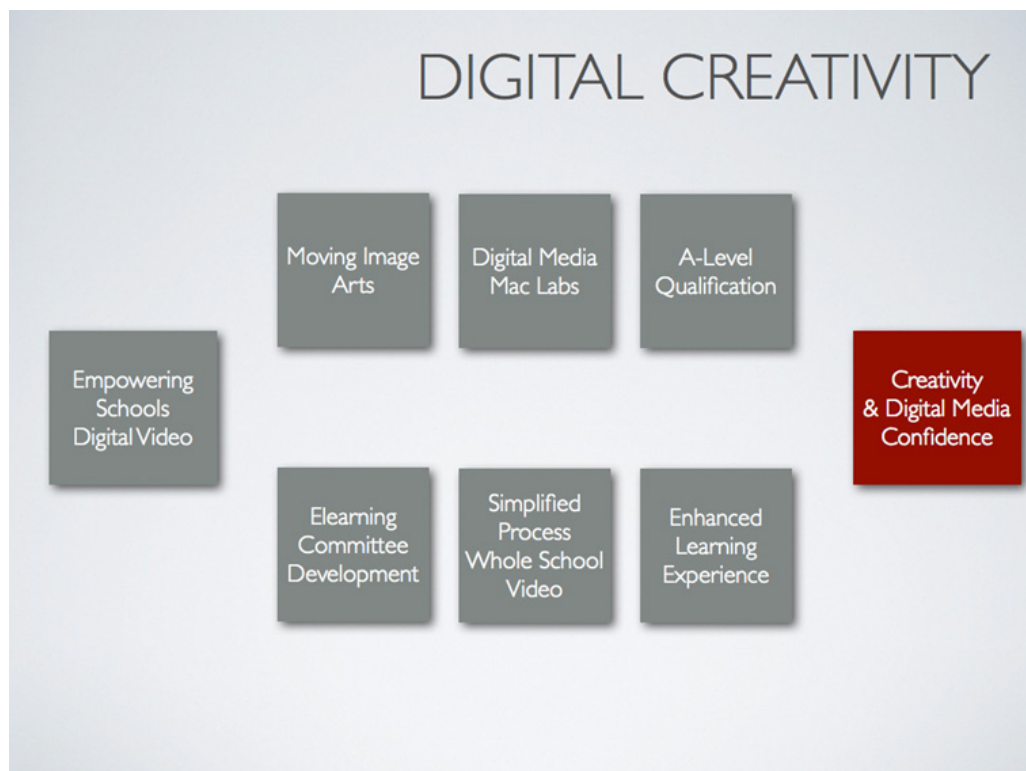
a technology and the actual branding of the machine is not relevant.

A crucial point to underline is that the School already had a substantial and well-developed ICT infrastructure in place before the project was launched. A number of senior staff members had been developing a sophisticated ICT learning architecture into which this project could be placed. This included a Vice Principal Curriculum who headed up an e-learning committee and an ICT Working group.

The brief of this structure was not merely, as they put it, to stay one step ahead of the pupils in this space but significantly, to promote creativity.

DIGITAL CREATIVITY

Moving Image Arts

Digital Media Mac Labs

A-Level Qualification

Empowering Schools Digital Video

Creativity & Digital Media Confidence

Elearning Committee Development

Simplified Process Whole School Video

Enhanced Learning Experience

This emphasis on creativity should not be underestimated. The centrality of creativity to all aspects of the curriculum and the recognition of the creative process as a central element of the contemporary economy situates this project in a wider debate about employability, 21st century working practices, and the skill set pupils need to fulfill their potential in the modern context. (See Staying Ahead 2007 www.theworkfoundation.com/assets/docs/publications/176_stayingahead.pdf) This creativity is not merely platitudinous in the Wallace context and is evident at the heart of the curriculum offer provided by the School, for example in the form of examination subjects in Moving Image Arts, digital media lab provision, and the more traditional Art or English subjects. All of this provision offers the opportunity for pupils to become proficient in the creative process.

The School has also been mindful of the need to facilitate use of Bring Your Own Devices - in particular the mobile smartphone - and the archiving of pupil documents in the Cloud to promote paperless classrooms but also to alleviate the need for other devices, for example pen drives, which are both expensive and subject to security issues. The focus on mobile technologies is especially important, since as the 2012 Horizon Report asserts, in its key trends survey:

People expect to be able to work, learn, and study whenever and wherever they want to. Life in an increasingly busy world where learners must balance demands from home, work, school, and family poses a host of logistical challenges with which today's ever more mobile students must cope. Work and learning are often two sides of the same coin, and people want easy and timely access not only to the information on the network, but also to tools, resources, and up-to-the- moment analysis and commentary. These needs, as well as the increasingly essential access to social media and networks, have risen to the level of expectations. The opportunities for informal learning in the modern world are abundant and diverse, and greatly expand on earlier notions like "just-in-time" or "found" learning. (www.nmc.org/pdf/2012-horizon-report-HE.pdf)
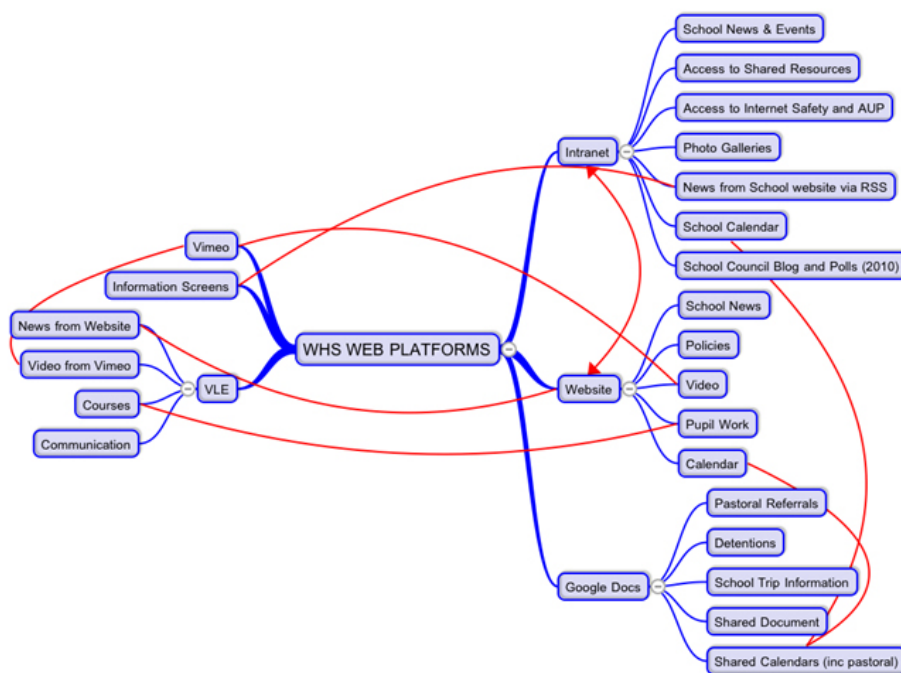
However, as important as these architectures are, they must be offered in a secure and supportive environment. The School has again developed sophisticated filtering and encryption protocols and, more importantly, undertaken NetSmart new media literacy training with both pupils and parents.

in 2010-2011 over 140 Pupil owned Devices

The diagram below offers an insight into the level of support available for parents and staff and analysis of the type of presentation made to parents underlines the comprehensive nature of the thinking around the virtual space. (See Appendices)

A diagram of WHS WEB PLATFORMS showing connections to Intranet, Vimeo, Information Screens, News from Website, Video from Vimeo, Courses, Communication, VLE, Website, and Google Docs, with their respective sub-items: School News & Events, Access to Shared Resources, Access to Internet Safety and AUP, Photo Galleries, News from School website via RSS, School Calendar, School Council Blog and Polls (2010), School News, Policies, Video, Pupil Work, Calendar, Pastoral Referrals, Detentions, School Trip Information, Shared Document, Shared Calendars (inc pastoral).

All of these skills must exist in a broader set of skills which allow young people (and parents) to interact confidently with the online world.

