

Glow or Glimmer? A case study of ICT innovation in a Scottish secondary school

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ABSTRACT

This paper argues that effective staff and ICT development are inseparable from the wider ecologies in which schools are positioned. The paper draws on data from a research and development project in which a Scottish secondary school pioneered the use of a virtual learning environment (VLE) before migrating this activity to 'Glow', the national schools intranet, in Scotland¹. Researchers worked closely with the school over a two year period to try and inform this process. A variety of methods to collect data were employed ranging from interviews and focus groups to the analysis of login frequencies and patterns of usage of VLE tools. These data were shared and facilitated ongoing reflection and understanding throughout the different stages of the project. The findings illustrate the ways in which the school and its teachers have experienced innovation in ICT as a challenge to their organisational and professional development. It is further argued that there is an urgent need to recognize and reconceptualise ICT development from a 'technology push' for change into a process of broader educational reform. Such a system wide development is necessary to prevent a deficit view of schools and teachers emerging in which debates about increasing support and resources are dislocated from the wider issues of educational development and transformation.

INTRODUCTION

Recent statistics indicate that 73% of UK households have access to the internet and 71% make use of a broadband connection (Ofcom, 2011a). The figure is lower however for Scotland in which 61% households make use of a broadband connection meaning that Scotland continues to have the lowest broadband take-up of all the UK nations (Ofcom, 2011b). The OECD indicates that 100% of pupils in the UK now have access to a computer in school and 95% have access to a computer at home (OECD, 2005)². In addition research indicates that young people have a 'multiple consumption' relationship to owning new technologies with many young people in their teens and younger possessing or aspiring to possess a Laptop computer, mobile phone, MP3 player, full-size games console and mobile games player (Becta, 2008, p.9). This use of new technologies by what could be described as a new digital generation of children and young people poses a challenge to schools and teachers seeking ways in which to engage effectively with their pupils and develop innovative teaching practices. In Scotland substantial investment in an ICT infrastructure for school education has been identified as crucial to this process and apparent in the funding of Glow, the national schools intranet. Glow is currently available to Scottish schools with nation-wide access expected to have been realised by the end of 2011. It was intended that Glow would offer schools, teachers and pupils secure and personalised access to the intranet and internet, virtual learning opportunities and a range of tools to enable users to collaborate, cooperate and communicate across the network (LTS, 2010). Learning and Teaching Scotland (LTS) predicted Glow 'will transform the way education is delivered in Scotland. It will work alongside Curriculum for Excellence to build capacity and ensure a

¹ Glow was funded by the Scottish Government and originally managed by Learning and Teaching Scotland (LTS) (now Education Scotland) in partnership with Research Machines (RM).

² These are differentiated by social class but the lowest class according to OECD figure has approx. 85% access to a computer at home. In addition there is, it is argued, a considerable positive effect on attainment for those in the lowest class who have access to a computer at home.

first-class education for Scotland'. A more critical appraisal of Glow, however, has emerged from a variety of different sources. Jaye Richards, one of Glow's pioneering teacher users (see LTS, 2010) is more skeptical of its potential:

Over the last two years I have used Glow in every possible way in the classroom and put it through its paces in a way that nobody else in the country has. I've come to the conclusion that classroom teachers don't have time to spend getting to grips with the system. It does not work properly (Quote from Times Educational Supplement Scotland 2010).

In an interesting critical analysis of what he terms the 'the dark side of Glow', Conlon (2008) surveys the '...risks and threats, including those of project failure, managerialism, inequity, cultural trivialisation and surface change' (p.64). His central argument is that Glow is being progressed amidst a poverty of critical debate presenting teachers and parents with '...an irrational-exuberant view of Glow, on the one hand, and a neo-Luddite refusal to have any engagement with it on the other...' (p.74). Conlon further asserts that teachers will be crucial to the success of Glow yet their voice has been significantly absent from debate. This paper will attempt to locate these emerging tensions in the development of Glow within the wider research literature on school reform and innovation in ICT. It will then draw on the analysis of data from a research and development project in ICT to explore the ways in which a secondary school and its teachers were able to orientate themselves towards innovation in ICT and the effective use of Glow. It draws on these data to argue that a deeper conceptualisation of Glow and the implementation of innovation in ICT that it entails is now necessary if Glow is to have a positive impact on everyday teaching practice.

THE CHALLENGES OF ICT DEVELOPMENT IN SCHOOLS

A wide range of research literature has explored the ways in which schools and teachers use of ICT can be developed. As far back as 2002 the OECD was recommending that the implementation of ICT should not be viewed as a technical issue but pertaining to the whole school and, as such, should be featured in school improvement plans (OECD, 2002). Twining (2008) provides an informative overview of different frameworks developed by researchers theorizing the development of ICT within schools. Included in this analysis is the Apple Classrooms of Tomorrow (ACOT) research project (Dwyer, *et al* 1990) which presented teachers' development of ICT as having five distinct phases: entry, adoption, adaptation, appropriation and invention. Progress through these phases represented a movement away from traditional (transmissive) models of schooling towards ones in which teachers appropriated ICT to the extent which 'new instructional patterns' were emerging (Twining, 2008 p.571). Twining also describes Sandoltz *et al.*'s (1990) three stage framework through which teachers progress in their use of computers. This work suggests a progression through three stages. Firstly, 'Survival', in which teachers face technological problems, changes in the classroom environment and pupil behaviour. Secondly, 'Mastery' in which teachers are technically competent in the use of technology and are more relaxed in their approach to the changing classroom dynamics. Thirdly, the 'Impact' stage which sees teachers making full use of the benefits of new technologies, engaging with pupils more effectively than in previous stages and viewing the computer as now essential to their classroom teaching (adapted from Twining, 2008 p.73). Twining argues that while such frameworks are useful in helping to understand the process a school must go through in realising the more effective use of ICT, caution needs to be exercised with regard to factors such as the cultural context of the research informing these different frameworks and perhaps, more crucially, the 'school's pedagogical vision of how ICT should be used' (p.574).

Other researchers seeking to build conceptual frameworks for the development of ICT have paid more attention to the complex contextual factors that structure learning. Drawing on a model of the learning process developed by Plomp *et al.* (1996) and Voogt and Odenhal, (1997), ten Brummelhuis & Kuiper, (2008) present an analysis of four distinct 'Driving forces' that may shape the development of ICT in learning. Their conceptual model

identifies the teacher, learner, infrastructure and content as key drivers of the learning process which are embedded within the wider context of school organisation and the local environment. Perhaps most crucial to this paper is the analysis presented of 'ICT infrastructure as a driving force' or 'technology push' in which increased access to ICT materials and infrastructure is recognised as a significant driving force in the increased establishment of ICT in learning. However in concluding their analysis ten Brummelhuis & Kuiper argue that the 'technology push' cannot alone be sufficient to the successful development of ICT in learning. Rather they argue that ICT infrastructure cannot be separated from those other vital dimensions of the learning process, the learner and the teacher. ten Brummelhuis & Kuiper argue further that the professional development of teachers is 'the most crucial factor for both the adoption and adaption of ICT in the learning process' (2008, p.107).

Researchers such as Fullan (1999) have addressed such concerns arguing that changes at classroom level, particularly pedagogical change, cannot occur effectively in isolation of broader processes of reform. Fullan asserts that major innovation in ICT should operate at three levels: schools, district (Local Council in Scotland) and state. Fullan argues that operating on only one level may mean that the innovation will be confined to 'episodic spasm' in which there is perhaps local change or reform but no likelihood of more large scale and sustainable system innovation. Fullan and Smith (1999, p.14) assert that as more powerful technology becomes available, it is imperative that there are good teachers in place to utilise such technology and that schools and their associated networks act as learning communities. The authors argue that innovation in ICT involves two distinct domains of knowledge - one of which is concerned with technology and learning itself and the other with knowledge of the process of change. Thus, according to Fullan and Smith substantial change and progress in the development of ICT cannot be achieved without the knowledge of and influence of the change process itself (Fullan & Smith, 1999, p.14). Similarly, Somekh (2007, 2008) draws on a range of research to argue for a socio-cultural approach to understanding the effective development of ICT by teachers and schools, one which acknowledges that:

Processes of change in schools and classrooms cannot be understood in isolation because they are necessarily co-constructed with students or local communities, and constrained or enabled by the regulatory frameworks and policies of national education systems and national cultures (Somekh, 2008, p.450).