This strategy is entirely in keeping with the proposition that to be literate in the 21st century it is no longer sufficient to be able to read, write and handle numbers. All of these skills must exist in a broader set of skills which allow young people (and parents) to interact confidently with the online world. The foremost scholar in this sphere, Howard Rheingold, calls this 'mindfulness'. In his most recent publication (http://rheingold.com/netsmart/) he outlines the kinds of skills young people will need to be literate, often using terminology they can relate to.

Rheingold begins by asking the question as to, '…how to use social media intelligently,humanely, and above all mindfully'.

He asserts that in this new information age there are five literacies which are 'changing the world' This is a bold statement and one which his book succinctly argues the case for. He lays out what these five literacies are:

• Attention
• Participation
• Collaboration
• Critical assumption of information
• Network Smarts.

This book demystifies and clearly explains what skills are needed not only to survive and negotiate a way through the labyrinth roads of the digital world but also how to 'thrive'. Rheingold asserts that not drowning in media is simply not enough, the social media user must learn to swim and indeed learn to swim in what could at times be described as mirky waters. The book defines, illustrates and interprets what each literacy is. It then furthers these understandings by analyzing each skill. To begin with the writer says that these are not the only social digital literacies a user needs but they are what he sees as the most essential tools a traveller should be equipped with to navigate through and into this digital world.

Rheingold believes that adherence to Gillmore's five principles of of Media Consumption turn consumption into active learning. They teach young people not only to recognize the multi-layered form of the computer but also how to negotiate successfully through these layers. These five principles are;

• Be skeptical.
• Exercise judgement.
• Open your mind.
• Keep asking questions.
• Learn Media Techniques.

These principles could be easily introduced into a classroom and taught in such a way that they become embedded into a young person's information literacy. Reingold uses the phrase 'infotention' to describe a 'mind-machine combination of brain powered attention skills and computer powered information filters'. He further explains that 'infotention' has three elements.

• The ability to know when not to text, when not to look up emails during a class, when to take a break from media.

• Knowing how to create intelligence dashboards, new radars and information filters from online tools.

• Infotention involves sociality. Many useful links are created using social media. Fine tuning and paying attention to PLNs is where the meeting of internal and technological take place.

Fear of information overload is not something new to the twenty first century. Rheingold believes that we should look at how information overload was handled in the past so as to inform how we should handle it. In 1545 Adrian Baillet warned that the introduction of so many books in such a flagrant fashion would ensure that the following centuries would fall into a state as barbarous as that which followed the fall of the Roman Empire. In 1755, Denis Diderot warned:

Fear of information overload is not something new to the twenty first century.

As long as the centuries continue to enfold, the number of books will grow continually, and one can predict that a time will come when it will be almost as difficult to learn anything from books as from the direct study of the whole universe.

Echoes of these words can still be heard in the work of Carr and Jackson. Diderot and the Enlightenment group developed ways to deal with this overload of information. They sorted the information into groups and categories. They organized this information and created the first encyclopedia. The first foundation stone needed to cope with information overload begins at a cognitive level. This reflects Cathy Davidson's observations on how to mould a child's attention by constantly exposing the child to experiences and linguistic values which are considered important within the child's environment. Rheingold believes that it is vital that before a person begins to engage with technology that they have already fine tuned their skills of attention and judgement. This attention and judgement are developed through 'mindfulness'. This concept seems naive-like however Rheingold believes that it is one of the main components of information literacy: goals should be formulated and at regular intervals attention should be paid to what you are actually doing to see if it directly relates to the bigger goal. This level of attention will relate directly to the micro decisions which are constantly made as the user negotiates her way through the swathes of digital information. These micro decisions will ensure that much irrelevant information is disregarded. However, it is vital that the user knows how to access the relevant information and furthermore manage to get this relevant information to actually come to the user. Rheingold explains that reliable information sources should be identified, sources which have developed sociotechnical systems which combine the judgements and knowledge of experts and which attempt

to crowd-source the filter to the digital aggregation of Twitter, YouTube or Flickr.

Net Smart. How to Thrive Online (2012) examines three new infoliteracies;

• Pay attention to attention itself.
• crap detection.
• infotention.

Rheingold advocates that once these three literacies have been acquired then it is possible for the user to gain maximum benefit fro the fourth literacy which is active participation.

From this we can clearly see that the existence of a sophisticated ICT infrastructure already existing in the School is important to this report since it offers clear evidence that the introduction of a tablet project was part of an on-going exploration of how new technologies can benefit pupil learning and enhance the teaching base. Indeed it could be argued that without this infrastructure and the concerted attention to the role of ICT in the curriculum this project may not have been possible. The centrality of this foundational work is an important factor for any other school contemplating such a venture.

RESEARCH METHODOLOGY

As Malinowski points out all research begins with a set of preconceived notions or 'foreshadowed problems' (Malinowski 1922: 8-9). This term was used to describe the way in which a researcher can carry a set of ideas or notions into the field, content to adapt and revise them as and when the evidence gathered demands.

A key aspect of this project, therefore, was to design a suitable methodology which could maximise output while acknowledging a range of constraints. The main constraints were:

• that the research should not interfere with what was already a contested learning space given the introduction of a disruptive technology

• gaining access on a regular basis given that the work was not being undertaken as a 'full-time' project and was being delivered as part of a wider work role

• assessing the impact of the technology given that any kind of quantitative evidence would be open to question - namely it would be difficult, if not impossible, to prove that the technology was any more importnat than good teaching, more proficient students and so on

• given the numbers involved and the time allocation for the project it would be impossible to offer a comprehensive report which offered an in-depth analysis of the attitudes of all pupils or indeed all staff

The central insistence, for instance, on the passivity of the participant observer depends on a belief that the subject of the research is really an object. The concern is to minimise 'distortion of the field', with the underlying fear that the object may be contaminated with the subjectivity of the researcher. Too easily it becomes an assumption of different orders of reality between the researched and the researcher.

Willis is adamant that there is no untheoretical way to see an object since the observation is always subject to the conceptual constructs of the researcher with the final account telling the reader as much about the researcher as the researched. The way in which the possibility that theory may 'guide' the participant observation is for the researcher to allow scope for surprise, the ability 'of reaching knowledge not prefigured in one's starting paradigm' (Willis 1980: 90). In this sense it is important to underline the fact that this report emanates from a conviction that there has been a seminal shift in the relationship between the individual and communication technologies which - whether in positive or negative terms - alters irrevocably the way in which young people learn and need to be taught.

The ethnographic data was collected through observation in the classrooms. At no time did the role as observer 'cross-over' into the realm of participant, although it is clear that an outsider presence would have had an impact, however slight, on the class. In some sessions the teacher explained what was happening but in others the presence of an observer was left unexplained. All observations were noted as the lessons were progressing and interpreted at a later date. It should be noted that at no time did any member of staff being observed attempt to intervene with comments or suggestions, allowing the class to be interpreted without any mediation.

Having collected data in an open and reflexive manner, the researcher is then confronted with the problem of representing the data, of producing a text which does not reduce those being researched to the status of the 'other' which has to be salvaged through a rhetorical construct which turns experience into text. 'Every description or interpretation that conceives itself as "bringing a culture into writing," moving from oral-discursive experience (the native's, the fieldworker's) to a written version of that experience (the ethnographic text) is enacting the structure of "salvage"' (Clifford and Marcus 1986: 113).

Most importantly in a School context where timetables and schedules have to be flexible to accommodate absence or special events (sports matches for example) in creating suitable structures to effect both the collection of data and the production of an ethnographic text the researcher must avoid what Willis terms 'the hegemonizing tendency of technique' (Willis 1980: 94) - the construction of a rigid data collection technique(s) which may interfere with the observation by privileging particular activities at the expense of others.

In essence, therefore, it could be argued that, while the research was overt and explicit, each pupil or member of staff interviewed was only told that which they wanted to know and, if they found a definition for the study which they were prepared to accept, it was considered counter-productive to question this accommodation. As Hammersley and Atkinson (1983: 71) suggest,

The other argument for not always providing a full account of one's purposes to gatekeepers and others at the beginning of the research is that unless one can build up a trusting relationship with them fairly rapidly, they may refuse access in a way that they would not do later on in the fieldwork. Once people come to know the researcher as a person who can be trusted to be discreet in handling information within the setting, and who honours his or her promises of anonymity in publications, access may be granted that earlier would have been refused point blank.

This first stage data was then transferred into a field diary where the notes were extended and detail added. The writing of the diary was in no way restricted in so far as it included both accounts of class activities and assessments of the researcher's role and feelings in relation to the activities being recorded. This dual account was essential in terms of the reflexivity necessary for the writing of a full ethnographic account which recognises the impact of the researcher on the research.

The third stage in the collection and recording of the data was an attempt to map the information against the research aims for the project. These theoretical themes and the actual teaching practices formed the hypotheses against which the detailed data could be mapped to provide evidence (or a lack of evidence) of the presence of pedagogical change or, more crucially, evidence of new

aspects, the aspects of the unexpected, that which will 'surprise' in the manner which Willis deems so essential to an informed ethnography. The result of this structured three stage process was an extremely detailed ethnographic diary which through a constantly adjusting mapping procedure was linked to the research themes under investigation while simultaneously offering a commentary on the role of the researcher in the research process. It is from this data that the written ethnographic text was constructed.

The production of a text from collected data is the central problem for the reflexive researcher. In many research situations the writing of the final report is a technical problem but one guided by the usual research conventions and notions of neutrality. In the case of ethnography, it is these very conventions the researcher must guard against.

This is doubly problematic for the reflexive observer. In the first place, the logic of ethnography, and the data so produced, do not readily lend themselves to such conventions. Second the reflexive observer will be acutely aware of their very conventionality (Hammersley and Atkinson 1983, 207).

Any attempt to break away from these conventions will involve the recognition that the creation of an ethnographic text is the telling of 'a story' and that, in the course of this process, it is inevitable that more than one story must be told. The production of a written methodology illustrates the anxiety of a researcher to tell his/her story but it would be misleading to suggest that in the detailing of a method then frees the researcher from the ethnographic story. Willis accepts this in Learning to Labour (1977) when he draws a dichotomy between narration and analysis and while this arrangement frees the ethnographic narrative from the constraints of analysis it has been criticised on the grounds that it makes the links between the portrayal of the culture in question and the analytical superstructure tenuous (Hammersley and AtAkinson 1983: 222). Nevertheless, this arrangement does facilitate the required move from the micro to the macro in terms of the development of general theory.

The outlining of the ethnographic method does not, therefore, exclude the researcher from the ethnographic story and this recognition has led ethnographers to seek explanation for their position in theories of narrative associated with structuralism and poststructuralism. Brown (1977: 7) suggests that the extensive use, for example, of irony and metaphor in ethnography make it particularly apposite that critical theory should hold relevance for ethnographic research.

For these reasons the critical concepts associated with the novel, poetry and drama - that is, "poetics" - provide a privileged vocabulary for the aesthetic consideration of sociological theory.

Essentially, therefore, there has to be a recognition that the ethnographer is involved in a process where the ethnographic encounter itself becomes what Clifford calls a 'fable of communication....a kind of fictional, but potent kinship' but a fable which has accepted the polyvocality of the ethnographic representation. Hence any structure is dialogical, the product of a collaboration between the researcher and the researched. This recognition clearly creates problems for any science which claims to move from the particular to the general since the number of distinct registers at work in the written account and the intersubjectivity of its translation form fieldwork to representational account renders any account extremely contingent.

Clifford argues that ethnographies are in effect allegories at the moment they attempt to turn oral accounts into written accounts since they then imply that the written text is saving the culture in some unidentified way. Quoting Benjamin, he suggests that 'appreciation of the transience of things, and the concern to redeem them for eternity, is one of the strongest impulses in allegory' (Clifford and Marcus 1986: 119). He recommends that the

written ethnography recognises this complication in two ways: by identifying and recognising the separate allegorical registers in the text and by making explicit the hierarchical structure of power whereby the author's stories 'translate, encounter, and recontextualise other powerful stories' (Clifford and Marcus 1986: 121). In relation to this it is important to note that data was not taken from all those involved in the project, nor was there an encounter with any teacher or pupil who had an unremittingly negative view of the work. In one subject area, English, there did seem to be major concerns around the relationship of their central mode of operation, the book, and this new technology and no English lesson was observed, although this may have due to logistics rather than an active unwillingness on the part of English teachers to be observed. Interestingly in the English literature space there are a number of co-produced apps which are offering original models for the relationship between technology and the written word, most notably apps about the work of Seamus Heaney and T S Eliot.

These arguments have been taken to their logical conclusion, in the post-modern context, by Stephen Tyler. For Tyler the process of ethnography in the post-modern world is neither representation or presentation but rather an 'evocation'. 'The key word in understanding this difference is "evoke," for if a discourse can be said to "evoke," then it need not represent what it evokes, though it may be a means to a representation. Since evocation is nonrepresentational, it is not to be understood as a sign function, for it is not a "symbol of," nor does it "symbolise" what it evokes' (Clifford and Marcus 1986: 129). This evocation creates a commonsense reality out of an 'emergent fantasy' and recognises that there will never be objective text in ethnography, only discourse. In many ways these arguments reflect Clifford in that they privilege notions of dialogue and polyphony but crucially Tyler (1986: 127) sees the polyphonic form as the key to the relationship between author, subject and reader.

Polyphony is a means of perspectival relativity and is not just an evasion of authorial responsibility or a guilty excess of democracy, though, as Vico might say, it articulates best with that social form, and it does correspond with the realities of field work in places sensitive to the issue of power as symbolised in the subject-object relationship between he who represents and she who is represented.

Interestingly, Tyler sees the process of post-modern fragmentation as the vital link between post-modernism and ethnography. Since all ethnographic experience is, by definition, fragmentary, this makes the ethnographic text the perfect vehicle for post-modern discourse. Categories such as induction, deduction, synthesis and symbolisation become obsolete for Tyler (1986: 135) since he defines ˝ethnography as a means of capturing a discursive experience.

> It [post-modern ethnography] aims not to foster the growth of knowledge but to reconstruct experience; not to understand objective reality, for that is already established by common sense, nor to explain how we understand, for that is impossible, but to assimilate, to reintegrate the self in society and to restructure the conduct of everyday life.

In Tyler's terms then, the process of reflexivity requires no more than a recognition that the ethnographic text is merely a discourse of discourses and it can, therefore, be written purely as a literary narrative serving the function of providing the therapeutic effect of restoring a commonsense reality on a world which which has had its commonsense reality ruptured through the workings of the post-modern condition.

It is clear that the transfer of data from field notes to ethnographic text is a process which has both technical and ethical difficulties. These difficulties are compounded in a situation where the material is dialogic only in so far as the dialogue has been mediated by the author, a situation created by the ethical difficulties associated with tape recordings or verbatim subscriptions of their accounts. Indeed some of the most telling comments by staff came in the context of informal conversations at break or lunch times sine they were delivered in a frame where off-guard remarks were also framed by the proximity of peers.

The acceptance of these criticisms does not suggest, however, an acceptance of Tyler's thesis that all ethnography should be delivered as an open, literary account where many voices compete to be heard in an unstructured cacophony where truth and fiction are indistinguishable. A recognition and addressing of accepted ethnographic problems does not render an ethnographic study futile. Two factors ensure that the ethnographic process can proceed with the same claim to 'scientific truth' as any other sociological pursuit. The first is the constant care by the ethnographer to make explicit the theories underpinning the ethnographic research. By so doing the ethnographer recognises that while all accounts represent both the researcher and the researched, the reader is in a position to assess the extent of the writer's theoretical intent. Secondly, the application of self-reflexive techniques by the ethnographer ensures the material is constantly questioned and, ultimately, that the science of ethnographic method is extended. As Atkinson (1990: 180) argues,

the ethnography, then, cannot inhabit a world of texts where conventionality is taken for granted, or where language is treated as unproblematic. The fully mature ethnography requires a reflexive awareness of its own writing, the possibilities and limits of its own language, and a principled exploration of its modes of representation. Not only do we need to cultivate a self-conscious construction of ethnographic texts, but also a readiness to read texts from a more 'literary-critical' perspective. Sociologists and their students must cultivate the discipline of reading their own and others' arguments for their stylistic and rhetorical properties.