Somekh argues that a lack of attention to the wider 'ecology' of ICT innovation has contributed to the rise of a deficit view of schools and teachers in which they are construed as resisting change and needing more training. This deficit view establishes teachers and schools as the focus of blame for continued failures and lack of innovation in schools. This, argues Somekh, deflects attention from 'policy makers and evaluators who have little understanding of the process of technological innovation' (p.450). For Somekh successful innovation in ICT in schools must address the main barrier to school transformation of '...fixed assumptions and settled tradition' (2007, p.108). To do so, argues Somekh, requires a fundamental restructure of the ways in which education is conceptualized and schools work. In a discussion of successful, transformative pedagogies with ICT Somekh (2008) identified the ways in which schools were, firstly, well equipped in terms of ICT but secondly and more crucially, focused primarily on '...changing the process of learning using ICT tools' (p.455). Teachers were identified as having time and opportunity to discuss problems as they arose with a range of colleagues and facilitators.

Laterza *et al* (2007) illustrate the need for close collaboration in ICT development in a study of school based research teams and their use of the Sakai Virtual Collaboration Environment. The authors refer to 'hacking', a process in which participants used the technologies available to them in new ways not intended or envisaged by the developers. In their conclusion the authors argue that the effective development of virtual environments

'...will depend on developing deep understanding of different educational contexts, on effective mediation between technologists, researchers and practitioners...' (p.265).

In linking the meso-level level (school level) analysis with the more macro-level (national policy level) analysis described above it becomes clear that the process of incorporating new technologies into education for the twenty-first century is a complex process. A range of research literature indicates that policy initiatives supporting the use of ICT in education have had little sustained impact on classroom practice and teachers are struggling to incorporate ICT more effectively into their pedagogical practice and keep up to date in the ways expected of them (Strudler & Herrington, 2008; Hammond, 2010). This has clear implications for policy makers, local authorities, schools (particularly those involved in school leadership) and teacher professional development. Research also indicates that teachers need access to skills training and expertise in terms of developing new pedagogical approaches (Hammond, 2010; Daly *et al*; 2009). For this reason programmes delivering teacher professional development need to equip teachers to become skilled users of technology resources (Thomas & Knezek, 2008). In addition research has indicated the need for innovation to be considered in the wider 'ecological' sense, situating innovation in pedagogy within global, national and local contexts (Davis, 2008; Hartley, 2007).

Drawing on an innovative form of multidisciplinary action research this paper will focus on the ways in which a large secondary school addressed the challenges of developing the potential of ICT to realise more innovative teaching practice. Three key research questions framed the initial development of this research:

- *To what extent are the school and its teachers able to harness the potential of new technologies?*
- *What infrastructure is available to support the development of this type of technological innovation in the school?*
- *What are the implications for further innovation and development?*

METHODOLOGY

The research involved collaborating with a large secondary school initially interested in developing its use of ICT. The phases of this engagement are described below but broadly involved supporting the school in the development of a local, school based virtual learning environment (VLE) then facilitating the school in migrating from this local VLE to one based within the national Glow environment described above. In a process similar to that described by Davis (2008) the research worked predominantly but not exclusively at school level exploring the 'maturity' of the school in terms of its ongoing incorporation of ICT at organisational and pedagogical levels (Davis, p.511). While not explicitly positioning itself as a socio-cultural study the research did examine the school's position within the broader national, local council and community contexts (the school serves a community experiencing high levels of social deprivation). A clear aim of the research was to illuminate the extent to which the school organisation and culture were able to progress developments in ICT to create new forms of learning. While having a particular focus on the organisation of the school and teacher professional development the project also explored the role that pupils played in the successful development of ICT in their learning.

The project evolved as a single case study which involved data collection from a variety of approaches. The action research nature of the project drew on an understanding of action research as 'cycles of action and reflection' (Ladkin, 2007). This meant that school staff and the research team worked closely together in an iterative process of development. There was constant communication between the school and the research team with a minimum of weekly meetings and other activities. These focused on the project development and generated data in the form of field notes and occasional recorded discussions, a record of these was collated in a research team blog. In addition the research included observation of training and development sessions. The VLE was initially introduced with two modern

studies classes before being made available across the upper school (years 4-6, 258 pupils).

An indication of pupil and teacher activity on the VLE was possible through the monitoring of server logs. These captured login frequencies of users as well as the patterns of use of the different tools within the VLE. Use of the VLE in terms of the chat and discussion tools also generated new forms of data for analysis (see Wilson *et al*, 2007).