IMPACT ON THE SCHOOL FABRIC

One of the 'surprising' aspects of this study, of the kind referred to above by Willis, was the way in which the actual physical fabric of the School was challenged. Like all large schools in order to operate effectively and safely, Wallace High School has clear guidelines about the use of corridors, cloakroom area, communal spaces and so on.

One of the 'surprising' aspects of this study, of the kind referred to above by Willis, was the way in which the actual physical fabric of the School was challenged. Like all large schools in order to operate effectively and safely, Wallace High School has clear guidelines about the use of corridors, cloakroom area, communal spaces and so on. As the tablet project advanced, and, more significantly, the working practices associated with the tablet became more embedded especially in relation to collaborative learning (see below), the use of certain spaces in the School began to alter. One example will underline this. The library is an important communal space for pupils, a space where they can access key information sets, and where they can undertake quiet, focussed learning. With the advent of the tablet project the role of the library as a provider of information was challenged and as the year progressed the pupils began to use the library as a collaborative working space. Clearly this in turn challenges notions of quiet and the role of a library and so the pupils began to take the collaborative practices out of the library and into a clear space just outside the library itself which acts as a junction for a number of major transit corridors. Senior staff indicated that this area was filled with chairs for an event involving parents but the pupils then appropriated these seats and started to use them as another setting for collaborative work. The Senior Staff facilitated this by leaving the chairs and allowing the pupils to feel they had acquired a space which belonged to them.

Arguing for the role of the tablet technology development in this process two things would appear to be happening. Firstly the pupils are devising their own learning strategies and literally making room for their learning. From observation it might be argued that very little of this learning is 'formal' in the traditional curricular sense, but crucially it is 'informal' learning (around games, apps, social networks) which serves to underpin the formal curriculum and which embeds the idea of learning in the young people concerned.

Secondly, it offers further evidence for arguments made in a number of contemporary studies that creativity flourishes where those involved can find open spaces which they can creatively colonise in order to talk, argue, draw, design and indeed actively make things.

The library is an important communal space for pupils, a space where they can access key information sets, and where they can undertake quiet, focussed learning.

The problem for the School is that any attempt by staff to formally recognise, or support, these spaces (and to the credit of the School such arrangements were being contemplated) will probably lead to them being abandoned by the pupils since the point in them is that they are self-identified by the pupils and 'owned' by them. Evidence of this is provided by the fact that a number of pupils indicated they were already moving away from this space since it was becoming too popular, and finding different niche/cult spaces to share their ideas and work, some of which were in the schoolyard/play areas which pupils considered absolutely to be their territory.

There is a sense in which we all need to create our own inner space, to allow ourselves the mental space and the time to play and dream and to vision new possibilities. Creativity and the conditions it needs to thrive require nurturing as   much as any other human activity if we are to enable our imaginations to dance.

It is important to realise that the quality of any physical creative space in itself will only enable learning and creativity to happen if co-operative, democratic and facilitative approaches to the learning and creative process are adopted by both   learners and teachers. It is these attitudes and approaches to the learning and   creative processes which enable the construction of shared meaning, knowledge   and understanding. (www.brighton.ac.uk/creativity/Library/UofB_msfc-ebook_FINAL.pdf; Page 25)

The second impact that the tablet project has had on the fabric of the school building is in relation to pupil storage spaces. A number of pupils indicated that the behaviour in these spaces had changed with much greater care being taken to ensure that the technology was protected (fewer bags thrown across floors) but these same pupils suggested that the facilities for storing all forms of technology would have to be rethought as it became more embedded. One pupil offered the intriguing suggestion that the School should develop an iPad park where machines could be safely deposited during meal times or games classes and where the machines charged as they were parked. The Senior Staff in the School were also aware of this and had provided designated iPad lockers, which might constitute a move towards the iPad park notion.

A study of school design has discovered that school layouts can influence a child's development by as much as 25 percent — positively or negatively — over the course of an academic year.

The 751 pupils using 34 classrooms across seven primary schools in Blackpool were studied over the 2011-12 academic year by the University of Salford's School of the Built Environment and architecture firm Nightingale Associates. Standardised data — such as age, gender and academic performance — were collected on each child at the start and end of the year, while each classroom was rated for quality on ten different environmental factors, such as orientation for natural light, shape, colour, temperature and acoustics.

The results, published in Building and the Environment, revealed that the   architecture and design of classrooms has a significant role to play in influencing   academic performance. Six of the environmental factors — colour, choice, connection, complexity, flexibility and light — were clearly correlated with grade scores. (www.wired.com/wiredscience/2013/01/school-design-grades/)

Thirdly, the advent of the tablet project has had a clear and profound impact on classroom geography. The classroom has become a flexible space, group arrangement of furniture has become commonplace, pupils are regularly assuming focal prominence, and staff position has shifted from the front of the class to the back. All of this underlines the need for a rethink of school/classroom design as noted above.

IMPACT ON DISCIPLINES

As outlined in the methodology section much of this observation is based only on a comparison between two terms of the first year of the project. Nevertheless it is clear that there was a profound impact on a number of disciplines, and the manner in which they carried out their teaching.

A key aspect of the dealing with this impact was the fact that the various subject areas were already working together and sharing co-designed resources before the project began. This collaborative process was vital in ensuring that no one teacher felt isolated, and at all times there was a foundation of support across which concerns and indeed good practice could be shared.

The crucial nature of this collaborative process should not be under-estimated. In the contemporary learning ecology (and indeed in the contemporary creative space as a whole) collaboration has become a key component of working practice. The complex matrix of skills needed to advance a 21st century curriculum is such that it would be untenable to presume that any one member of staff could have the capacity to deliver all of these pedagogical talents. However, an effective and open utilisation of the collaborative process can ensure that pupils gain access to the range of learning and teaching they need somewhere in the staff cohort responsible for delivery of that subject area. In general, this collaborative working practice was well developed in this project and has been key to its survival to this point.

The disciplines observed over the year of the project were Sciences, Languages, and the Humanities - History and Geography.

The crucial nature of this collaborative process should not be under-estimated.

SCIENCES

As indicated the Science staff at Wallace High School had already developed strong collaborative practices and extensive sharing of teaching resources. The training day supplied by Apple staff also suggested that there would be large numbers of pre-designed apps which would work well in the science sector.

However, it quickly became clear to staff that while many of the apps were in themselves well designed and offered innovative and interesting explanations of scientific material, their effectiveness in the classroom was questionable.Observation and discussion with the pupils and staff would suggest a number of reasons for this. From the pupil point of view most of these apps are made for individual consumption and it was difficult to share their use in a teaching context. (This was of course also an issue for staff.) Secondly, the content did not necessarily seem to fit with the curriculum as it was being taught to them, and more importantly many of the pupils - particularly the younger pupils for whom this type of work was relatively new - could not negotiate where the app would fit into their learning. Finally, and perhaps most interestingly, many of the apps functioned through principles of gamification and the pupils encountered a serious mismatch between the gaming nature of the apps and the 'presumed' nature of the learning/teaching experience. Hence they were not sure whether this was 'real' learning.

Not surprisingly, this factor also loomed large in the concerns of staff. A number of staff expressed a worry that they were not sure where the 'play' finished and the 'learning' started. Given the historical educational conventions around what constitutes learning and pedagogical method these concerns are entirely understandable and natural. However, reference would again be made to the work of Cathy Davidson et al which produces a convincing argument that the every day lived experience of young people in the contemporary space means that this historical framework may no longer be relevant as a learning environment. Indeed a number of experiments, many of them analysed by Jane McGonigal in her 2011 book Reality is Broken, indicate that the inclusion of gaming principles in the school curriculum vastly improves the performance of young people and has a profound impact on their psychological profile in terms of esteem, confidence, and attitudes to concepts such as success or failure.

James Paul Gee, game-based learning advocate and guru refers to this as "situated learning." We know that students must construct and apply knowledge for deeper learning. In great games, students are both learning content and applying in complex problems to solve. Take Portal for example. In this game, the player must create portals between two flat planes. The player not only experiences principles of physics, but must use this knowledge to solve related puzzles. In addition, the player takes on an authentic role. Although based in a fantasy world, the player b e c o m e s one with the playable character of the game and invests in the growth and story of that character. When playing in this authentic story and learning environment,the player sees the relevance in learning the content for the purposes of playing.

Games can be another tool for engaging in rigorous and authentic learning. There are many games available to classrooms, from educational games at iCivics, to educational versions of games, like Minecraft. There are even noneducational games that are being paired with instruction to make the game educational, such as Sid Meier's Civilization or World of Warcraft. Explore what other teachers have done and start engaging students in meaningful play.

A further concern for staff around apps was the inability to fit them in any seamless way into the curriculum plan designed for the term in question. This had two aspects. One was the issue of how far the content was matching the curriculum and, perhaps more importantly, where the app dovetailed with complex, and very carefully designed, workbooks. The consensus amongst staff was that the apps are a good 'extra' but are not necessarily ever going to be a central component of the core curriculum. Those that were most useful were those which offered access to key information sets, for example, the periodic table.

One final point on apps. One member of staff offered the suggestion that apps would be very useful if they were designed by the staff themselves in the context of their own school and working practices. This is a profoundly important observation and offers an indication of where the staff training should be focused if this project is to be progressed.

It is important that the impression is not given that in the science subjects the 'traditional' printed workbook was merely sent to the pupils as a digital copy and used in exactly the same way. The introduction of the disruptive technology would have made that

strategy impossible if only because the timing of the lessons would have been radically altered with pupils being able to complete the relevant worksheet much more quickly. The material had to be revised introducing elements of search and problem-solving into the workbook.

The nature of the workbook completion exercise was altered also and this reintroduces the issue of collaboration. Since the work was mainly completed online pupils were in a much better position to share problems, interests and, indeed answers, so the nature of the workbooks changed, and are continuing to do so, from information based - often retrieval type exercises - into problem-solving and creativity-based activities. Clearly, this is educationally a good thing.

A note on the issue of information is worth mentioning at this point. Most people who have already gone through the schooling system would presume that the role of the teacher, whatever technique is used, is ultimately to transfer their information base to the pupils they are teaching. The advance in search technologies, and crucially in this case, the entry of the search engine through the iPad into the classroom, makes the concept of information transfer entirely obsolete, since within seconds any pupil can have gathered more information about a given subject than a teacher could master in a lifetime. Hence the role of the teacher - as argued by Howard Rheingold for example - is to give the pupils the necessary skills to negotiate the searches undertaken, to be able to find appropriate, relevant, and reliable information to complete the task in question. This is especially the case for curriculum where the subject is grounded in ideographic detail, for example history. The debate is still on-going as to whether pupils need to be able to memorise elements of the knowledge base, but the skills of finding and effectively applying information may be more useful in the 21st century environment than mere information acquisition. Significantly, however, this shift in the focus of teaching does underline the growing tension between a teaching environment grounded in the application of thinking skills and an examination regime grounded in information memory and regurgitation.

A central aspect of the teaching of science-based subjects is the practical lesson. Pedagogically, practical lessons have traditionally posed two key problems: how to assess the group work element and how to ensure that all pupils participated in the practical session and hence maximised their learning. The introduction of the tablet into the practical space addresses these issues in an interesting fashion.

Observation of the pupils taking part in practical experiments showed that one of the group was allocated the job of recording the activity as a moving image file which was then shared with the rest of the group. The teachers pointed out that this was not a strategy designed by them but one which the pupils had themselves initiated, a different pupil being allocated recording duties for each experiment. Two factors emanated

The advance in search technologies, and crucially in this case, the entry of the search engine through the iPad into the classroom, makes the concept of information transfer entirely obsolete

from this practice. Firstly, the conduct of the experiment became much more 'knowing' for the pupils involved. In other words each step of the process had to be clearly delineated and articulated otherwise it would have been useless as a piece of text which could be returned to at a later date. Hence, for example, pupils undertaking a particular practical task would address the camera and offer a spoken articulation of the process. The added learning value in such a methodology is extensive. Since little of this footage would be edited (although some of the pupils undertook this work voluntarily and the act of editing is a sophisticated skill in itself encompassing as it does decisions about relevance and summary) the camera operator was constantly ensuring that angles were right, that the whole experiment was being captured and that the sequencing was correct. The sophistication of this process and the learning involved should not be underestimated.

The follow up for this activity was that the recording was then available for learning reinforcement, either on and on-going basis or, significantly, when the examination period arrived. A number of staff should be commended for the fact that when it became apparent that this process was happening they adjusted their workbooks to make it a key aspect of the classroom practice, although one pupil did point out in an interesting aside that when they were doing it 'unofficially' she thought it was more interesting and that they had more ownership of it. Evidently how to manage the relationship of the informal to the formal in the classroom space poses dif-

ficult questions for staff, but given the health and safety issues involved in science laboratories making the recording a formal protocol is the correct strategy.

MODERN LANGUAGES

Initial consideration might suggest that Modern Languages, where real time verbal articulation is one of the measures of skill in a given language might not find the introduction of the tablet a useful addition to classroom practice. However, observation of such classes in operation would suggest that this is not only not the case, but that the potential for the tablet to assist and encourage the acquisition of language skills is indeed significant.

It should be noted that much of the apparent success of the languages teaching as observed may be due to the competence of the teacher in question in seeing not only the potential of the technology but also methodologies for controlling it and using it to its best advantage in this subject area. Most significantly the tablet in the Modern languages lessons observed was being put at the service of the language not the other way round. In all of the classes observed the language skill came first, underpinned by the technology, this despite protests by the member of staff that she had not been given 'enough time to learn and prepare' before being confronted by a classroom of tablet-bearing pupils.

The central mode being used in the language classes as observed was the Keynote presentation. Pupils worked both in groups and as individuals for various presentations and the visuals were a mixture of text, images and music/sound. As part of the presentation the slides on occasion contained questions as defined by the teacher but often the pupils decided the format of the slides themselves. Given the age profile of the pupils and, for many of them, their newness to the language and the relatively new nature of the lesson content, the sophistication of the presentations was high, and the quality very good. At all times, however, the emphasis form the teacher was on the language skill(s) being used to 'present' the slides. On completion of each presentation the pupils were encouraged to probe further aspects of what they had seen and heard and only at the end of each pupil interrogation did the teacher then intervene and offer both questions and positive criticism. (Where a pupil did not have a tablet, the teacher had encouraged them to use a pen drive hence eliminating to an extent any opportunity for isolation or exclusion.)

The tablets appeared also to encourage spontaneous self-criticism and adaptation. As presentations were being made it was clear that many pupils were altering their presentations as criticisms were being made of others, or on realising that they had omitted a key phrase, or simply not used the correct linguistic terminology. Since the teacher was actively engaged with those presenting it was not possible for her to intervene in this process but it is worth asking if any such intervention should take place. This continual real time learning from peers is, it could be

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argued, something to be encouraged rather than halted, although there are clear implications fro examination settings.

A number of important factors can be drawn from the teaching in Modern Languages observed:

• the use of the tablet seems to remove any reticence among pupils to stand in front of their peers and use a new language. Received knowledge presumes that males are less likely than females to engage fully in public language speaking but this was not in any way apparent in these classes.

• the balance between the use of the technology and technology-based platforms appears to be equal. As noted this may be related to the skill of the teacher but there may be a more profound factor in that the pupils do not consider the tablet to be 'technology' but merely another aspect of their learning environment - the 21st century pencil and paper. This being the case there is clearly a need to stop talking about concepts such as the 'digital' or the 'digital native', concepts which mystify and mythologise practices which are now, as the great cultural commentator Raymond Williams would have described it, part of the contemporary 'every day lived experience' of a school.