In addition more formal open-ended, in-depth interviews were conducted at key phases of the project with a range of school staff. This process was necessary to capture understanding of the shifting direction of the project and, in the second phase in particular, the changing of staff holding specific responsibilities for its development. These interviews included members of the school management team (headteacher, depute headteacher), the teacher responsible for leading the development of Glow in the school (Glow leader), principal subject teachers (4) class teachers (2) and a teacher/technologist. Seven pupils were also interviewed during the course of the project. To contextualise the project, interviews were also conducted with 2 policy leaders within the local council, one leading a specific project engaging virtual environments and the second having responsibility for managing the introduction of new technologies in schools. Later in the course of the projects two members of the research team joined a group formed by the local education department to assist in the implementation of Glow within its schools including the school engaged in the project. This provided access to strategic planning informing the development of Glow within the case study school.

As indicated above an ongoing analysis of these very different forms of data was necessary to inform the step by step development of the project. Crucial to the process was ongoing communication and discussion between the research team in which the use of email and the blog permitted a form of working similar to 'memo writing' as used by grounded theorists and more explicitly described by Charmaz (2006) and Strauss (1987). This was complemented by more formal qualitative analysis of interview material which drew on a 'thematic approach' broadly aiming to examine the commonalities, differences and relationships within the data (Gibson & Brown, 2009). Combined, these processes enabled the research team to work collectively in identifying, reflecting on and understanding emerging issues.

Phase one – initiating the use of a virtual learning environment

As part of a larger collaborative research project the research team³ had access to, knowledge of and experience of using a Sakai based VLE⁴. This expertise allowed the team to construct virtual environments and make them accessible to schools. The case study school initially experimented with a virtual environment as a means of supporting a year 4/year 5 modern studies class. This first virtual environment was developed in collaboration with the school and the modern studies teacher in particular who had experience of virtual environments and was enthusiastic that a VLE could be particularly useful to pupils whose attendance at school and engagement in learning was at times sporadic. The development process involved the school management team, teachers and researchers negotiating the most effective architecture for the VLE and deciding which tools would be useful. The

³ Authors supported by a research assistant and school based teacher/technical support worker.

⁴ 'Worksite' is the key unit within the Sakai virtual environment and it comprises a distinct virtual environment equipped with a set of tools selected to support the activities of individual groups. The tools include various synchronous and asynchronous communication tools, (e.g. Discussion forum, Chat Room, Announcements, Email Archive, Mail Tool, or a Blog), or tools geared to support collaborative working, including a Resources area for sharing and storing digital files (texts, audio, video etc.) and a Wiki tool for collaborative writing. There is also an integral Schedule for organising dates and deadlines and an individual Drop Box accessible only to individual pupils and their teacher and especially useful for individual teacher-pupil exchange such as the handing in of homework and receiving of comments online. The Web content tool enables the collation of relevant external websites which can be accessed without leaving the Sakai environment. The flexible structure of the environment means that the number and type of tools can be selected according to the specific needs of the users of a particular worksite. Access to the environment is password controlled, which makes it a secure collaboration space (see Rimpilainen & Carmichael, 2006).

research team demonstrated the use of individual VLE spaces for year group level, class level or smaller groups and the potential of tools such as discussion forum, resources areas (file stores), chat and web links. It was agreed that these tools provided a suitable baseline for commencing the project. Issues such as the access permissions, location and membership of year group sites, subject based sites and pupil based collaborative sites were addressed and resolved as they emerged. The space was used enthusiastically by the modern studies teacher who was initially interested in archiving lessons and resources that would then be accessible to pupils and useful to both their ongoing class work and exam revision. The teacher argued that the virtual environment was also useful in encouraging pupils to take more responsibility for their work at home:

And it's nice to be able to say, well look, everything that you need, that we all covered in class, is available for you online and you can go and get it there. You don't have to come to me and say 'I wasn't in yesterday can you give me the stuff?' and I've got to fish it out of a folder and I've found that's really helped in terms of training my students to stop asking me '...what did we do yesterday?' (interview with class teacher).

However as use of the site developed, other tools such as a personal Drop Box emerged as useful and the potential to interact differently with pupils began to be realised:

I always leave a little message [in VLE] to say 'you can save a copy [of assignment] in your drop box between now and the day that it's due in and then I'll look at it, I'll make some comments on it, I'll save it back in and give you a chance to change it again'...this is something with students we've never done before (interview with class teacher).