• the key to the success of these classes was their interactivity. Not interactivity as embedded in any lesson but an interactivity grounded in the practices of the young people taking part. Again there is an element of gamification, where young people have adapted to a new articulation of the notion of 'failure', where to fail is not seen as pejorative but as a learning process preparing the individual for the next attempt. As Jane McGonigal argues: We often think of games as escapist, a kind of passive retreat from reality...Game design isn't a technological craft. It's a twenty-first-century way of thinking and leading. And gameplay isn't just a pastime. It's a twenty-first-century way of working together to accomplish real change. (McGonigal 2011)

• the motivation levels of all pupils seemed extremely high in these classes. The role and skill of the teacher cannot be underestimated in this motivation but a strong case can also be made that the combination of collaborative learning, interactivity, performance and focused positive criticism, within a technology-grounded platform and environment, substantially heightens motivation and engagement.

HISTORY

History offered an interesting case study since while it offers some of the best opportunities for using technology it is at the same time a subject which traditionally depended a great deal on didactic teaching and the learning of ideographic detail.

As a discipline it has also been developing ways to make the subject interactive without sacrificing the core of the discipline as an academic area of study. This has been a major issue for the 'teaching' of history in museums and history theme parks where the introduction of technology has created an experience which ironically might undermine the authenticity of the material being 'taught'. Hence the ability to call up still and moving image representations of historical character and event has to be carefully mediated by the teacher if it is not to give a fictional account or, more crucially, overwhelm the investigation into the politics, emotion, or psychology of a particular person or period.

The history staff observed were well aware of this contradiction, and as the year progressed developed a number of strategies to deal with it. The most successful was to ensure that the presentation of material was matched by the historical rigour of the content. In other words the quality of the historical research, empathetic investigation, and writing was the starting point for any interactive presentation created on that topic.

History also offered the most pronounced example of the 'flipped' classroom in action. Interestingly the staff concerned did not think this had happened and in interviews were at great pains to emphasise that the classroom practice associated with the delivery of the history curriculum had not altered significantly. Classroom observation, however, would suggest that the best aspects of the previous teaching method were now being combined with a careful manipulation of, and negotiation with, the tablet technology to create a classroom environment which was essentially flipped. To recap the concept of the flipped classroom Davidson asserts:

In flipping, students do the homework before class, typically reading course materials or watching videos of lectures online. Class time is spent on individual or small group tutoring, with the lesson plan set by the student, concentrating on areas he didn't understand.

The cartwheeled classroom not only connects text books and classrooms to the real world, but it also inspires, uplifts, and offers the joy of accomplishment. Transformative, connected knowledge isn't a thing--it's an action, an accomplishment, a connection that spins your world upside down, then sets you squarely on your feet, eager to whirl again. It's a paradigm shift. (www.fastcoexist.com/1679807/why-flip-the-classroom-when-we-can-make-it-do-cartwheels)

In the first term observed the history staff would lay out the nature of the lesson explain what was going to be covered that lesson and then, as would have been expected, talk the students through the topic in question, taking the necessary time to ask questions, offer clarification, probe pupils understanding, and create space for the taking of appropriate notes, some of which were typed directly to the tablet. The lesson was effective and engaging, although it might be argued its success was in no small part related to the enthusiasm, skill and personality of the teacher concerned.

On seeing the same class in the second term it was clear that a major shift had taken place in classroom practice, although as noted above the staff member was adamant that not a great deal had changed. This is an important factor, and one which should be commended, in that this member of staff would appear to have embedded practices which are seen as complementing the good practice already on show while giving the same (or enhanced) student outcomes.

The changes can be characterised thus:

• staff had taken 'ownership' of the technology. On entering the classroom pupils were told to place the tablet face down on the desk and not to touch them until instructed to do so. This offered a clear indication that the tablet was now an integral element of classroom planning. When the lesson for that day had been articulated and agreed then the pupils were given permission to use the tablet.

• Where previously the knowledge base resided with the staff member there was now an acceptance that the tablet held the potential for more information than any staff member might be able to provide. Hence on identification of the historical focus for that day - for example an 18th century monarch - the pupils were instructed to use the tablet to find 'the Five Ws' - who, what, where, why, and when. After an appropriate time the teacher then interrogated the pupils to come up with the key information sets relating to the topic being studied. The flipped classroom in action. This strategy allowed the teacher to offer guidance on reliable sources, the 'truth' of any

GEOGRAPHY

Geography is again a subject where it might be expected that the access to complex interactive material and detailed information, for example related to climate or landscape, would be an enhancement to the classroom practice. But as in History this access is a two-edged sword, capable of swamping and confusing as well as enhancing and teaching.

It is perhaps for this reason that the geography staff observed explicitlyretained a classroom practice which combines use of the tablet and the traditional method. The classes observed used, for example, a combination of jotter and tablet for recording work and the pupils appeared to move seamlessly between the two formats without any difficulty or questioning. In the geography lessons observed the teacher also appeared to make greater use of the in-class computer than in other lessons, a good deal of prior preparation (shared resources created by the geography teaching team) having clearly gone into creating complex resources which needed a good deal of teacher mediation.

Having said that, geography was also a subject where extensive use of Apps seemed to be taking place. For example in a lesson on weather the pupils were encouraged to access weather apps to solve a number of questions. The teacher did not dictate the apps to be used and the pupils could use whichever app they felt was best suited to their learning style. The reporting back session merely concentrated on the results, not on the technologies used to gain those results. This is clearly another example of embedded technology which becomes transparent relative to the learning being pursued. On another occasion the pupils were completing a chart which they had downloaded from the member of staff and this was an activity which would have been more cumbersome, more time-consuming had it not been for the use of the tablet. The creation of the chart did not in any way interfere with the key element of the exercise, the creation of information to populate the chart.

The geography staff seemed to be making more use of Google Docs than encountered in other classes and significantly the member of staff invovled in most lessons observed offered the opinion that the tablet had contributed to both 'independent learning and in-depth learning'

It is, however, worth mentioning that the ability to create sophisticated presentations, charts etc, was an area where students could become engrossed in what might be termed 'over-adornment'. The capacity to constantly return to a piece of graphical information and re-edit meant that some pupils spent an exaggerated amount of time trying out various templates, colours, and designs, time which

This is clearly another example of embedded technology which becomes transparent relative to the learning being pursued.

might have been better utilised writing or searching for more detailed information. Interestingly, and naturally this point would need much greater focused research to be deemed robust, it appeared that this attention to presentational detail was more prominent amongst the female pupils, which suggests that the 'traditional' notion that girls are somehow programmed to be 'neater' in their work than boys carries over into the new technology environment. If this is the case then these attitudes are being internalised by pupils through some other channel, and at a much earlier stage in their learning development, although it would be enlightening to see if the use of tablets in primary schools from an early age challenged these conventional notions.

ONE-TO-ONE INTERVIEWS

A number of one-to-one interviews were undertaken to allow staff and students to offer observations on the project away from the strictures of the classroom and in a situation where they might have the opportunity to be more reflective. While staff were interviewed individually, the pupils were interviewed in pairs (one from each gender) to facilitate both security and confidence.

An interview was specifically arranged with a member of staff responsible for SEN provision in the school since there is anecdotal evidence that this is an area where technology can aid in advancing learning. (It should be pointed out that the concept of SEN is relative in the Wallace environment as most pupils are high achievers and the majority of learning issues encountered relate to dsylexic practice, autism, emotional/psychological stresses, or physical issues)

The attitude of the staff to the introduction of the tablet technology was overwhelmingly positive with a cnumber of key caveats. From an administrative/recording point of view, a crucial element in dealing with pupils registering in the SEN environment, it was felt that the tablet allowed for high levels of organisation, both for the staff and the pupil. Handouts could be stored for later access, as could reminders for work to be completed, or checklists for pupils who exhibited attention deficit problems. In this context the staff considered that the various 'mind-mapping' apps available were particularly useful, as were the drag-and dictate facilities inherent in the technology. These, it was felt, allowed these pupils to compete and increased their

motivation, especially since the neatness of the work improved and the pupils could see an improvement in their overall contribution both in class and through homework.