In addition, the teacher arranged to be available at set times to respond to pupil queries online. This enabled pupils to make contact with their teacher when they had specific questions or encountered difficulties outwith lesson time and normal school hours.

As the potential usefulness of the virtual environment to assist teachers and engage pupils became recognised within the school, it was decided that it should be expanded to include all those pupils in S4-S6 studying for their 'Higher' certificate examinations. A meeting was organised by the researchers leading the development with the principal subject teachers to introduce them to the virtual environment and provide some initial training in its use. This attempt to move from a small developmental project to incorporating the VLE into everyday practice school wide was mainly due to the perceived benefits of enabling pupils to have easy access to their coursework and assignments. However, some of the teachers were also interested in developing the pupils' use of the site so that when the pupils logged on they would recognise and communicate with others, potentially leading to interaction that would increase their learning.

Expansion of the use of the environment to a larger number of teachers and other subject areas however produced variable results. Some teachers found the virtual environment a valuable addition to their teaching and an extremely useful way of managing resources and interacting with pupils. Others, less familiar with such technology, found understanding the virtual environment, logging in and using its various tools challenging. These teachers struggled to see how the environment could be useful to them. Throughout this process teachers had no access to higher education research literature (no subscription to journals) and had little knowledge of where to look for examples of innovative practice, particularly those informed by research. The lack of practical support and training available for teachers and the restrictions on their time, frustrated their attempts to get to grips with the technology. This meant that some initial barriers such as unfamiliar login procedures, or knowing how to add files effectively halted their (and their pupils') use of the environment. In contrast pupil use of the VLE grew steadily from the outset of the project as they realised the usefulness of having all their work safely collated in one place and easily accessible from home:

When we've got a test or something I can go on it and get all the things we did in class – revision stuff and all that kinda thing. And also if I'm absent I can just go on it and get the work that they did in class. And if I'm stuck with my homework etc., you can send him [teacher] a wee email and, and I can put things in my Drop Box as well, so he [teacher] can mark my essay over the weekend, which is good (interview with pupil).

The research team received a small number of enquiries from pupils with regard to password resetting but no requests for help with other VLE tools. The server log data indicated that pupils made use of tools such as resources, chat and discussion without difficulty. Some pupils made use of a profile tool to which they added their photographs, a task the research team had not known was possible.

In addition online access to their teacher and other pupils outside of school hours and when working at home was seen as important in their development as independent learners. However, such pupil reliance on the virtual environment was complicated by the fact that in many classes only the teacher had access to a networked computer. In this situation pupils had little opportunity during class time to access their personal work, to revisit issues raised in chat or discussion areas or to make use of resources located on the VLE. Teachers echoed this difficulty:

I'm using it [virtual environment] for something that they can do at home. I can't really see a use for it as a classroom resource. By the time you get it up and the time you get logged onto a laptop your period's over. As a classroom resource, we're a long way, you know, away from that. I think as a school we need to address our lack of ICT provision for our pupils. Unless we start giving pupils a laptop, which... if we're expecting the kids to do things like this, and we're expecting them to work hard and do 5 Highers, then I think they should look at some way of providing this for them (interview with principal subject teacher).

The use of the virtual environment progressed into its second year and the research team continued to research its development. While the Sakai platform was not ideal it was functional and provided the necessary range of tools to support the expectations of those teachers making use of it. The baseline of tools described above was provided within all new VLE spaces established. Two teachers made use of more advanced tools, the Drop Box and an imaging tool which enabled graphics to be displayed. To further nurture the development of the VLE and meet the growing practical and administrative tasks, the research team and the school combined monies to fund a part-time teacher/technologist (0.2 FTE, for 6 months). The post was filled by a teacher with ICT expertise and previous experience of working in the school. Their support enabled small group training at departmental level and regular access for teachers to one to one support. This support resulted in a diversification of the initial virtual environments into a number of additional subject specific environments and expedited practicalities such as enabling pupils to be registered and logged in to the system. However those teachers that found the environment challenging or who had little confidence in its usefulness did not make full use of this support. It is important also to note that some teachers still experienced difficulty in finding time to access the one to one support available. For those struggling with the technology the required time commitment to become effective users of the technology remained a barrier.