The staff member suggested that the tablet offered 'great potential for creativity' and made drafting and correcting much easier for pupils. It also facilitated those young people whose learning needs were multi-sensory - iMovie was especialy useful in this context - and who found the one-size-fits-all nature of large school learning unmanageable.

The most significant observation offered by staff working in this area, however, was the suggestion that 'technology is superseding the withdrawal'. This is an assertion which shoud be researched further since any intervention which negates the need for pupils to be removed from the everyday classroom environment, and which can compensate for this withdrawal, will be a paradigm shift in learning opportunity for the pupils involved.

It must also be noted, nevertheless, that the staff working in the SEN environment had two major issues with the tablet technology and its use in the classroom:

• firstly, it appeared that for any child who had been diagnosed as being hyperactive, the tablet may offer a further, major distraction

• the reliance of these pupils on the tablet technolgoies may mean they would be severely disadvantaged in examinations. This is clearly a factor which can be relatively easily resolved (some examinations such as the Moving Image Arts 'A' level are already technology-based), and discussions should be opened with the relevant examination boards and CCEA as soon as possible.

The contrast in the interviews between staff and pupils was instructive. The staff were, quite correctly, viewing the tablet technology as an addition to the classroom which had to be managed and for which teaching and learning strategies had to be developed. The pupils, however, had no realisation that this was a new venture, that it was in any way innovative, and indeed were somewhat perplexed that there should be so much interest in the use of tablets in a classroom.

This is a crucial point. It suggests that the one aspect of the Digital Native theory which might be correct is that young people do not view new technolgy as 'new' or as 'technology'. This is not an esoteric, academic issue, but of vital significance to the ways in which technology and learning find an accommodation. For young people the tablet is just another tool, allowing them to do interesting 'stuff' but no more useful than a pen, pencil or jotter might be in a different context. For the pupil there is an assumption that if asked to carry out a particular task there will be the opportunity to avail of the best tool to complete that task. Hence any over-emphasise on the idea of the 'digital' is countrerproductive. Young people do not categorise their technolgoy use as digital or analogue, they merely use whatever it is they need to do the 'stuff' they need ot do.

The staff had a number of positive points to make about the project. They viewed it as having a 'mobile computer suite' on tap at all times, and saw it as a real asset in research terms. The increase in organisation of pupils was welcomed, as was the facility to email pupils with core notes, and to ensure that pupils missing classes could catch up with the work quickly and efficiently. The reduction in photocopying time and costs was also welcomed, although there was a question mark over the amount of time pupils would give to emailed notes in comparison to the time it would have previously taken them to write the required notes. Similarly there were concerns about whether the fact that notes were not now written meant that less learning woud take place. When this point was put to the pupils they countered by suggesting that not less, but different learning would take place. One member of staff commented that he had become extremely proficient in the use of online gradebooks and found them 'brilliant', allowing as they do a continual overview of the teaching completed, and the progress of each student on an individual basis. All staff interviewed were of the opinion that their teaching styles and practices had significantly altered with the introduction of the tablets to the classroom.

It suggests that the one aspect of the Digital Native theory which might be correct is that young people do not view new technolgy as 'new' or as 'technology'.

Staff concerns fell into a number of groups:

• there were a number of practical concerns, for example that the wifi coverage was sustained and available at a suitable speed, that the memory of the tablets was not sufficient for major archiving, that there were not enough suitably relevant apps for their subject area, or that there was not enough time to give the students the necessary NetSmart skills needed to exploit fully the web's potential.

• the arrival of the tablet in the classroom has forced the staff to rethink entirely how they manage the classroom space. Some staff now feel that the accepted geography of the room is not suitable for technology-embedded learning. Two examples illustrate this; as mentioned previously staff have had to start teaching from the back rather than the front of the room; knowing whether pupils are answering questions from knowledge or search becomes impossible although one science class observed had an ingenious response to this issue. Pupils wrote their answers on the tablet and then held it above their heads so they could see other answers but not change their own, while of course the member of staff could view all the answers.

• staff were concerned about the replacement of writing skills with typing and cutting and pasting skills. In fact classroom observation would suggest that a much more mixed economy of recording is taking place with pupils still using notebooks and flipping between writng and tablet use according to need and context. This mixed economy is a

vital strategy since as John Paul Titlow points out in a recent article: our brains work differently when we form letters with a hand-held implement - and we learn more effectively than when we type. This makes total sense. I've long noticed that when I'm writing in a paper journal, it mentally feels different than when I'm typing out my thoughts on a computer. I thought it had something to do with the more focused nature of paper vs. connected devices. He goes on to argue that a series of studies conducted in the last few years have indicated that students learn more effectively when they form letters and shapes by hand as opposed to doing so digitally. (http://readwrite.com/2013/01/11/why-writing-with-our-hands-is-still-important)

• All staff were especially exercised by the possibilities for distraction which the tablet appears to offer. They worried that pupils would go 'off message', that they were communicating through iMessage in class, that they were sharing answers (although this might constitute positive collaborative learning), that they would be playing games or accessing irrelevant apps, or that they were simply opting not to engage with the lesson knowing that they could make up the learning at a later date.

Without wishing to in any way underplay these staff concerns, particularly the final one, this may be an opportune point to examine what the pupils interviewed had to say about the tablet in the classroom.

Taking the final staff concern first, all the pupils conceded that they accessed a number

of 'distractions' during any gvien class. These distractions ranged from iMessage, through various games/apps, to actively listening to music or watching video snippets. Crucially none of the pupils saw any of this activity as interfering with their ability to study or learn, and to a person they suggested that being able to break away from the lesson and do something else for a minute or so renewed their enthusiasm and attention for the class in question. One might argue that they would of course say this, but observation of a range of classroom lessons appeared to underline their view. Many pupils took virtual time away from lessons, undertook some diversionary activity, and within a very short time period went back to the learning activity being addressed. One year 9 female pupil looked entirely confused when the staff concerns were relayed and almost nonchalantly offered two observations: 'This is just the modern version of hang-man that they played', and 'It isn't fair to blame the iPad if a lesson is boring'. While no solution to this issue will please all it might be worth considering that an outcome driven learning curriculm, with carefully constructed assessment timings, might alleviate the concerns about how much learning is taking place in specific environments.

In general the pupil response to the tablet in the classroom was more measured, bordering on the disinterested. While some expressed an initial fear about looking after expensive kit the tablet had very quickly become 'just another book'. All pupils interviewed expressed enthusiasm for a mixed economy of tablet and notebooks/jotters and indicated lessons where they felt the tablet did not offer any great advantage, for example maths and art although they were keen to point out that this was to do with the nature of the subject not the teacher. Some subjects were felt to be extremely well-suited to tablet use, Music, French, History and Science all being named. Possibly in respone to an issue which was live at the time of the interviews, a number of pupils expressed a view that the intricacies of Biology were not esily accomodated by the tablet and explained concerns their parents had about the tablet interferring with 'proper' revision for examinations.

Significantly they felt that the tablets advanced the prominence of group work, but they were not convinced by the storage/archiving/communication facilities offered by My Big Campus since they saw this (correctly) as a staff controlled platform and were therefore wary. Their major complaints related to slowness of connections, the lack of wireless printers, and the fact that there was no consitency of use across the curriculum. They had all taught themselves to type, appreciated the ability to accesss information quickly, and had two crucial points to make about their actual learning. One year nine female pupil asserted that 'research is better than being taught' while a year 10 male pupil said his most important new skill was the ability to 'do a comparative search'.

Helping students develop strong research skills can be essential for teaching critical thinking and developing disciplinary and interdisciplinary depth. Digital tools and resources can help students master the practices of developing researchable questions, searching, evaluating and annotating sources, and working with original, meaningful data. Research-based projects that introduce students to these tools—as well as model and make explicit the various practices involved in responsible research—are an important category of high-impact practices that can be expanded through technology-enhanced learning. (https://itel.georgetown.edu/developing-your-project-2-0/#flipping)

For all pupils the dichotomy between school and home appeared to be challenged by the tablet. All pupils interviewed said they used the tablet to access social networking platforms and gave examples of collaborative working, for example where one pupil who was especially adept in a particular subject would mail their ideas to others. Classroom board work was often photgraphed and mailed across class groups so pupils were gaining learning from more than one teacher or source and seeing different ways of approaching the same subject/topic. Some pupils had establsihed their own homework forums and were developing group chat platforms to share ideas. One pupil offered the opinion that having the tablets and communicating outside school increased the bond between people who lived at a distance from each other.