Phase two – transition to the national schools intranet

The second phase of the case study involved moving the Sakai based virtual spaces provided by the research team into Glow, within which there was a range of similar tools available capable of hosting virtual learning environments and facilitating collaborative working⁵. This migration to the national system was viewed as necessary by the school and its local education department. It was seen as providing a sustainable option for progressing

⁵ See <http://www.ltscotland.org.uk/usingglowandict/glow/index.asp> for details on Glow and the tools it offers.

the school VLE (developed in Sakai), giving access to national level training and enabling much easier administration in terms of whole school logins (Glow was to be integrated with other school databases). Drawing on its experience of phase one of the project the school invested heavily in this process sending 15 senior teachers on the full, 3-day training course. The intention was that these teachers would then 'cascade' their knowledge to colleagues facilitating a school wide development process. The transition process was however problematic. Adapting to the new environment required the school to assign staff to a range of tasks including merging existing databases of pupils and teachers in order to establish school level access. In addition there was a requirement to design and establish the school profile in the new environment, a complex task which involved understanding and setting a range of different permissions. Teachers in the school were assigned responsibility for various tasks associated with this initial set-up of Glow but meeting these responsibilities was often complicated by both a lack of access to IT support and time to resolve glitches. Teachers indicated that the new Glow environment was not particularly intuitive and placed additional demands on their time to engage with it:

I find Glow quite a complex system and I am a computing teacher so I can easily find my way around computer systems but other members of staff, not so computer literate have problems...the length of time that it actually takes to do things...the development time is massive. I think that there is a lot of potential there for it but we need more support (interview with class teacher).

Findings indicated that even after the first year of engagement pupils were not using the VLE and the most advanced teacher users were still using the technology at a very basic level (storing files etc rather than communicating or engaging in any form of collaboration). There was no investment made, or possible, either at school or local education department levels to address this limited development of the environment. This may have involved more dedicated school based support, available to teachers individually. With specific regard to the VLE the movement of materials from the older Sakai based VLE to the new one created a major stumbling block. Teachers interviewed were disappointed to have been left with the burden of migrating their materials which had been accumulated over the past two years and had little time to do so themselves. This was disheartening for some teachers who were then reluctant to invest more time learning about and adapting to a new environment. However this problem was soon overshadowed by more significant structural difficulties experienced in the new environment.

In contrast to the previous one the new Glow environment had no on-site support for teachers. Those who encountered login problems, the forgetting of their or a pupil password, for example, were unable to resolve such issues themselves and often required to wait for days for others to assist. Teachers found the new environment much more complex with many staff who described themselves as competent IT users, reporting the system difficult to use:

It's very slow and glitchy, it's not like click click click...And then all of a sudden it will crash and it's things like that that stop you using it (interview with class teacher).

The new VLE was not intuitive and even after attending full training sessions teachers found making effective use of the space difficult. The intention at local council level, as has been stated, was for teachers to be offered specialist training in the new environment and for this to then be 'cascaded' to other teachers in the school. However opportunities for the training of teachers by senior teachers who had accessed the full training course was limited with only small periods of time being allocated to this activity from whole school training and development days:

At the October break I had a certain number of staff that were given a forty-five minute slot for [Glow training]. How do they [teachers] know what they can do with it [Glow] if they have not had

enough experience or understanding of it? And the Glow leaders training is so much that they do it in three days... and a forty-five minute to one hour introduction [training that school staff received] doesn't give it justice. It is literally 'this is what Glow is'.

Talking to others [Glow leaders] the training was intense and they didn't then have the time to keep it up when they went away from it.
(interview with Glow leader in school).

There were no specific resources to nurture this process at local education department or school levels and the school was unable to draw on extra resources to facilitate effective training for teachers. This had a range of implications. Whereas in the previous environment teachers had made use of tools such as chat and discussion to facilitate collaborative working with pupils, teachers using the new environment found themselves struggling to establish even simple groups for pupils in which they could chat and collaborate on school work outside of school hours. Some teachers expressed concern that engaging effectively with the virtual environment required dedicated time which they did not have opportunity or the authority to devote in this way:

[Glow leader in school] Not a lot is happening with Glow at the moment. We have logins but we don't have the time. We're supposed to go on to Glow and check the NARS [National Assessment Resource for Curriculum for Excellence] but we are not checking the NARS. People are getting mixed up and they don't have their logins. Nobody has time to use Glow. I set up the email on Glow for staff to check their email so I have some staff on board that way. They will login and check their works email if they have been out for a few days.

[Researcher] Is there a VLE?

[Glow leader in school] No. We're scared to put resources on as we keep getting told it might be going (interview with Glow leader in school).

Teachers also expressed concern that the use of Glow varied between different Education Departments:

If you move school your Glow account doesn't go with you.

[In previous Education Department] We set up groups and shared resources for pupils to go on and do their homework, all sorts of things. It [Glow] depends on staff and management and how it is run. Staff really need to buy into it as a whole...it's a different way of working (interview with class teacher).

The only evidence of 'progress' was that certain resources (e.g. national assessment subject-based resources) were made available for teachers by the council only in the new Glow environment. This required teachers within the school to login to Glow and access them in order to fulfill statutory requirements. Once again access to appropriate academic support was conspicuously absent.

DISCUSSION

An initial interpretation of the above findings would draw attention to the benefits of the 'bottom-up' nature of the development of the VLE in phase one and perhaps question the 'top down' imposition of technology in phase two. This would not be unfounded. The school was interested in ICT innovation and able to forge a partnership with an external organisation (University research team) which enabled it to be active in shaping and developing the VLE in a way that recognized and addressed its needs. This first phase of the project came close to the collaborative forms of ICT innovation and development that the research literature indicates as essential. The initial development and realization of the VLE in the school was a collaborative exercise involving school staff, researchers and, crucially, the software developers as necessary. An iterative process evolved in which the school, teachers, researchers and developers collaborated on the VLE structure and problem solving. In the second phase of the research this collaborative working was dissolved as the

school was required to transfer its VLE to the national schools intranet, Glow. While the first phase VLE had been, at least to an extent, a responsive, negotiated development the second phase VLE, based in Glow was a fixed environment which the school and teachers had to learn about and adapt to rather than shape themselves.

However a deeper analysis and interpretation of the project produces more similarities than suggested above. The first phase was of course not without its difficulties. Not all teachers embraced the potential of the VLE. Despite the support of the school management team the time available to teachers to become familiar with the technology and develop its use in their teaching was limited. Subsequently what teachers were able to put into practice was almost entirely determined by their individual interest and ability to engage with the environment in their personal free time. Crucially there was no opportunity for teachers to develop a thoughtful, strategic approach to including virtual environments in their teaching. There was no opportunity to learn how virtual environments had been developed by other teachers in their subject area and no formal opportunity for sharing experiences. This weakness was exacerbated because the research team, while able to provide technical support and advice on the basic architecture of the site, had no specific expertise in the ways in which ICT could be used to increase student learning or impact on pedagogical practices. The school had developed and populated a VLE available to support the learning of most of the senior school pupils. However it had not been able to progress development beyond the reinforcing of existing classroom practice. There was no indication of innovation in terms of pedagogies. These outcomes align closely with the existing research evidence that characterises VLE development as local micro/meso level initiatives dependant on a few committed individuals rather than more widespread reform and innovation:

We found that the exploitation of VLEs at curriculum level resembled more of a cottage industry than a national technological revolution. In most cases, at subject level, the VLE remained one small aspect of learning, supported by enthusiastic staff and learners (Ofsted, 2009).

Applying the theoretical frameworks suggested above (Twining, 2009; Sandoltz *et al*, 1990) can illuminate the ways in which the school has made progress and it is possible to locate the school as wavering between the 'survival' and, optimistically, the 'mastery' stages described above. However what is apparent in both phases of the research but perhaps more explicitly in phase two were the difficulties the school faced not in terms of finding uses for the new technologies available but in finding support to nurture their implementation. In phase one of the project the research team/school collaboration was eventually stunted by the wider structural issues in terms of the availability of time and space for teachers to progress development. The demand for further teacher professional development and access to expertise for example was not within either the school or wider project team capabilities to deliver. There was not extensive funding available, as perhaps had been the case for schools in the Apple Classrooms of Tomorrow programme referred to above. Addressing this needed support from the local education department and, particularly in terms of funding, from government. Similarly access to appropriate academic expertise required identifying, costing and arranging support. Again such development was beyond the reaches of the school.