OUTCOMES AND RECOMMENDATIONS

The observations offered as the concluding element of this study are not, clearly, in any way conclusive.

This is an on-going strategy which is only 18 months into its development. Nevertheless the close observation of its inception and advance within the School does offer some strong indications of what the medium to long term impact of tablet technology in the classroom might be.

DISRUPTIVE TECHNOLOGIES

As noted previously all new technology tends to disrupt and with a technology as pervasive and radical as the tablet the potential for disruption is high.

The School has created a sound ICT environment in which this technology can be tested and has quite rightly introduced it to pupils who are not yet facing crucial examinations. Early indications, both qualitative and quantitative, are that the introduction has gone according to the School's plan with 98 percent of young people opting to use the tablet and evidecne of a 2 percent rise on average grades since it was initiated. However, these statistics exist in something of a vaccuum with no formal benchmark against which to compare them and, more importantly for this study, there are indications that some of the emerging practices could gain disruptive momentum. A school should not be surprised if there was a period of retrenchment around performance, but similarly should not allow this to impede the development of the tablet strategy if it does emerge. Once the new practices have become embedded with both staff and pupils there is sufficient evidence to suggest that both teaching and learning will be greatly enhanced.

CURRICULUM DESIGN AND DELIVERY

Many of the staff observed have reacted in innovative, creative and extremely professional ways to the challenges the tablet in the classroom has posed their respective disciplines.

By the nature of the project much of this reaction and adaptation has been on a 'just-in-time' chronology and developed on an individual basis, although as noted many of the disciplines have been building collaborative resources. A much more collaborative ethos will have to be sustained across the School as the tablet technology becomes embedded. Most significantly, much of the responsibility for this will lie with the curriculum examination boards who dictate teaching content. If the examination boards and the methodolo-

gies they demand, fail to recognise the practices associated with all forms of new technoloogy then there will be a further mismatch between the learning and the assessment of that learning. Armed with the evidence from all the reports on this project the School should initiate and, where possible, drive discussions about the reforming of curriculum design and assessment at education boards, examination boards, the Curriculum Council and indeed the Department of Education.

INFOLITERACY

As indicated the School has been addressing the issue of mindful use of the online space with both pupils and parents.

A key recommendation of this report, based on the classroom observations, is that this educational thrust should be extended and embedded in the curriculum as an equal and formal element of the School's literacy policy. Being infoliterate is not a luxury in the 21st century but an entitlement for those seeking to progress to the highest levels in their chosen higher edication/employment sector.

There are a range of leading academics and institutions building curriculum for this core literacy (for example the aforementioned Howard Rheingold at Stanford University) and the School should consider becoming part of the new literacy movement in a formal capacity.

APP DEVELOPMENT

A number of staff (and pupils) registered frustration with the fact that many of the apps presently available do not meet the teaching and learning needs of the School. In a wider context as the various forms of technology become embedded further a point will be reached where 'off-the-shelf' app/web solutions simply will not be able to meet these needs.

It is recommended, therefore, that the School develop a robust core curriculum addressing programming and coding skills. This issue has been addressed in the USA through initiatives such as the Code For America movement and in the UK momentum is gathering around the work of key commentators such as John Naughton. The School is beginning to introduce coding in specific areas but it is encouraged to consider the introuction of coding as a core element across the School. Coding for young people is the magic of the 21st cnetury facilitating a deeper understanding of everyday technology practices. The work of Google, Facebook, Apple, Microsoft and Amazon, what Bruce Stirling calls 'The Stack', illustrates without any doubt that the algorithm is the poetry of the 21st century.

One way into this space which is gathering momentum in Northern Ireland is through the Raspberry Pi movement (ww.raspberrypi.

org/). These minimalist computing boards introduce elementary programming (primary schools have been particulalry acitve) but can support advanced programming as the user becomes more proficient. They will sit comfortably in a curriculum space which spans computing, ICT, and design technology adndintroduce pupils to the central aspects of the burgeoning maker movement. Wallace High School is to be commended for having been at the forfront of such developments in NI, piloting projects with the Code Academy and working cosely with innovative centres such as the Digital Circle in Belfasr to develop opportunities for pupils to learn coding and advanced web design.

CONNECTED LEARNING

The recent work of Chris Anderson (2012) suggests that there is a new economic model developing which is running parallel to the new technology movement.

It is imperative that the new technology skills gained by pupils are seen to have useful economic consequences. The global Maker movement, centred on new forms of production such as Arduino, and the 3D printer, are developing on a foundation of high end infoliteracy. It is recommended that the skills being gained through initiatives such as the tablet project be embedded across the School and that the School's creativity policy underpins a joined up curriculum offer aimed at addressing the complexities of the developing new economic model(s).

OPEN FRAMEWORKS

While the present project is centred on a branded technology, the work of Wallace High School in this area is a key touchstone for other providers.

It is essential that the knowledge gained can be shared with others doing similar work or entering the field for the first time. It is recommended that as the work of the School advances in the new technology sphere, consideration should be given to constructing it through and around Open Source systems. This will faciltiate access to the growing android app environment, support initiatives such as the Raspberry Pi as mentioned above and give the School access to important work being done by others. Similarly, affiliation to the Creative Commons movement should also be considered when developing copyright for developer work.

ONLINE TEACHING

As the technology base in schools advances the notion of physical classroom time will be challenged.

It is recommended that the School investigate the development of 'real-time' online teaching platforms (for example Big Blue Button) which will add a further dimension to the teachng possibilities, add flexibility to the teaching timetable and increase teaching capacity without creating a need for new physical resource. Naturally, when constructed these portals also offer excellent facilties for collaborative work and social network informal learning. Consideration should also be given to the possibility of pupil ownership of such learning platforms. The evidence from those using online teaching is, that as part of a mixed delivery economy, online teaching can be highly motivating for pupils. This is clearly connected to issues of School design.

FURTHER RESEARCH

This study merely begins to address the key issues and problems associated with the introduction of mobile tablet technologies into the classroom.

For any kind of conclusive evidence to be created a more thorough, constant, rigourously constructed, and resource-driven research study is necessary. It is recommended that the School seek a partner(s) with whom a funding bid can be developed to undertake such a study. This is the more important as the technology becomes embedded across the whole School population.

CONCLUSION

The limitations of this research project have been clearly outlined and discussed. Despite these limitations the ethnographic study of the tablet project in Wallace High School has indicated the real potential new forms of technological practice have for advancing teaching and learning. As observed and experienced the overarching feeling amongst staff and pupils is that the impact of the project has so far been positive, with a few serious caveats as noted.

While it probably does not need reiterating it is both useful and important to remind ourselves that no technology can replace or supplant the need for good teachers. And at the risk of concluding on a cautious note it is worth quoting from an article published earlier this year written by an iPad education sceptic:

Technological aids present a possible contradiction here: they may increase engagement while creating barriers that affect the student-teacher relationship. The best learning solution for technology, then, is one where the technology facilitates engagement and understanding while keeping students (and teachers) relatively oblivious to its existence.

Technology can certainly make lives easier. But simply replacing aspects of the learning experience with technologies that accomplish the same thing is unwarranted, because, as one high school teacher put it to me, there may always be difficulties in implementing a technological solution, but "chalk always works."

The greatest mistake we can make is to think that by implementing any technological solution, we are saving education. Enthusiasm for technological solutions in education should always be bounded, and collectively, we should work towards technology that may align with student and teacher values.

Such scepticism is healthy but should not undermine the determination to harness the strengths of technology for the education of the generation(s) who will be most immersed in it. As Cathy Davidson pointed out, 'it is not going away any time soon', so we will need to learn to manage the radical changes technology will bring and to understand fully the consequences of these changes. The work undertaken by teachers and staff in Wallace High School is a valuable, and timely, addition to that understanding.