The initial stage of phase two of the project was in some ways the inverse of phase one. The VLE environment was supported at national and local levels requiring the school to interface with local council and national infrastructures. This gave the appearance at least of supporting the resolving of technological problems and providing adequate training for teachers. However such support was problematic and ultimately made it difficult for the school, once again, to progress beyond the 'survival' stage of development. In both phases the need for strategic professional development of teachers identified by ten Brummelhuis & Kuiper above was not adequately addressed.

The two phases of the project then originated and developed from very different positions but in a sense converged in terms of both failing to enable the school to realise

innovation in ICT in terms of a functioning, effective VLE. The frameworks for theorizing ICT development described above bring some illumination here. In a sense the development of the school's use of ICT may be easily conceptualised as a 'technology push' as articulated by ten Brummelhuis & Kuiper. In phase one this was initiated by the school and, arguably, the research team and in phase two by government and then local council interests. Common to both phases, though perhaps more carefully addressed in phase one, was an enthusiastic drive to realise the school adoption and unproblematic assimilation of an existing technology. In both phases however the process of school development quickly became stunted and unable to deliver on either school expectations or, equally, to the full potential of the technologies. To understand these developments it is useful to look to a more socio-cultural analysis as articulated by Somekh. Somekh's starting point is the dilemma that many of the 'visionary policy initiatives' (2008, p.449) progressing innovation in ICT have resulted in minimal changes in practice and further contributed to a deficit view of schools and teachers in particular. An analysis of phases of our research concurs with this and, uncomfortably, illuminates the research team as perhaps complicit in the process. The critical barrier identified by this research was a pervading discourse which establishes ICT development as an innovation process led by a particular group and, in the absence of any collaborative development, effectively creating 'technology push'. One avenue for addressing this situation may be to acknowledge and pay attention to the call by Somekh (2008) and Twining (2009) to increase knowledge and awareness of the change and innovation process itself. An explicit understanding and discussion of the ways in which innovation and change are approached and may impact on school culture, for example, may have led to a more integrated and collaborative development process. In both phases of this project the absence of a collaborative developmental process engaging policy-makers from the local council and government, meant that the school and its teachers were unable to effect change.

CONCLUSION

It appears that new technologies may have an important role to play in providing platforms for both collaborative working and new forms of teaching and learning. However the evidence presented above provides some critical insight into the extent to which schools and teachers are able to explore and realise this potential. Teacher time is explicitly accounted for and few of the teachers had time specifically allocated to support these developments. Access to information to support innovation in ICT is particularly crucial but teachers faced difficulties in terms of gaining access to relevant and accessible academic publications. While teachers were clearly interested in developing the new technologies in ways which would benefit their pupils' engagement in learning this was frustrated by both a lack of adequate support and time for individual teachers to develop their ideas. The school, while sympathetic to the project and its potential, was constrained in terms of resources to develop the project. In this sense teacher professionalism, in particular in terms of professional learning, was curtailed by the demands of the daily management and operation of school life. Teachers were effectively powerless to progress innovation and their ability to act as self directed, autonomous professionals was inhibited. This can be understood as an example of teachers, who lack sufficient time for development, being unable to progress from the 'survival' stages to the 'mastery' and 'impact stages' described above.

In attempting to realise the benefits of new technologies in education this Scottish example seems to mirror the general research literature. As a case study the research was based on one school within one local education department but it raises issues which may not be unfamiliar to other schools and education departments across Scotland. There are immediate technical support issues which will need to be addressed to enable teachers to access and start working effectively with Glow. After this stage however, there will need to be further technological support as well as considerable professional development opportunities. This will enable teachers to have access to expertise which will enable them to learn how to make changes to their pedagogy. The implementation of Glow represents a

major programme of capital investment, which has the potential to initiate new approaches to technology. Teachers, schools, local councils and other institutions are developing a range of responses as the initiative is progressed. This paper has highlighted the need for investment in resources and support for schools and teachers if technologically informed innovation in teaching and learning is to be established as a feature of the landscape of Scottish education. The research literature is clear that successful effective ICT development needs the support of all the key sectors of Scottish Education; policy, curriculum and assessment, pedagogy, school organisation and administration, and crucially, teacher professional development (ten Brummelhuis & Kuiper, 2008). There is still perhaps time to reflect on the wisdom of Conlon (2008) and to reconsider the 'push' to impose Glow in favour of more careful attention to the structure of Scottish education and the ways in which real transformation can occur. Ongoing national level research is needed to inform this process.

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